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Characterization of Date Palm (*Phoenix dactylifera* L.) Wild Relatives In Coastal Salt Marshes at Wadi El-Gemal Protectrate

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ABSTRACT

The present study focuses on characterization of an important salt tolerant species, the date palm (*Phoenix dactylifera* L.) genetic resources growing naturally at delta of Wadi El-Gemal, one of the main protectorates at Red Sea coastal area, Egypt. Five sites were selected at date palm grove dominating the delta for soil and plant sampling and field measurements. Particle size distribution, pH, EC, and organic matter were analyzed in rhizosphere soils. Chloride, sodium, potassium, calcium, and magnesium were analyzed in both surface soil samples and dried leaves of date palm. Statistical evaluation of the obtained data showed significant variations in silt and clay content, EC, and available content of Cl^-, Na^+, K^+, and Ca^{2+} between different sites. Soils of W. El-Gemal delta are strongly saline with highly significant variation between different sites (EC= 62.98 ± 31.97 dS m^{-1}). Accumulation of certain ions in date palm leaves was highly correlated with soil ions. The high accumulation of Na^+ and Cl^- may serve as useful mechanism for providing osmotic solutes to enable the date palm to be the most salt tolerant fruit species. The high salinity tolerance of the date palm tree makes it a good model for saline soil reclamations. The Delta of W. El-Gemal holds an important wild relative of date palm and the authors recommend that this delta should have a special concern within the protectorate as an important hot spot for *in situ* conservation of date palm genetic resources.

Keywords: Conservation, soil plant interaction, *Phoenix dactylifera*, saline soil, Wadi El-Gimal, Coastal area, Red Sea, Egypt.

INTRODUCTION

Date palm, *Phoenix dactylifera* L. (Palmae) is one of the oldest cultivated fruit trees in arid ecosystems especially the Arab countries region. Saker and Moursy (2003) stated that Egypt is the origin of date palm tree. Date palm was known in Egypt since 4000 year, and this fact can be simply proved from date palm photos appeared on the walls of Ancient Egyptian temples. Date palm is one of the multipurpose trees; its fruit has provided the staple carbohydrate food of local people for nearly 5000 years (Jones, 1995; Mokdad, 2003). Habitats of date palm trees are characterized by hot and dry conditions with annual rainfall of about 100-150 mm (El-Baradi, 1968; Nixon, 1969).

In 2005, the date production of the world was approximately 5087 thousand tons (FAO, 2007). According to the annual agricultural statistics of Arab Countries Council (2006) and FAO (2007), Egypt is the first country in the world in date palm production (1170 thousand tons) followed by Iran (997 thousand tons), Saudi Arabia (970 thousand tons), Algeria (516 thousand tons), Pakistan (496 thousand tons), Iraq (404 thousand tons), and Sudan (328 thousand tons) (Fig. 1). Dates production in Egypt has been increased from 542 thousand tons in 1990 to 1170 thousand tons in 2005 (Fig. 2) (FAO, 2007). The total number of varieties and cultivars of date palm exceeds 3000 cultivars, spreading from Morocco on the Atlantic Ocean in the west to the countries of Arab Gulf in the east. Iraq leads the Arab countries in the number of date palm cultivars where about 600 cultivars have been identified, followed by countries of Gulf with about 400 cultivars, Libya with about 400 cultivars, Tunisia with about 200 cultivars and Egypt with about 100 cultivars (FAO, 1998). Many varieties of date palm have been collected and preserved in international gene banks to be available for different breeding programs.

In general, plant genetic resources for food and agriculture as one of the most critical resources for the survival and well-being of human beings are seriously threatened. The lack of capacity to ensure conservation and to promote sustainable utilization of these resources undermines the quest for world food security and needs of the growing world population (FAO, 1996).

Genetic diversity of the date palm is subjected to two main threats; (1) the threat that national programs may aim to multiply only a limited number of date palm varieties, thereby causing a replacement effect on *insitu* varieties; and (2) market forces that encourage farmers to grow only a few, high value varieties of date palms, to the exclusion of a wide range of other varieties. These two threats have great negative impact on the date palm genetic resources leading to rapid genetic erosion (FAO, 1996; UNDP, 2006) and increasing susceptibility of the limited cultivated varieties of date palm to different types of pests (e.g., red palm weevil, *Rhynchophorus ferrugineus*) (Cox, 1993; Murphy and Briscoe, 1999).

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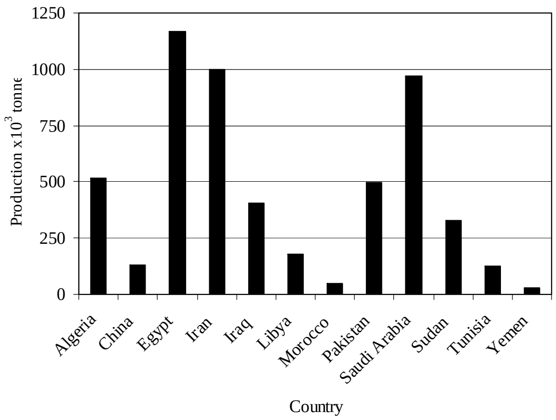

Figure (1): Dates production of 2005 in the top 12 countries in the world.

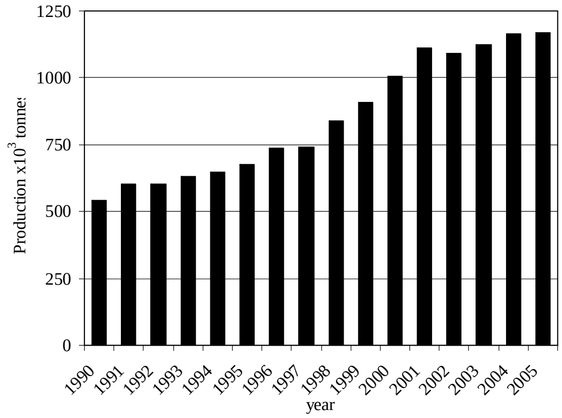

Figure (2): Annual production of dates in Egypt through the period: 1990-2005.

Increasing salinity in Egyptian soils and rising water table levels represent a hard problem which could face fruit production (Hassan and El-Samnoudi, 1993). The even increasing demand for agricultural products requires a reassessment of the production potential of low-quality land and water resources (Epstein *et al.*, 1980). Date palm is considered the most salt tolerant fruit crop (Ayers and Westcot, 1994). It is highly recommended for reclamation of saline soil, which represents one of the major soil problems in arid ecosystems (Balba, 1995)

This study aimed to clarify the ecological situation of date palm wild relatives growing in one of the highly saline coastal area, the delta of Wadi El-Gemal, with focusing on their associated vegetation groups, socio-economic aspects, and salt tolerance characterization. This study provides required information that may help in building conservation and sustainable use strategies of date palm wild relatives.

MATERIALS AND METHODS

Site Description

Wadi El-Gemal is the third largest wadi in the Eastern Desert draining into the Red Sea, and one of the best vegetated, with an estimated watershed area of some 1476.7 km² (EEAA, 2003) (Fig. 3). It is one of the hyper arid regions characterized by hot, rainless summer and mild winter, and irregular precipitation falling mainly in autumn and winter months in the form of short and heavy showers causing flash flooding. The average annual precipitation is about 17.4 mm (meteorological stations of Ras Banas). The monthly mean temperature varies between 24-38 ^{o}C during summer and 12-26 ^{o}C during winter. The relative humidity varies between 28% in summer and 57% in winter. The average evapotranspiration varies between 8.7mm/day in winter and 28 mm/day in summer.

In general, vegetation in W. El-Gemal Protectorate, as a hyperarid desert region, is mainly confined to wadis (Ayyad and Ghabbour, 1985; Moustafa *et al.*, 2007), where soil moisture conditions permit its establishment and continued growth. Moisture conditions vary among individual catchments and drainage systems. Surface water and soil moisture in the upper part of the soil is highly unreliable and trees and other perennial vegetation seem therefore to rely mainly upon deeper and permanent soil moisture during the long dry periods between rains (Kassas and Imam, 1954). Floristically, Kassas (1993) classifies Wadi El-Gemal area as a part of the "Southern (Nubian) Section" of the Eastern Desert. This area harbors more than one hundred plant species of mainly perennials and including few number of important genetic resources of tree species such as *Acacia tortilis*, *Balanites aegyptiaca*, and *Pheonix dactylefera* (Barakat, 2003; Andersen and Krzywinski, 2007; Moustafa *et al.*, 2007).

Field survey

To describe the vegetation at delta of W. El-Gemal, 25 stands (20x20 m) were selected in a restricted random approach along different zones of the delta including the littoral zone, depressions, phytohillocks, and ridges. At each stand, canopy cover of each plant species was measured. T?ckholm (1974) was followed for identification of plant species, while updating species names and life forms were following to Boulos (1995, 1999, 2000, 2002, and 2005). Latitude, longitude and altitude (using GPS receiver "Trimble model") were recorded. The nature of soil surface was described following to Hausenbuiller (1985).

Five sites were selected within the grove of date palm at delta of Wadi El-Gemal representing the salt marsh habitat (Fig. 3). At each site, three surface soil samples (from the rhizosphere) and three leaf samples of date palm were selected.

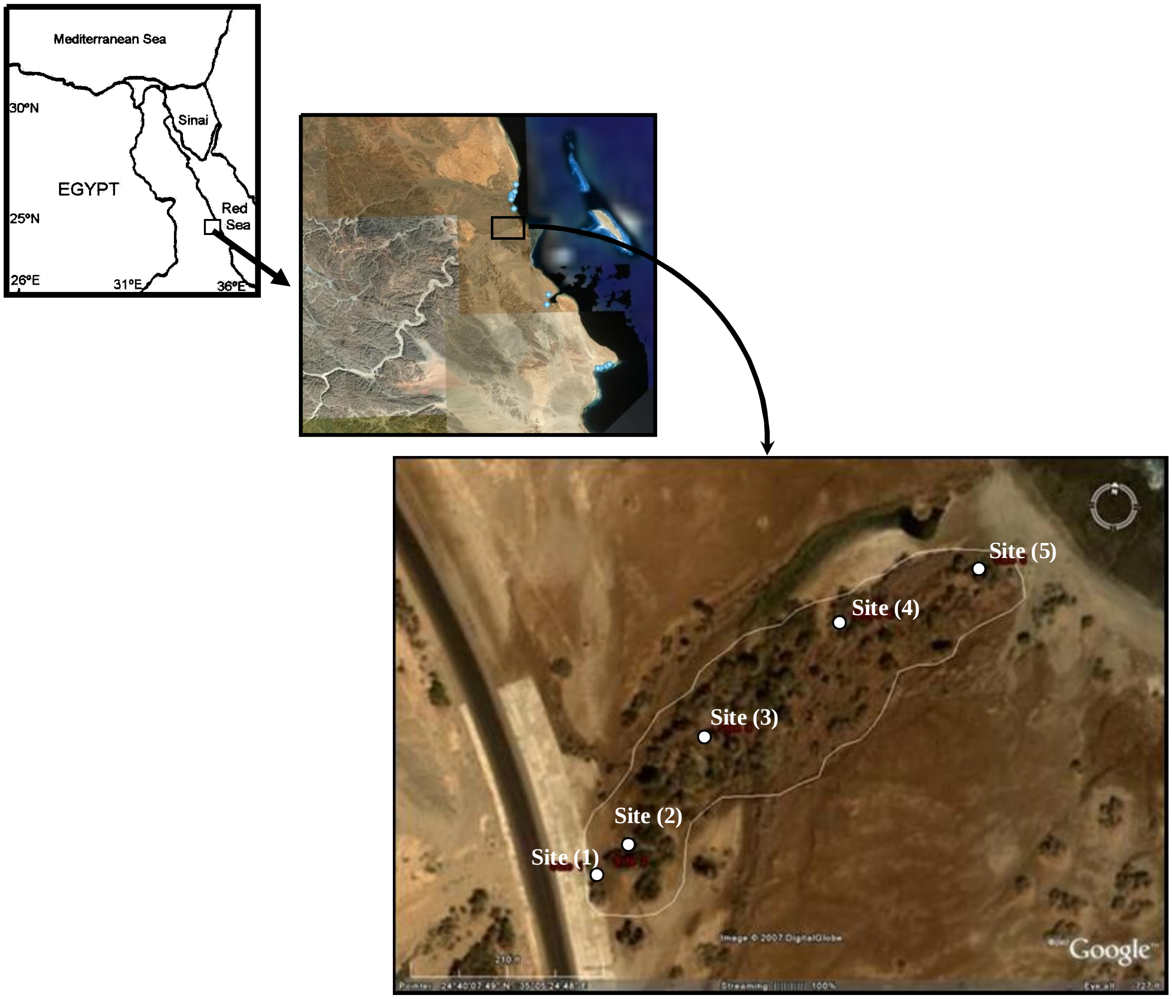

Figure (3): Satellite image showing the five selected sites at date palm grove in delta of Wadi El-Gemal, Red Sea coastal area, Egypt.

Socioeconomic aspects of date palms were evaluated through three different meeting with Ababda, the local inhabitants, at two main settlements; W. El-Gemal and Abu Ghusoon.

Soil and Plant Analysis

Soil analyses included particle-size distribution (Richards, 1954; Gee and Bauder, 1986), pH, EC, total carbonate (TC), total nitrogen (TN), and soil organic matter (SOM). Available cations and anions were analyzed in different soil samples including Cl^-, HCO_3^-, SO_4^{2-}, Na^+, K^+, Ca^{2+}, and Mg^{2+} (Sparks *et al.*, 1996). Leaves samples were oven dried at 70°C and prepared for elements analysis. These elements include Cl^-, N, P, Na^+, K^+, Ca^{2+}, and Mg^{2+}. Chloride was extracted from the ashed samples with water. Other elements were measured in sulphoric acid-hydrogen peroxide extract. Plant chemical analysis was following to Kalra (1998) and Robertson *et al.* (1999). Statistical analyses of the data were carried out (Zar, 1984) using SPSS software (Statistical Package for Social Sciences, version 11.5).

RESULTS

Vegetation Structure

Delta of W. El-Gemal is a salt marsh region that is characterized by different types of habitats: (a) sea shore dominated by *Zygophyllum album*, (b) large open area of littoral saltmarsh dominated by *Aeluropus massauensis*, (c) depressions with accumulated fresh or brackish water "small ponds" dominated by *Juncus rigidus*, and *Phragmitis australis*, (d) few ridges dominated by *Phoenix dactylifera*, and further from the shoreline, (d) phytohillocks dominated by *Tamarix nilotica*. The delta of Wadi El Gemal also harbors other species such as *Zygophyllum coccineum*, *Hyphaene thebaica* (Dom palm), *Zilla spinosa*, *Pulicaria undulata*, and *Panicum turgidum*.

The delta of Wadi El-Gemal contains the only known natural fresh water swamp on the Red Sea coast in Egypt. Although occupying a very small area, the swamp is important as a relict habitat supporting reed swamp community dominating by *Phragmites australis*, and *Juncus rigidus*.

In general, the delta is characterized by condensed halophytic vegetation dominated mainly by *Tamarix nilotica,* followed by *Aeluropus massauensis,* and *Zygophyllum album*. These species are growing in form of phytogenic mounds or phytohillocks. The vegetation groups dominating the delta of W. El- Gemal are growing in definite layers or zones. The average of plant cover may reach 25%. The vegetation groups characterizing the area include (1) *Aeluropus massauensis,* (2) *Tamarix nilotica,* (3) *Tamarix nilotica* **-** *Aeluropus massauensis,* (4) *Phoenix dactylifera,* (5) *Phragmites australis - Juncus rigidus - Cyperus sp.*, (6) *Zygophyllum album - Aeluropus massauensis - Tamarix nilotica,* and (7) *Zygophyllum album.*

Phoenix dactylifera vegetation group is associated with different species depending on salinity and soil moisture gradients. The associated species include *Hyphaene thebaica* (site 1), *Tamarix nilotica* (site 2), *Phragmites australis, Juncus rigidus* and *Zygophyllum coccineum* (sitet 3), *Zygophyllum album* and *Tamarix nilotica* (site 4), and *Zygophyllum album* (site 5).

Vegetative Characteristics of Date Palm

More than 100 of reproductive date palm trees are growing naturally on narrow grove with total plant cover about 30-40%. Field vegetative parameters measured in the studied sites (Fig. 3) could be summarized as follow. Sites one and two are the furthest sites from the sea shore and characterized by 5 to 10% of vegetation cover of date palms. Sites number 3 and 4 are located at the middle of the grove close to the swamp bond and characterized by condensed growth of reproductive date palm trees. The total plant cover at these sites is more than 70%. The closest site to the sea shore is site number 5, where number of date palm trees decreased to one to two palm trees per 25 m^2, and vegetation cover decreases to less than 5%. The mean diameter at breast height (DBH) of the date palms is 33.2 ± 4.71 cm. Height of the date palms and length of date palm leaves are 4.83 ± 1.57 m, and 2.56 ± 0.48 m, respectively.

Socio-economic aspects

Ababda are the main indigenous inhabitants of W. El-Gemal Protectorate. They work in grazing, collecting plants, whether for food or trade, producing charcoal from the trees of the region, especially, *Acacia tortilis*, fishing, tourism, and some of them work as guards in the mines in the area. The main settlements of Ababda are concentrated at Wadi El-Gemal, Wadi Ghadeer, and Abu Ghusoon. Number of families ranges varies from 50 to 75 with average 5 to 10 person per each.

The grove of date palms is one of the historical landmarks characterizing one of the highly saline habitats, the delta of W. El-Gemal. The age of date palms may exceed 200 years. The delta used to support older palms but they were washed away due to flash floods, frequently happened in W. El-Gemal every 7 to 10 years. Ababda used to depend on these palms for providing an important part of their food and other goods and services. Some of the elders used to take care of the date palms and they were collecting tons of dates every year and distributing the yield equally between the whole families of Ababda tribe. Each family used to get between 70 to 100 kg every year. The average yield per date palm ranged between 20 and 30 kg. The dates yield was higher in the middle portion of the date palm grove than the edges. Most of the date palm trees in the surveyed sites were productive. The highest yield was reported in site 3, followed by sites 1, and 2. Low yield was recognized in sites 4 and 5.

Soil conditions

Soil physical analysis showed that surface soils of the different sites at delta of W. El-Gemal are characterized by significant variation in soil texture ranging between sandy loam (site number 1) and sand clay loam (sites number 2, 4, and 5). Site number 3 is characterized by loamy soil (Table 1).

These soils are characterized by low alkalinity (pH= 7.62 ± 0.32), low content of TC (4.39 ± 2.87%), medium to high content of SOM (2.11 ± 1.96%), low to medium content of TN (0.11 ± 0.1%) (Table 1).

Table (1): Soil physical and chemical properties at different sites at Delta of W. El-Gemal. Mean values of each variable with similar letters indicate no significant variation according to Duncan's multiple range test at significant level 0.05.

Site No.	Sand%	Silt%	Clay%	Texture	pH	TC	SOM%	TN%
1	64.87	22.43^{bc}	12.71^{a}	S. loam	7.72	5.68	0.74	0.04
2	60.52	10.90^{ab}	28.58^{b}	S. Clay loam	7.71	2.65	0.53	0.03
3	48.59	32.44^{c}	18.97^{ab}	Loam	7.48	3.59	2.87	0.14
4	47.74	21.85^{bc}	30.41^{b}	S. Clay loam	7.31	3.93	4.64	0.23
5	64.58	2.65^{a}	32.77^{b}	S. Clay loam	7.96	6.50	1.00	0.05
Mean	56.47	19.36	24.17		7.62	4.39	2.11	0.11
St. Er.	3.00	3.70	2.76		0.10	0.87	0.57	0.03
St. Dev.	9.96	12.26	9.14		0.32	2.87	1.96	0.10
F	N.S.	7.30**	4.03*		N.S.	N.S.	N.S.	N.S.

* *F* ratio is significant at the 0.05 level, ** *F* ratio is significant at the 0.01 level, N.S.: non significant

Table (2): Electric conductivity, cations, and anions of the studied soil samples at different sites. Mean values of each variable with similar letters indicate no significant variation according to Duncan's multiple range test at significant level 0.05.

Site No.	EC $dS\ m^{-1}$	Na^{+} $meq\ l^{-1}$	K^{+} $meq\ l^{-1}$	Ca^{2+} $meq\ l^{-1}$	Mg^{2+} $meq\ l^{-1}$	Cl^{-} $meq\ l^{-1}$	SO_4^{2-} $meq\ l^{-1}$	HCO_3^{-} $meq\ l^{-1}$
1	23.75^{a}	82.18^{a}	4.63^{a}	129.30^{a}	82.30	289.80^{a}	4.44	12.00
2	33.85^{ab}	110.44^{a}	6.49^{ab}	226.40^{ab}	130.90	484.50^{a}	7.40	14.00
3	79.20^{cd}	771.56^{bc}	7.60^{ab}	431.30^{bc}	255.63	1460.73^{b}	64.97	15.50
4	104.45^{d}	1317.80^{c}	21.93^{c}	537.90^{c}	331.40	1810.50^{b}	933.10	30.00
5	65.55^{bc}	680.96^{b}	15.30^{bc}	115.90^{a}	187.50	931.30^{ab}	197.90	7.00
Mean	62.98	608.86	10.86	301.17	202.83	1037.67	212.13	15.67
St. Er.	9.64	150.40	2.20	58.00	38.38	198.73	147.45	4.15
St. Dev.	31.97	498.83	7.30	192.36	127.28	659.10	361.17	10.17
F	11.22**	9.42**	6.46*	6.64*	N.S.	6.08*	N.S.	N.S

* *F* ratio is significant at the 0.05 level, ** *F* ratio is significant at the 0.01 level, N.S.: non significant

Soils of W. El-Gemal delta are strongly saline with highly significant variation between different sites (EC= 62.98 ± 31.97 dS m^{-1}). Site 4 is the highest in salinity (104.45 dS m^{-1}), whereas the lowest salinity level was 23.75 dS m^{-1} at site one (Table 2).

Concentration of ions related to soil salinity such as sodium, chloride, and sulphate is very high (Table 2). Sodium and chloride have the highest concentration among soil ions (608.86 ± 498.83 and 1037.67 ± 659.10 meq l^{-1}, respectively) followed by sulphate, calcium, and magnesium (212.13 ± 361.17, 301.17 ± 192.36, and 202.83 ± 127.28 meq l^{-1}, respectively). Potasium and bicarbonate showed the lowest concentration in soil water extract (10.86 ± 7.30 and 15.67 ± 10.17 meq l^{-1}, respectively). Magnesium, sulphate, and bicarbonate showed non significant variation within different sites (Table 2). Based on Pearson Correlation statistical analysis, highly significant positive relationship was recognized between soil electric conductivity (EC) and some soil salinity indicators especially Na (r = 0.968) and Cl (r = 0.967), followed by Ca (r = 0.830), Mg (r = 0.790), and K (r = 0.751). Non significant relationship was recognized between soil electric conductivity and soil sulphate (Table 4).

Chemical properties of Date Palm Leaves

Chemical analysis of certain ions in leaves of date palm showed very high concentration of Na and Cl (11.11 ± 20.07 and 13.12 ± 13.01 g/kg, respectively)(Table 3). Mean values of calcium and magnesium in date palm leaves were 9 ± 4.28 and 5.65 ± 3.43 g/kg, respectively. Date palm leaves content of Na, K, Mg, and Cl showed highly significant variation between different sites. On the other hand, variation in N and P content was non significant (Table 3). Date leaves of site 5 have the highest content of Na, Mg, and Cl (54.66, 11.88, and 41.12 g kg^{-1}, respectively). Only Ca content in leaves was significantly positive correlated with EC, Na and Mg content in soil. Sites 3 and 4 were higher in Ca content in leaves than the other sites. Potasium and Phosphorus content in leaves were significantly negative correlated with EC, Na and Cl content in soil. Non significant relationship was recognized between soil and plant content of Na, Mg, and Cl (Table 4). In the mean time, highly significant positive relationships were observed between Na/Ca_{ext} (sodium calcium ratio) in soil, and Na, Cl and Mg content in leaves. Pearson correlation values and their significance of these relationships were as followed: $r = 0.888$, $p < 0.0001$; $r = 0.917$, $p < 0.0001$; and $r = 0.793$, $p = 0.006$, respectively.

DISCUSSION

The diversity in vegetation patterns along the delta of W. El-Gemal could be interpreted through micro-topographic variation and soil heterogeneity characterizing the area and controlling the soil moisture and salinity gradients (Kassas 1960, Zahran and Willis, 1992). In agreement with Zahran & Willis (1992) and Barakat (2003), delta of W. El-Gemal, as a part of the littoral salt marshes, is characterized by definite layers or zones of characteristic vegetation types. These distinct zones are evident within the coastal plant communities corresponding to their levels of salinity tolerance.

Soil texture data indicates long history of vegetation and climate interaction to develop such types of soils that ranges from sandy loam to sand clay loam, and also indicates the information collected from Ababda about the age of the date palm grove that may exceed 200 years old. Due to the aridity conditions, hot climate, and closeness to the sea and salty sprays, soils of the delta of W. El-Gemal are characterized by high salinity (EC= 62.98 ± 31.97 dS m^{-1}). The large variation in soil salinity among different sites in delta of W. El-Gemal may be related to variation in micro-topography in addition to the presence of the fresh to brackish water springs that form swamp in the middle of the date palm grove. Date palm is considered one of the most salt tolerant fruit crops (Ayers and Westcot, 1994). Sodium and chloride in soil were the highest correlated ions with soil salinity. They cause membrane damage,

Table (3): Cations and anions in dry leaves of date palm trees growing at different sites. Mean values of each variable with similar letters indicate no significant variation according to Duncan's multiple range test at significant level 0.05.

Site No.	Na^+ g kg^{-1}	K^+ g kg^{-1}	Ca^{2+} g kg^{-1}	Mg^{2+} g kg^{-1}	Cl^- g kg^{-1}	N g kg^{-1}	P g kg^{-1}
1	2.03^a	8.61^b	4.05^a	2.97^a	8.38^a	7.51	1.87
2	1.06^a	7.60^b	8.10^{ab}	2.52^a	5.82^a	6.72	1.73
3	3.14^a	2.30^a	11.70^{ab}	5.40^{ab}	7.40^a	11.71	1.37
4	2.93^a	2.01^a	14.10^b	6.12b	8.58^a	2.80	1.38
5	54.66^b	3.66^a	7.20^a	11.88^c	41.12^b	5.46	1.31
Mean	11.11	5.02	9.00	5.65	13.12	7.80	1.52
St. Er.	4.73	0.64	1.04	0.83	3.07	1.67	0.08
St. Dev.	20.07	2.70	4.28	3.43	13.01	7.07	0.34
F	1462.94***	11.38***	2.76*	21.65***	222.6***	N.S.	N.S.

* *F* ratio is significant at the 0.05 level, ** *F* ratio is significant at the 0.01 level, *** *F* ratio is significant at the 0.001 level, N.S.: non significant.

Table (4): Pearson Correlation between soil electric conductivity (EC), some soil salinity indicators, and ions content in dry leaf tissue of date palm.

		EC dS m^{-1}	Water soluble Ions in soil (meq l^{-1})						Ions Content in dry leaf tissue (g kg^{-1})					
			Na^+	K^+	Ca^{2+}	Mg^{2+}	Cl^-	$SO4^{2-}$	Na^+	K^+	Ca^{2+}	Mg^{2+}	Cl^-	P
EC dS m^{-1}														
Water soluble Ions in soil	Na^+	0.968**												
	K^+	0.751**	0.774**											
	Ca^{2+}	0.830**	0.752**	0.475										
	Mg^{2+}	0.625*	0.718*	0.625	0.718									
	Cl^-	0.967**	0.883**	0.671*	0.896**	0.707*								
	$SO4^{2-}$	0.723	0.855*	0.845*	0.526	0.704	0.532							
Ions Content in dry leaf tissue	Na^+	0.065	0.096	0.318	-0.456	-0.035	-0.055	-0.012						
	K^+	-0.885**	-0.844**	-0.532	-0.647*	-0.607*	-0.841**	-0.529	-0.250					
	Ca^{2+}	0.704*	0.727*	0.510	0.631	0.833**	0.615	0.599	-0.174	-0.539*				
	Mg^{2+}	0.247	0.301	0.341	-0.260	0.145	0.107	0.165	0.878	-0.517	-0.027			
	Cl^-	0.069	0.103	0.339	-0.465	-0.082	-0.047	0.010	0.991**	-0.249	-0.169	0.844**		
	P	-0.761**	-0.716*	-0.347	-0.556	-0.401	-0.741**	-0.793	-0.278	0.714**	-0.047	-0.385	-0.294	

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

which may be considered as a basic toxic component of salt injury (Pitman, 1984, Greenway and Munns, 1980). The present work indicated that salinity in terms of Na:Ca ratio in soil increases the accumulation of Na and Cl ions in leaves of date palm. The salinity response of date palm may be classified as halophytic in nature (Hassan and Abou El-Azayem, 1990). The ability of date palm to tolerate salinity seems to depend on its ability for accumulation of these ions in their leaves, which may serve as useful function by providing osmotic solutes (Hassan and Abou El-Azayem, 1990). In contrary with Hassan and El-Samnoudi (1993), and Ayers and Westcot (1994) who stated that date palm shows zero production at soil salinity equals to 23.24 and 32 dS m^{-1}, respectively, the reproductive date palms growing at the delta of wadi El-Gemal can tolerate up to 80 dS m^{-1} (EC of site 3).

In conclusion, the date palm at delta of W. El-Gemal is considered one of the most salt tolerant varieties. W. El-Gemal Protectorate, as most of the world's 8500 national parks and other protected areas, was established with little specific concern for the conservation of wild crop relatives and wild plants for food production (FAO, 1996). We recommend that delta of W. El-Gemal should have a special concern within the protectorate as an important hot spot for *in situ* conservation and sustainable use of date palm genetic resources. *In situ* conservation should imply comprehensive planning in which protection, production and genetic conservation aspects of date palm wild relatives have to be considered. Participation of Ababda in activities of date palm protection and production is essential to guarantee successful and continuity of the conservation activities. Sustainable use strategy of date palm should be integrated with the specific needs of Ababda. Awareness and training of Ababda on best practices in the field of date palm cultivation have to be conducted. Finally, propagation and rehabilitation of date palm wild relatives will increase the diversity of date palm; and help in reclamation of saline soils and security the increase demand for food and agricultural products.

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توصيف الأصول البرية لنخيل البلح فى السبخات الساحلية لمحمية وادى الجمال

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الملخص العربـــى

تهدف هذه الدراسة إلى صون الأصول البرية لنخيل البلح والذى يعتبر واحد من أهم الأشجار المثمرة التى يعتمد عليها الإنسان فى توفير جزء أساسى من غذاءه وبخاصة فى المناطق الصحراوية الجافة بالوطن العربى ، وذلك من خلال توفير المعارف الأساسية لخصائص وبيئة هذه الأصول الوراثية وبخاصة قدرتها على مقاومة الملوحة. ركزت هذه الدراسة على أحد الأصول الوراثية لنخيل البلح والنامى بصورة طبيعية فى دلتا وادى الجمال على ساحل البحر الأحمر.

تم اختيار خمس مواقع فى منطقة النخيل بدلتا وادى الجمال لإجراء القياسات الحقلية وأخذ عينات التربة السطحية وعينات من أوراق النخيل. هذا بالإضافة لعدد 25 موقعاً لتقدير الغطاء النباتى ووصف الكساء الخضرى والمجتمعات النباتية المميزة لدلتا وادى الجمال. اشتملت تحليلات التربة على تقدير قوام التربة، والأس الهيدروجينى، والتوصيل الكهربائي، والكربونات الكلية، والنيتروجين الكلى، والمادة العضوية، والأنيونات والكاتيونات. كذلك اشتملت تحليلات العينات النباتية على تقدير عناصر الصوديوم والبوتاسيوم والكالسيوم والماغنسيوم والكلوريد والنيتروجين والفوسفور. تم معالجة البيانات المتحصل عليها إحصائياً.

أظهرت النتائج تميز دلتا وادى الجمال بتتابع خاص من المجتمعات النباتية المميزة للبيئات الساحلية الملحية المختلفة ، حيث أمكن التعرف على ست مجتمعات نباتية. تتميز دلتا وادى الجمال بوجود تجمع لأشجار نخيل البلح المثمر والذى يعد من العلامات التاريخية لدلتا وادى الجمال. أوضحت نتائج تحليلات التربة السطحية مدى التباين التى تتميز به من حيث قوام التربة ، وملوحة التربة بدلائلها المختلفة.

وتعتبر دلتا وادى الجمال من أشد المناطق الساحلية ملوحة ، حيث تراوحت ملوحة التربة من $23.75\ dS\ m^{-1}$ إلى $104.45\ dS\ m^{-1}$. أظهرت التحليلات الإحصائية مدى الارتباط المعنوى بين تراكم عناصر الملوحة فى أوراق النخيل مع نسبة الصوديوم إلى الكالسيوم فى التربة الأمر الذى يفسر قدرة نخيل البلح على تحمل هذه الملوحة العالية.

يعتبر نخيل البلح النامى بدلتا وادى الجمال من الأصول الوراثية الهامة لهذا النوع لما له من قدرة عالية على مقاومة الملوحة واحتفاظه بقدرة انتاجية عالية الأمر الذى يميزه عن كثير من الأصناف المنزرعة والمذكورة فى المراجع المختلفة والتى يتوقف انتاجها عند درجات ملوحة تصل إلى ما بين 20 و $30\ dS\ m^{-1}$. توصى الدراسة باعتبار دلتا وادى الجمال من المناطق الهامة للصون الموقعى للأصول الوراثية لنخيل البلح وتوفير برامج إدارة قادرة على حمايتها وإكثارها ومتابعة خصائصها المورفولوجية والإنتاجية والجينية. :ذلك توصى الدراسة أن تشتمل برامج الصون على تفعيل مشاركة العبابدة (السكان المحليين) لضمان نجاح وفاعلية أنشطة الحماية. وأخيراً فإننا نوصى بإكثار الأصناف البرية لنخيل البلح وتشجيع استزراعها فى الأراضى الملحية ، الأمر الذى سوف يساهم فى زيادة تنوع نخيل البلح والحفاظ عليه بالإضافة إلى المساهمة فى استصلاح الأراضى الملحية.