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FRUIT CHARACTERIZATION OF PAKISTANI DATES

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Abstract

Fruit of 85 varieties of Pakistani dates were collected throughout the harvest season. Appropriate Performa was designed to write the scientific and commonly used properties. These properties included fruit color at Khalal stage, shape, size (length & diameter), color & height of perianth, fruit group (soft, semi-dry, dry), edible stage and the micropyle position and split (wide, narrow, deep). Furthermore, pictures of the whole fruit, longitudinal and transverse sections and dorsal & ventral sides of seed have been taken. This study aimed to evaluate the quality of different Pakistani dates. Aseel variety is considered as one of the predominant and commercial varieties in Pakistan. It is elliptical in shape like most of the Pakistani dates. A few of the evaluated varieties have good properties. The majority of Pakistani dates fall in the semi-dry group. Most of the varieties, if not all are sensitive to monsoon rains, which synchronizes with ripening/harvest season. The harvest season of dates in Khairpur, Pakistan starts from the end of June until the mid of August. Urgent and rapid demand is being required for the high quality varieties. Whether, this demand can be achieved by means of micropropagation of offshoots of these evaluated and selectable varieties by the tissue culture or to import offshoots of best quality dates from abroad for propagation needs.

Introduction

Date palm (*Phoenix dactylifera* L.) is considered as an important cash crop of the district Khairpur, which is also the major dates producing district in Pakistan. The date palm has an economic importance because of its fruit, which is most nutritive and energy providing food (Ishtiaq *et al*., 1988). Dates are rich in certain nutrients and provide a good source of rapid energy due to high carbohydrate content. In addition to carbohydrates dates contain minerals, proteins, fats and vitamins etc. Date palm cultivars are of three main types according to their fruit moisture content i.e., soft, semi-dry and dry cultivars (Selim *et al*., 1970).

Some researchers characterized dates based on different ways. Khatchdourian *et al*., (1983) classified 5 major Saudi date varieties according to physical and chemical characteristics. According to Hussein & Hussein (1982), the average weight, length and diameter of Sakkoti (dry Egyptian variety) ranged from 6.11 to 8.84 g, 27.75 to 29.45 mm and 12.08 to 13.18 mm respectively. Whereas, Selim *et al*., (1970) used the fruit flesh weight, thickness of the flesh and pit weight. On the other hand, some of studies utilized the chemical characterization as carbohydrates, minerals, proteins, fats, vitamins and crude fibers. It seems that the differences in these components among different varieties are not significantly different. It should depend firstly on the physical properties which is easy and paramount and then chemical, if needed.

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Ismail *et al.*, (2006) reported that chemical and physical characteristics of the fruits influenced their mechanical and rheological properties, which in turn can be indicators of firmness and ultimately of quality. Also, it revealed new and essential information for better understanding of the date fruit that helps to enhance industrialization and propagation of the best date varieties that satisfy producers as well as consumers demands.

No one has referred to the color of the variety as a one of visual properties to distinguish dates variety. Also, shape of fruit gave us an idea about the pedigree of the most of varieties. As well as, the earliness of different varieties to determine the availability of fruits in market. In addition, to avoid the monsoon rains as for as possible. This study used as many physical properties as possible to characterize the Pakistani dates of Khairpur district. This district is considered as biodiversity center of date palm.

Increasing the elite varieties and individual lines by tissue culture technique is very important to give the chance to these promising palms to replace the low quality varieties. This work aimed to focus mainly on the Pakistani dates (85 varieties) in district Khairpur, which is the biggest area of date palm in Pakistan. Studies were carried out to determine the physical properties of these varieties and selecting the most promising varieties.

Materials and Methods

This work was performed in Date Palm Research Institute (DPRI), Shah Abdul Latif University, Khairpur, Sindh, Pakistan. This study was carried out on 85 varieties grown in Khairpur district, Pakistan, during the harvest season of 2006. Three uniform palms (20 – 30 years old) were selected from each variety. Samples from each variety were taken. Physical fruit characteristics were estimated as follows:

1. Fruit color (yellow, greenish yellow, red, dark red, orange and spotted orange).
2. Fruit shape (ovate, obovate, ovate elongated, obovate elongated, elliptical, cylindrical, falcoid elongated, spherical and global).
3. Fruit dimensions (length and diameter).
4. Perianth (color and height).
5. Seed (Micropyle position and split).
6. Fruit type (soft, semi-dry and dry).
7. Earliness (early, intermediate and late variety).
8. Edible stage (Khalal, Rutab and Tamar).

Fruits were divided into 3 groups on the basis of its length and diameter. Small fruit (less than 4.0 and 2.4cm), medium fruit (4.0 – 5.0 and 2.5 – 2.9 cm) and large fruit (more than 5.0 and 3.0 cm) respectively. Early varieties are harvested before 10^{th} of July, intermediate harvested before 1^{st} of August, and late varieties are harvested after 1^{st} of August. Regarding the perianth, there are yellow, red, orange and other colors.

The perianth height either 1 mm less means the perianth less than the level of fruit top, whereas, 1-2 mm means the perianth at the same level of fruit top. The third class was more than 2 mm means the perianth position is higher than the fruit top. On the other hand, the micropyle position means the seed pore near to the head, far from the head or at the middle of seed.

Pictures for each variety were taken. A picture showed the whole fruit at Khalal stage and/or Rutab stage, ventral and dorsal sides of seed, longitudinal and transverse sections of fruit and perianth.

This study is a part of the complete screening of all Pakistani date varieties which is undertaken by DPRI. Thus each variety will be given a serial number. Also, a simple performa was made to collect all fruit properties for each variety. Some of these data is classified in preliminary detailed Tables and concluded in Tables 1 to 5. Therefore, the studied varieties were arranged alphabetically. All the data was statistically analyzed by the methods of Steel & Torrie (1980).

Results and Discussion

Varieties: The Aseel variety is the most important commercial variety of Pakistan. This is a predominant variety of Khairpur district (Fig. 1). It is an excellent semi-dry variety with suitable fruit size (4.3 cm in length and 2.5 cm in diameter). These results are in agreement with the findings of Markhand, (1991) and Khushk *et al*., (2004). The fruit of this variety is consumed at Rutab (Dang) and Tamar (dates) stage. Aseel has sweet taste without scorch in the throat. This is very important character for the excellent varieties. It is a first candidate for micropropagation. The environmental conditions and soil types play an important role in the properties of this variety's fruit. Aseel fruit produced from palms grown in Eastern part of district (near to small mountain range) has low moisture content. Consequently, the shelf life of this fruit is longer than the fruit of the same variety in the rest of district. The fruit of Aseel variety can not be eaten at Khalal stage due to the high percentage of tannins. Therefore, Rutab and Tamar stages are appropriate for use. According to Tafti and Fooladi (2005) during maturation of fruit tannins and moisture content decreases and in parallel sugar content increases, this makes fruit edible. As Jandan (1974) described ripening of fruit by saying that ripe is an elastic term, meaning dates at the khalal stage to one class of customers and those in the Tamar stage to another.

However, many growers harvest Aseel crop at khalal stage and boil fruit to make "Chuhara". Otherwise, whole of the crop will be destroyed and lost if there is monsoon rain.

The most commonly cultivated varieties in study were Fasly (Toto) and Karbalian. Fasly fruit (Fig. 1) is yellow in color, the shape is obovate, fruit size small, the perianth yellow in color and at the same level of the fruit top and the micropyle was far from the top of seed and the split was narrow. People used to eat fruit of this variety as a fresh, at Khalal & Rutab stage.

Karbalain variety (Fig. 1) has yellow, obovate and medium size fruit with yellow perianth above the level of fruit top and the micropyle was in the middle of seed with deep split. This variety is also a semi-dry and is being eaten at Rutab and Tamar stage only and not at Khalal stage like Fasly which is mainly eaten at Khalal stage. However, the Fasly variety is early to intermediate and Karbalain is late in harvest.

Autakin variety is one of the best and famous soft varieties of Khairpur. It is widely spread and semi-sweet with a big size fruit (Fig. 2a).

Fruit color and shape: Most of Pakistani varieties are yellow in color (Table 1). Around 71 varieties having yellow color, 6 red and 8 orange, out of 85 varieties which were under observation. On the other hand, the Pakistani varieties tend to be in a cylindrical shape. Where around 42 varieties are in a cylindrical shape. Secondly, ovate and obovate shapes were commonly observed in Pakistani varieties. Where 11 and 12 varieties out of 85 varieties were ovate and obovate shapes respectively. The spherical fruit shape is scare, only one variety was observed having this type of fruit shape in present study.

Table 1. Fruit color and shape of some Pakistani date palm varieties grown at Khairpur district during 2006 season.

Varieties number	Varieties percentage	Fruit color	Fruit shape
11	12.9	Yellow	Ovate
12	14.1	Yellow	Obovate
1	1.2	Yellow	Spherical
16	18.8	Yellow	Elliptical
31	36.5	Yellow	Cylindrical
6	7.1	Red	Cylindrical
3	3.5	Orange	Ovate
5	5.9	Orange	Cylindrical
85			

LSD at 0.05 2.1

Table 2. Fruit dimensions of some Pakistani date palm varieties grown at Khairpur district during 2006 season.

Varieties number	Varieties percentage	Fruit dimensions (cm)	
		Length	Diameter
48	56.5	2.4 – 3.9	1.5 – 2.4
21	24.7	4.0 – 5.0	2.5 – 2.9
16	18.8	5.0 – 6.0	3.0 – 4.5
85			

LSD at 0.05 4.3

Table 3. Fruit perianth of some Pakistani date palm varieties grown at Khairpur district during 2006 season.

Varieties number	Varieties percentage	Perianth	
		Color	Height (mm)
6	7.1	Yellow	0.9
49	57.6	Yellow	1.0 – 2.0
22	25.8	Yellow	2.1 – 4.0
2	2.4	Red	1.0 – 2.0
2	2.4	Red	2.1 – 4.0
3	3.5	Orange	1.0 – 2.0
1	1.2	Greenish –yellow	1.0 – 2.0
85			

LSD at 0.05 1.9

Table 4. Fruit seed of some Pakistani date palm varieties grown at Khairpur district during 2006 season.

Varieties number	Varieties percentage	Seed	
		Micropyle position[z]	Split
6	7.1	Near	Narrow
4	4.7	Near	Deep
12	14.1	Near	Wide
16	18.8	In the middle	Narrow
12	14.1	In the middle	Deep
16	18.8	In the middle	Wide
15	17.7	Far	Narrow
0	0.0	Far	Deep
4	4.7	Far	Wide
85			

[z] near from the head, far from the head , or in the middle of seed
LSD at 0.05 2.8

Table 5. Fruit type, earliness and edible stage of some Pakistani date palm varieties grown at Khairpur district during 2006 season.

Varieties number	Varieties percentage	Fruit type	Earliness	Edible stage
52	61.2	Semi-dry	Intermediate	Rutab
13	15.3	Semi-dry	Late	Rutab
3	3.5	Semi-dry	Early	Khalal - Rutab
12	14.1	Soft	Early	Khalal
5	5.9	Dry	Late	Dates
85				

LSD at 0.05 7.6

Fruit dimensions: Most of the Pakistani varieties have a small size fruit (Table 2). Fruit of 48 out of 85 varieties was in a range of 2.4–3.9 cm in length and 1.5–2.4 cm in diameter. The fruit of 21 varieties was of a middle size. Where the fruit length was 4.0- 5.0 cm and the diameter was 2.5 –2.9 cm. The predominant variety Aseel is related to this class. Even, if the female palms of this variety are well fertilized and well-pollinated with superior males, the fruit did not exceed from 5 cm in length (Markhand, 1991). However, Iqbal *et al*., (2004) has reported that the pollination at different times significantly affected fruit length and diameter of Dhakki variety. There is no significant effect of different pollination methods on fruit size of Khalas and Khasab cultivars (El Mardi *et al*., 2006). On the other hand, only 16 varieties were having a big size fruit with 5-6 cm length and 3-4.5 cm diameter. This group of varieties deserves much care and can be utilized only best varieties of this group in mass propagation through traditional methods (by offshoots) or by tissue culture techniques. Finally, the fruit size significantly varied from one cultivar to another. Similar findings were also reported by Al-Hooti *et al*., (1997).

Fig. 1. Three predominant varieties in Khairpur district, (from left to right) Assel, Karbalain, and Fasly at Khalal stage.

Fig. 2. (a) Autakin and (b) Kupro varieties at Khalal stages.

Fig. 3. (a) Bhand Wary and Kachua Wary (b) varieties are similar in all properties except the Micropyle position and split.

Fruit perianth: The color of perianth and height are ranked as genetic properties of each variety. Data in Table 3 shows that the highest percentage of varieties have fruit with yellow perianth (90.5%). Low percentage of varieties have red and orange color perianth (4.8% and 3.5%, respectively). only one variety was with greenish yellow color perianth. There was a significant difference among different varietal groups.

Sometimes two varieties are similar in all morphological properties except color of perianth. Moreover, the color of perianth is not necessarily similar to the color of fruit. As found in Donger variety, this has yellow fruit but red perianth. But this is not the case with the most of varieties where colour of fruit and perianth is same.

Seed: Data presented in Table 4 shows the varieties percentage for fruit seed of studied Pakistani varieties. It is observed that 51.7% of studied varieties had micropyle pore in the middle of the seed and significantly different from other groups (near and far groups).

Regarding the split, most of split was narrow. Where the percentage of varieties with seed had narrow split was 43.6% followed by wide split having 37.6%. Fruit seed is considered as a one of the most important physical characters. Sometimes two varieties are similar in everything except the seed properties. For instance, Kachua Wary and Bhand Wary varieties are similar in all properties except the micropyle position and split (Fig. 3). Where the micropyle position was far and in the middle respectively. Also, the split was narrow and wide respectively.

Fruit type, earliness and edible stage: Upto 80% of studied varieties were semi-dry varieties (Table 5). Around 61.2 of semi-dry varieties were harvested in the middle of harvest season (July). Most of the semi-dry varieties were being eaten at Rutab stage. However, few of semi-dry varieties were harvested early in the end of June and early July (3.5% of studied varieties). These varieties can be eaten at Khalal or Rutab stages. Kupro variety (Fig. 2b) was one of these groups and widely cultivated in Khairpur and surrounding areas. A few of studied varieties were soft and eaten only at Khalal stage (14.1% of studied varieties), whereas, the percentage of dry varieties significantly decreased to 5.9%. These varieties mostly encounter the monsoon rains which starting mostly from the month of July in the district, where the most of palm farms are located in Pakistan (Ahmed *et al*., 1972). The rain causes damage to most of the crop on the trees. Attention be given on early and intermediate varieties with good properties. Also, it was observed that most of Pakistani varieties in this area were semi-dry not soft or dry. This may be due to the temperature unit requirements in this area which allows this type of varieties to spread. However, the climatic conditions also permit the growth and development of soft varieties.

Conclusion

Although the color and size properties of fruit are controlled mainly by the type of pollen grain but these properties may differ from season to season with the use of pollen grains from different palms (Metaxenia) and different pollination timings (Iqbal *et al*., 2004). It is necessary to take in consideration that the color can't change completely to another color. Same is the case with size. There are many integrated factors which play a role in fruit size. For example fertilization and irrigation operations and head palm treatments. However, it still remain that an average fruit size is preferred to every variety.

The harvest season in Khairpur district starts from 20th of June and extends to 15th of August. There is a great need to determine the naturally resistant varieties to monsoon rains and good quality too for extension in cultivation, also, to replace the susceptible varieties which are damaged completely if there is severity of rain drop during the harvest season. Late varieties encounter the risks of heavy rains. Thus the earliness of predominant and commercial varieties is required.

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