# Morphological Analysis of Leaves and Fruits in Three Date Palm Cultivars: Zahdi, Barhi, and Umm Al-Dahn (Phoenix dactylifera L.) in Babylon Governorate

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Doi: 10.21608/ajsr.2025.422205

#### Receiving the search 7-6-2024Acceptance of publication 1-7-2024

Tama, Saddam Hussein & Obaid, Imad Ali (2025). Morphological Analysis of Leaves and Fruits in Three Date Palm Cultivars: Zahdi, Barhi, and Umm Al-Dahn (Phoenix dactylifera L.) in Babylon Governorate.*The Arab Journal of Scientific Research*, AIESA, Egypt, 9(10), 73-84.

https://ajsr.journals.ekb.eg

### Morphological Analysis of Leaves and Fruits in Three Date Palm Cultivars: Zahdi, Barhi, and Umm Al-Dahn (Phoenix dactylifera L.) in Babylon Governorate

### Abstract:

This study focused on three date palm varieties (Zahidi, Barhi, and Um Al-Dihin) in Babylon Governorate to compare some morphological characteristics of their leaves and fruits. The results were analyzed using a Completely Randomized Block Design. The findings showed that the variety factor significantly affected all studied characteristics of leaves and fruits, including their length and size. Regarding leaves, Um Al-Dihin significantly outperformed in terms of spine length (10.50 cm) and leaflet length (57.40 cm). Zahidi recorded the highest number of fronds (85 fronds), while Barhi excelled in frond length (4.84 m), number of spines (29.08), leaflet width (3.34 cm), and leaflet count (209.2). For fruits, Um Al-Dihin significantly outperformed in fruit length (39.03 mm) and volume (13.90 cm<sup>3</sup>).

#### Keywords: - Plant, palm, date, species

# **1-** Introduction:

The date palm (*Phoenix dactylifera* L.) is a prominent fruit species within the Arecaceae family, which consists of approximately 240 genera and 4,000 species (Ibrahim, 2008; Henderson, 1999). This plant possesses distinctive characteristics and has historically been regarded as a symbol of blessings. It is frequently referenced in both the Holy Quran and Hadith.

Date palms are predominantly cultivated in tropical and subtropical regions, thriving in hot climates, particularly within the latitudes of 16° to 27° north of the equator. Such climatic conditions are common in many Arab countries, including Iraq, where date palms are extensively grown, particularly in the central and southern regions.

Morphological traits play a critical role in the identification of date palm cultivars. As noted by Najjar et al. (2020), the identification process relies on both vegetative and floral characteristics. Several studies (e.g., Bahramz et al., 2021) have demonstrated substantial variation in morphological traits, such as frond length, spine count, and leaflet dimensions, across different date palm cultivars. Research conducted in Algeria (Abdelkrim et al., 2020) and Iraq (Najjar, 2017) has similarly highlighted the morphological variation in vegetative and floral attributes, which are valuable for cultivar differentiation.

A study by Al-Najjar (2017) revealed significant morphological variation among 30 rare date palm cultivars, particularly in vegetative and floral characteristics. Key distinguishing traits include frond length and width, frond blade length, and the number of fronds, which accounted for 19.203% of the total variance. Khalaf et al. (2017) also observed variability in vegetative, floral, and fruit characteristics across date palm cultivars with varying maturation stages. They found that trunk circumference, frond length, and frond thickness, along with fruit weight during the early and late stages of the Khalal phase, were critical for distinguishing between cultivars.

Furthermore, studies by Abd et al. (2019) and Basaheh (2019), along with Abdullah (2019), indicated phenotypic differences between male date palm cultivars. Haider et al. (2015) and Saker et al. (2010) demonstrated that measurements taken from fronds, such as thorn length, frond count, and frond length, are effective for differentiating between cultivars. Additionally, fruit characteristics such as size, weight, and diameter show considerable variation among date palm cultivars. Abdul Sahib (2020) found notable differences in the length, diameter, and weight of fruits across studied cultivars. A similar study by Abdul et al. (2012) on date palm cultivars in the Basra region revealed significant differences in all measured physical characteristics.

Research by Al-Essa (2006) on three date palm cultivars (Ikhlas, Shisi, and Azeez) in Al-Ahsa and Qatif showed distinct differences in fruit size, weight, length, and diameter. Ahmed (2017) studied 89 Algerian date palm cultivars in the Ziban region of Biskra and found significant differences in fruit length, width, and weight. Abd et al. (2013) also emphasized that fruit size, weight, and length can serve as reliable indicators for differentiating between various date palm cultivars.

The aim of this study is to compare the morphological characteristics of leaves and fruits among three date palm cultivars in Babylon Governorate, providing further insight into the diversity of these traits in the region.

#### 2- Methodology:

#### **Study Location:**

Fieldwork was conducted in two locations in Babylon Governorate:

- 1. Al-Mahawil Horticulture Station, located in Al-Bu Zaydiyah.
- 2. A private palm farm in Al-Imam Village, Al-Sabbaghiyah area.

Soil samples (3 kg from each farm, taken from a depth of 30 cm) were mixed and analyzed. Water samples (2 liters from each site) were also collected for laboratory testing.

Table (1) Chemical properties of the studied soils in
<b>Babylon Governorate</b>

Dubyion Governorate					
Organic matter OM%	Gypsum CaCO 4 g/kg soil	carbonateCalciumCaCO 3texture		Soil components	
		%		Clay	
1.66	-	20	Sandy Loam	15.6	

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ISSN: 2537-0367

eISSN: 2537-0375

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Table (1) Chemical and physical properties of thestudied farm water in Babylon Governorate

Total dissolved	Dissolved ions mmHg /L				
solids TDS mg/L	CL-	<b>SO</b> 4	нсоз	Со3-	K+
896	5.5	7.3	5	0.4	0.3
2752	11.4	30.4	6.8	0.8	0.8

#### **Tested Varieties:**

The study focused on three date palm varieties: Zahidi, Barhi, and Um Al-Dihin. Four trees of each variety, aged 10–15 years, were selected. Each tree's leaves (3 fronds per tree, totaling 12 per variety) and fruits (10 fruits per tree, totaling 40 per variety) were analyzed. Irrigation was conducted through flooding.

# Morphological Traits of Leaves:

- 1. Number of Fronds: Total frond count per tree was recorded.
- Frond Length (m): Measured from the base of the smallest spine to the tip of the terminal leaflet using a measuring tape. Fronds were categorized as short (<3.53 m), medium (3.53–4.74 m), or long (>4.74 m) based on previous studies (Ghalib, 2008; Al-Akidi, 2010).
- 3. **Number of Spines:** Counted per frond. Spines were classified as few (<20), moderate (20–30), or many (>30).
- 4. **Spine Length (cm):** Measured from the base to the tip. Spines were classified as short (<10 cm), medium (10–15 cm), or long (>15 cm).
- 5. Leaflet Length (cm): Measured from the base to the tip of the leaflet. Leaflets were classified as short (<61 cm), medium (61–75 cm), or long (>75 cm).
- 6. Leaflet Width (cm): Measured at the widest point. Leaflets were classified as narrow (<3.4 cm), medium (3.4–4.4 cm), or broad (>4.4 cm).

7. **Number of Leaflets:** The average number of leaflets per frond was calculated.

# **1-2 Morphological Traits of Fruits:**

- 1. Fruit Length (mm): The length of 10 fruits per tree was measured using a Vernier caliper. Fruits were classified as short (<20 mm), medium (20–30 mm), or long (>30 mm).
- 2. Fruit Diameter (mm): The diameter of 10 fruits per tree was measured using a Vernier caliper. Fruits were classified as small (<20 mm), medium (20–30 mm), or large (>30 mm).
- 3. Fruit Weight (g): Fruits were weighed, and the average was calculated.
- 4. **Fruit Volume (cm<sup>3</sup>):** Measured using a graduated cylinder and the water displacement method.

### Statistical Analysis:

Data were analyzed using a Completely Randomized Block Design with a single factor (variety). The Least Significant Difference (LSD) test was applied at a 5% significance level.

#### **Results and Discussion:**

# 2-2Morphological Traits of Leaves:

# 1-2-2 Leaf Length (mm)

From Table (3), it is observed that the leaf length significantly varied among the studied varieties, depending on the cultivar. The Barhi cultivar had the longest leaf, reaching 4.82 meters (long), while the Um-Dahan cultivar had the shortest leaf length at 4.17 meters (medium). These results align with the studies of Abad et al. (2008), Abd et al. (2013), Hider et al. (2015), Basahih (2019), Abdullah (2019), and Bahramz et al. (2021), as well as with the findings of Alghool and Benismail (2007) in their study on the morphological traits of semi-dry date palm varieties growing in Libya. The results are also consistent with Ageez and Madbooly (2011) in their study on using

vegetative indicators to differentiate between male and female date palm cultivars, particularly the Siwi cultivar. Elibrism et al. (2012) explained that the variation in leaf length is attributed to several factors, most notably the cultivar, genetic factors, environmental conditions, and the palm care operations.

#### 2-2-2 Number of Leaves

From Table (3), it is observed that the number of leaves significantly varied among the studied varieties, depending on the cultivar. The Zahdi cultivar produced the highest number of leaves, totaling 87 leaves, with significant differences compared to both the Um-Dahan and Barhi cultivars. The Barhi cultivar had the lowest number of leaves, with 52 leaves. These findings are in agreement with the studies of Basahih (2019), Abdullah (2019), and Bahramz et al. (2021). The difference in the number of leaves is likely due to the impact of the cultivar, genetic factors, environmental conditions, and palm care practices.

# 3-2-2 Spine Length (cm)

From Table (3), it is observed that spine length significantly varied among the studied varieties depending on the cultivar. The Um-Dahan cultivar had the longest spine, measuring 10.47 cm (medium), showing significant differences from the Zahdi cultivar. The Zahdi cultivar had the shortest spine length, measuring 8 cm (short). These results are consistent with the findings of Abad et al. (2008), Abd et al. (2013), Al-Najjar (2017), Basahih (2019), and Bahramz et al. (2021).

# 4-2-2Number of Thorns

From Table (3), it is observed that the number of thorns significantly varied among the studied varieties depending on the cultivar. The Barhi cultivar had the highest number of thorns, totaling 29 thorns (medium), with significant differences compared to both the Um-Dahan and Zahdi cultivars. The Zahdi cultivar had the fewest thorns, with only 10 thorns (low). These results align with the studies of Abad et al. (2008), Ageez and

Madbooly (2011), Elibrism et al. (2012), Khaleef et al. (2017), Basahih (2019), Abdullah (2019), and Bahramz et al. (2021). **Table (3): Average Leaf Length, Number of Leaves, Spine Length, and Number of Thorns for the Studied Varieties. Table (3) Average length and number of fronds and length and number of thorns for the studied varieties.** 

Cotogorios	Palm length	Number of	Palm length	Number of
Categories	(m)	palm leaves	(cm)	forks
Mother of fat	4.17 b	73.5 b	10.47 a	18.50 b
Ascetic	4.31 b	87.5 a	8 b	9.33 a
Barhi	0.29 a	12.93 c	2.20 b	2.53 a
LS D	0.29	12.93	2.2	2.53

As shown in Table (4), the number of fronds varied significantly across the studied varieties. The "Barhi" variety produced the highest number of fronds, reaching 209.2 fronds, which showed significant differences when compared to the "Um Al-Dahen" and "Zahidi" varieties. The "Zahidi" variety produced the fewest fronds, with 189.2 fronds. These results are consistent with the findings of Elsherbiny and Rizk (2005), Ageez and Madbooly (2011), Al-Abresim et al. (2012), Hider et al. (2015), Al-Najjar (2017), Al-Saadi (2019), and Bahramz et al. (2021).

Here is a more scientifically precise rewording of the sections:

# 5-2-2 Frond Length (cm)

Table (4) reveals a significant variation in frond length among the studied date palm cultivars. The Um Al-Dahen variety exhibited the longest fronds, measuring 57 cm, showing statistically significant differences when compared to the Zahidi and Barhi cultivars. The Barhi cultivar had the shortest fronds, with a length of 50 cm. These results align with the findings of ElSharabasy (2015), Al-Abresim et al. (2012), and Ageez & Madbooly (2011).

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# 6-2-2 Frond Width (cm)

Table (4) demonstrates significant variation in frond width among the cultivars studied. The Barhi variety had the widest fronds, measuring 3.43 cm, though these were thinner than those of the Um Al-Dahen cultivar. The Zahidi cultivar exhibited the narrowest fronds, with a width of 2.90 cm. These findings are consistent with previous research by ElSharabasy and Rizk (2005), Al-Abresim et al. (2012), Haider et al. (2015), Al-Najjar (2017), Al-Saadi (2019), and Bahramz et al. (2021).

 Table (4) Average number , length and width of fronds for the studied varieties

Categories	Number of palm fronds	Length of palm frond	Wicker display
Mother of fat	180	57.4	2.9
Ascetic	189	52.23	3.23
Barhi	209 a	50.20 b	3.43 a
LS D	12.65	4.52	0.24

Different letters mean a semantic difference

# **3. Morphological Traits of Fruits:**

1.3 Fruit Length (mm)

From Table (5), it is observed that the fruit length significantly differed across the studied cultivars. The cultivar "Um Dahan" produced the longest fruit, measuring 39.03 mm, with significant differences compared to the "Barhi" cultivar. The "Barhi" cultivar had the shortest fruit length. These findings are consistent with studies by Al-Marzouqi et al. (1998), Al-Essi (2006), Sakr et al. (2010), Abdi et al. (2012), Abdi et al. (2013), Jorani (2016, 2017), Ahmad (2017), and Abdul-Sahib and Abdul-Sahib (2020).

# 2.3. Fruit Diameter (mm)

As shown in Table (5), the fruit diameter did not show significant differences between the studied cultivars. The "Um Dahan" cultivar had the largest fruit diameter, measuring 25.60 mm, with numerical differences compared to the "Zahidi" and

"Barhi" cultivars. The "Zahidi" cultivar had the smallest fruit diameter, measuring 22.70 mm. These results are in line with Al-Marzouqi et al. (1998), who noted that certain Omani date palm cultivars are similar in some physical characteristics, including fruit diameter. However, these findings differ from those of Abdi et al. (2012), Abdi et al. (2013), Jorani (2016), Helf et al. (2017), Ahmad (2017), and Abdul-Sahib and Abdul-Sahib (2020).

 Table (5) Effect of variety on length, diameter, weight and size of fruit

Categories	Fruit length ( mm)	Fruit diameter (mm)	Fruit weight (g)
Mother of fat	<b>39.03</b> a	25.6	14
Ascetic	36.68 b	22.7	10.88
I'm bored	29.63 b	24	9.13
LS D	5.5	Non-moral	Non-moral

# Different letters mean a meaningful difference .

# **Conclusion:**

The study concluded the following:

- 1. **Um Al-Dihin** significantly outperformed in spine length, leaflet length, fruit length, and fruit volume.
- 2. Zahidi excelled in the number of fronds.
- 3. **Barhi** led in frond length, number of spines, leaflet width, and number of leaflets.
- 4. There were no significant differences in fruit diameter or weight among the varieties.

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ISSN: 2537-0367