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AUTOECOLOGICAL AND ECO-PHYSIOLOGICAL STUDIES ON *Pancratium arabicum* (Sickenb)

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ABSTRACT

Pancratium arabicum plants, Family Amaryllidaceae were collected from two habitats; Abu Lahw El-Bahary and Cleopatra sand dune habitats at Marsa Matruh. It was observed that *Pancratium arabicum* plants grow and flourish under moderate conditions of temperature.

The soil moisture was higher in Abu Lahw El-Bahary than that of Cleopatra habitats. The soil texture was sandy loam at Abu Lahw El-Bahary and sandy at Cleopatra habitats.

The soil was slightly alkaline in reaction. The percentages of cation and anion contents were higher in Abu Lahw El-Bahary than that in Cleopatra habitats.

It was clear that Abu Lahw El-Bahary habitat was suitable for the plant than that of Cleopatra habitat.

It was obvious from the vegetation analysis at the two habitats that the dominant species was *Ammophila arenaria* and the second major plant was *Pancratium arabicum* during winter and summer, and the third plant during spring and autumn at Abu Lahw El-Bahary. Meanwhile, *Pancratium arabicum,* was the second major plant during all seasons with the exception of summer, where it was the third plant at Cleopatra habitat.

Concerning the eco-physiological studies, it was found that *Pancratium arabicum* stored water in its tissues to overcome the dry weather conditions, where the moisture content in the leaves and bulbs reached its maximum value during winter and its minimum value during autumn at the two habitats. The total and soluble carbohydrates in the leaves and bulbs reached their maximum values during spring and their minimum during winter at the two habitats. The total nitrogen reached its maximum value in winter and its minimum value in autumn in the leaves, while it reached its maximum value in autumn and its minimum value in winter in the bulbs at the two habitats. The total ash content was slightly higher in the leaves and the bulbs at the two habitats during winter.

Key words: *ecology ,ecophysiology, matruh coast ,Pancratium* .

1. INTRODUCTION

Family Amaryllidaceae includes about 86 genera and 1310 species, which are widely distributed in all warm moderate temperature and dry regions (Täckholm and Drar, 1954; Hutchinson, 1960; Lawrence, 1969 and Data, 1970).

Pancratium arabicum, Sickenb is rather similar to the other *Pancratium* species, but the bulbs larger and the leaves are broader, up to 18 mm, at base with large papery-membranous sheaths. Flowers up to 11 together and 15 cm long. It is present in maritime dunes and sandy calcareous hills along the Mediterranean coastal strips form El-Sallum to Rafah (Montasir and Hasib, 1956, and Täckholm, 1974).

Family Amaryllidaceae plants are usually perennial herbs, with a root stock, either rhizomes as *Agave* and *curculigo* or bulbs as *naricissus, pancratium,* and *Crinumi* species. Plants are usually pregnant by means of bulbs. (Benson, 1967 and Täckholm, 1974).

Economically, the *Amarylidaceae* contributes a large number of plants that are important to many activities (Lawrence, 1969).

In spite of the fact that ecological studies on certain species of *Pancratium* have been carried out, nothing could be found dealing with *Pancratium arabicum,* Sickenb.

Our investigation aimed to clarify the range of environmental factors within which *Pancratium arabicum* can grow and adapt itself in the main community in two different habitats.

2. MATERIALS AND METHODS

2.1. Ecological studies

Environmental factors

2.1.1. Climatic factors

The mean values of climatic factors of Marsa Matruh, Western Mediterranean coastal region were obtained from the Meteorological Department of Egypt during the period of investigation; 1998.

2.1.2. Edaphic factors

The soil profiles supporting. *Pancratium arabicum* were taken from the successive depths at: 0-20 cm, 20-40 cm, 40-60 cm and 60-80 cm.

2.1.2.1. Soil physical properties : (Granuleometric analysis)

Soil texture was determined through mechanical analysis by the sieve method (Jackson, (1967). The soil moisture content was determined at different depths (0-20, 20-40, 40-60 and 60-80 cm) using the methods described by Wilde *et al.* (1979).

2.1.2.2. Soil chemical properties

Determination of soil soluble salts involved an estimation of total sulphates and chlorides in soil solution according to the methods of Richard (1954) and Jackson (1967). Carbonates and bicarbonates were determined in the soil extracts by titration against 0.1N hydrochloric acid using phenolphthalein and methyl orang as indicators , respectively. Determination of Na, K, Mg and Ca using the Flame Photometer was achieved according to Allen, *et al.* (1974). Electric pH meter was used to determine the soil pH of the collected samples using 1:5 (soil:water) suspension. The total soluble salts in the soil samples were determined according to Jackson (1967).

The structure of vegetation of *Pancratium arabicum* at Abu Lahw El-Bahary and Cleopatra habitats of Mersa Matruh western Med.region was analyzed sociologically according to the procedures described by Kassas and Girgis (1964); Kassas and Zahran (1965) and Migahed *et al.*, (1971, 1974). The component species in the community were listed and counted in a series of 20 quadrates, 10 × 10 m each. The species area relationship was then deduced. The frequency index, frequency classes and frequency diagram were also complied. The importance of component species was determined by computation of density and relative density.

2.2. Eco-physiological studies

The water content of *Pancratium arabicum* (leaves and plant bulbs) were estimated according to the method described by Slatyer and Macllory (1961). The total and soluble carbohydrates were determined according to Chaplin and Kennedy (1994). The total nitrogen content and total ash content were determined according to British Pharmacopoeia (1980).

3. RESULTS AND DISCUSSION

The present work was carried on various habitats to study the ecology and eco-physiology of *Pancratium arabicum* Family Amaryllidaceae, where the environmental factors governing the growth and distribution of the species were studied. However, the natural vegetation was analyzed to interrelate the abundance, dominance, frequency, frequency index, density... etc., of *Pancratium arabicum* in relation to other associate species.

3.1. Ecological Study

3.1.1. Phenology

Pancratium arabicum herb flowers in summer and fruiting in autumn. Growth of *Pancratium arabicum* increased during winter and green foliage leaves were observed almost throughout the year (except the end of spring).

The average plant heights in the different seasons are presented in Table (1). At Abu Lahw El Bahary habitat the height of *P. arabicum* ranged between 22.5 and 5.5 cm, while it ranged between 21.0 and 5.0 cm at Cleopatra habitat in winter and autumn, respectively. The mean diameter of plant cover of *Pancratium arabicum* ranged between 22.2 × 22.8 cm and 5.6 × 5.2 cm at Abu Lahw El Bahary in winter and autumn, respectively. Meanwhile at Cleopatra habitat, it ranged between 22.0 × 22.4 cm and 5.5 × 4.0 cm in winter and autumn, respectively.

3.1.2. Environmental conditions

The climatic data during the year (1999) of the Mersa Matruh area are presented in Table (2), which indicate that the mean maximum temperature region ranged from 31.6^{o}C in September to 18.0^{o}C in January. On the other hand, the mean minimum temperature ranged between 21.9^{o}C in September and 9.1^{o}C in January.

The monthly mean temperature varied from 26.7^{o}C in September to 13.5^{o}C in January.

The relative humidity varied between 75.3% in August and 65.0% in September. The presence of the studied habitats at the Mediterranean Sea region plays an important role for increasing the values of the relative humidity.

Pancratium arabicum was subjected to severe winds which blow occasionally in the desert, where the exposed areas were greatly affected by wind action. Data indicate clearly that wind velocity varied from 11.3 knot/hour in April to 6.5 knot/hour in January. Data also indicate that the maximum precipitation of rainfall was 14.3 mm in January; with a minimum value of 1.4 mm in February and no rainfall in the months (May, June, July, August, September and October), indicating a dry rainy year with a total amount of 41.7 mm/year rainfall.

The water vapour pressure varied between 25.5 Mpa in August and 10.7 Mpa in February (Table 2).

3.1.3. Edaphic factors

3.1.3.1. Physical properties of the soil (Granuleometric analysis)

3.1.3.1.1. Soil texture

Results of granuleometric analysis of the soil associated with *P. arabicum* indicated that the soil is sandy loam at Abu Lahw El-Bahary habitat and sandy at Cleopatra habitat, both of the coastal sand dunes of Marsa Matruh.

Table (1): The average height and mean diameters of *P. arabicum* during 1998 - 1999 at the two habitats.

Season	Mean height (cm)		Mean diameter (cm)	
	Abu Lahw El-Bahary	Cleopatra	Abou Lahw El Bahary	Cleopatra
Winter	22.5	21.0	22.2 × 22.8	22.0 × 22.4
Spring	18.0	15.3	8.4 × 9.5	8.0 × 7.3
Summer	8.0	9.2	6.0 × 7.5	6.0 × 7.0
Autumn	5.5	5.0	5.6 × 5.2	5.5 × 4.0

Table (2): The mean values of climate particular of Marsa-Matruh during (1999).

Month	Temperature (°C)			Relative humidity	Wind speed at km\ knot	Rainfall (mm)	Water vapour Pressure mean (Mpa)
	Mean Max.	Mean Min.	Months Mean				
January	18.0	9.1	13.5	71.6	6.5	14.3	10.9
February	19.2	9.5	14.3	66.7	7.8	1.4	10.7
March	19.8	10.6	15.2	72.7	8.2	4.6	12.4
April	21.2	12.6	16.9	67.0	11.3	4.1	13.0
May	26.7	17.0	21.3	75.0	7.4	0	19.3
June	27.0	18.7	22.8	75.0	8.3	0	21.1
July	28.9	21.1	25.0	72.0	11.2	0	22.9
August	29.8	21.6	25.7	75.3	7.4	0	25.5
September	31.6	21.9	26.7	65.0	6.7	0	21.8
October	25.0	16.6	20.8	66.3	6.9	0	17.3
November	23.0	15.6	19.3	75.0	7.9	11.3	16.7
December	20.0	15.0	17.5	70.0	8.3	6.0	12.1

Mpa = megapascal

3.1.3.1.2. Soil moisture content

Soil moisture contents reached thier maximum values of 5.00 and 4.00% in winter and their minimum values of 0.6 and 0.4 in summer at Abu Lahw El Bahary and Cleopatra habitat, respectively. They were associated with drought, high rates of evaporation and low relative humidity (Table 4).

Table (3): Granuleometric analysis of soil supporting *Pancratium arbicum* at Abu Lahw El-Bahary and at the sea shore of Cleopatra habitats.

Locality	Soil Depth (cm)	Soil texture	Granuleometric analysis of the soil fraction mm%			
			Course sand %	Fine sand %	Silt	Clay
Abu Lahw El-Bahary	0-20	Sandy loam	38.1	37.1	18.2	6.6
	20-40	Sandy loam	35.2	38.0	20.0	6.8
	40-60	Sandy loam	31.7	40.3	21.2	6.8
	60-80	Sandy loam	29.7	41.0	22.0	7.3
Sea shore of Cleopatra area	0-20	Sand	40.1	47.5	7.8	4.6
	20-40	Sand	38.9	48.7	7.1	4.2
	40-60	Sand	36.2	55.1	4.8	4.2
	60-80	Sand	35.1	55.9	4.6	4.1

The obtained results show that there was a general trend in all seasons for an increase in soil moisture content with the increase in soil depth, where the surface layer of the desert soil was subjected to intense evaporation, while the deeper layers were protected against evaporation. Meanwhile, the soil moisture content was more available at the bottom layers (40-60 and 60-80 cm), where it was actually exploited by the root system of *Pancratium arabicum* and expressive of the soil moisture conditions under which the plant flourishes. This layer was further protected from the evaporating induction of the atmosphere by the upper layers. Shalaby *et al.* (1981) reported that in desert soils below a certain depth, there was a permanently wet layer which supplies deep-rooted perennials with available water around the year.

Table (4): Mean values of soil moisture content of *Pancratium arabicum* at Abu Lahw El Bahary and Cleopatra habitats during (1998-1999).

Locality	Sample depth (cm)	Soil moisture content (%)			
		Winter	Spring	Summer	Autumn
Abu Lahw EL-Bahary	0-20	1.99	1.65	0.6	1.93
	20-40	3.60	2.36	1.20	2.59
	40-60	4.00	2.90	2.00	3.20
	60-80	5.00	3.15	3.00	3.87
Cleopatra	0-20	1.75	1.40	0.4	1.94
	20-40	3.00	2.20	1.0	2.32
	40-60	3.70	2.46	1.7	2.90
	60-80	4.00	2.60	2.90	3.00

3.1.3.2. Chemical properties of the soil

3.1.3.2.1. pH-value and electrical conductivity (E.C.) of the soil:

The soil was slightly alkaline in reaction with a pH ranging between 7.8 and 8.2 at Abu Lahw El-Bahary and between 7.9 and 8.2 at the Cleopatra habitat. While the electrical conductivity (E.C.) decreased from its maximum value of 0.38 mmhos/cm at surface to 0.28 mmhos/cm at the most for depths (20-40 and 40-60 cm), then it increased to 0.34 mmhos/cm at a depth 60-80 cm in Abu Lahw El-Bahary habitat. Meanwhile, it decreased from 0.12 mmhos/cm at the surface layer to 0.11 mmhos/cm at the two layers (20-40 and 40-60 cm), then increased to its maximum values of 0.14 mmhos/cm in the bottom layer (60-80 cm) at Cleopatra habitat (Table 5).

3.1.3.2.2. Total soluble salts (T.S.S.)

The total soluble salts (T.S.S.) decreased from its maximum value of 0.24% at the surface to 0.18% at depths (20-40 and 40-60 cm) then increased to 0.22% at the depth 60-80 cm in Abu Lahw El-Bahary habitat. Meanwhile, it decreased from 0.08% at the surface layer to 0.07% in the two layers (20-40 and 40-60 cm), then increased to its maximum value of 0.09 in the bottom layer (60-80 cm) in Cleopatra habitat (Table 5).

3.1.3.2.3. Ion contents of the soil

3.1.3.2.3.1. Cations content

The first major cation component was the sodium ion. It decreased from a maximum value 2.90 meq/100 g soil in the surface layer to its minimum value of 1.34 at depth (20-40 cm) at Abu Lahw El-Bahary. It decreased from 0.66 meq/100 g soil at the surface layer to its minimum value of 0.58 meq/100 g at depths (20-40 and 40-60 cm) then it increased to its maximum value of 0.71 meq/100 g soil in the bottom layer (60-80 cm) at Cleopatra area.

The second major cation component was calcium. It decreased gradually from 0.60 meq/100 g soil at the surface layer (0-25 cm) to 0.57 meq/100 g soil in the medium layer (20-40 cm) and 0.51 meq/100 g soil in the layer (40-60 cm), then increased to its maximum value of 0.63 meq/100 g soil in the bottom layer (60-80 cm) at Abu Lahw El-Bahary.

In Cleopatra habitat, calcium decreased gradually from 0.31 meq/100 g soil at the surface layer (0-20 cm) to 0.23 meq/100 g soil in the midium layer (40-60 cm) then it increased to its maximum value of 0.38 meq/100 g soil in the bottom layer (60-80 cm) (Table 5).

The magnesium ion increased from 0.27 meq/100 g soil in surface layer to 0.31 meq/100 g soil at the depth (20-40 cm) and then increased to its maximum value of 0.34 meq/100 g soil at the depth (40-60 cm) and in the bottom layer (60-80 cm) at Abu Lahw El Bahary.

Meanwhile, at Cleopatra habitat it increased from 0.17 meq/100 g soil at the the surface layer to 0.22 meq/100 g soil in 40-60 cm then it increased to its maximum value of 0.23 meq/100 g soil in the bottom layer (60-80 cm).

It was observed that Ca concentrations were higher in Abu Lahw El Bahary habitat than in Cleopatra habitat.

The minor cation component was potassium. It decreased from 0.12 meq/100 g soil at the surface layer to the minimum value 0.08 meq/100 g at (20-40 cm) and 0.11 at the depth (40-60 cm) meq/100 g soil. It increased to 0.13 meq/100 g soil at the bottom layer (60-80 cm) in Abu Lahw El-Bahary. However, potassium decreased from 0.11 meq/100 g soil at the surface layer to 0.08 meq/100 g soil at the layers (20-40) cm and (40-60 cm). It increased to its maximum value of 0.14 meq/100 g soil in the bottom layer (60-80) cm of Cleopatra habitat. It is clear from Table (5) that cation contents of the soil samples were higher in Abu Lahw El-Bahary habitat than those in Cleopatra habitat.

3.1.3.2.3.2 Anion content

Table (5) shows that the soluble carbonates were present as traces in the two locations. The maximum value of bicarbonates was 0.72 meq/100 g soil at the surface layer, then decreased to 0.48 meq/100 g soil at the depth (20-40 cm) and increased gradually to 0.49 at the depth (40-60 cm) then to 0.59 meq/100 g soil in the bottom layer (60-80 cm) in Abu Lahw El-Bahary habitat. Meanwhile, its maximum value was 0.36 meq/100 g soil at the surface layer, decreased to 0.31 meq/100 g at the depth (20-40 cm and 40-60 cm) and increased and to be 0.33 meq/100 g soil in the bottom layer (60-80 cm) in Cleopatra habitat (Table 5).

It is clear from Table (5) that the maximum value of chloride content in Abu Lahw El Bahary was 2.30 meq/100g soil at the surface layer (0-20 cm), decreased to 1.70 meq/100g soil at the depth (20-40 cm), then increased gradually to 2.16 meq/100 g soil in the bottom layer (60-80 cm). In Cleopatra habitat chlorides decreased from 0.61 meq/100 g soil at the surface layer to 0.56 meq/100 g soil at (20-40 and 40-60 cm) then increased to its maximum value of 0.77 meq/100 g soil in the bottom layer (60-80 cm).

Table (5) shows that the sulphate content of the soil sample reached its maximum value of 0.81 meq/100 g soil at the surface layer (0-20 cm), decreased to 0.62 meq/100 g soil at the depth (20-40 cm) then increased gradually to 0.68 meq/100 g soil in the bottom layer (60-80 cm) in Abu Lahw El-Bahary habitat. In Cleopatra habitat, it decreased from

0.28 meq/100 g soil at the depth (0-20 cm) to 0.24 meq/100 g soil at the depth (20-40 cm) then increased gradually to its maximum value of 0.34 meq/100 g soil in the bottom layer (60-80 cm). (Table 5).

It is observed that the anion contents of the soil samples were higher in Abu Lahw El-Bahary habitat than that of Cleopatra habitat.

3.1.3.3. Vegetation analysis

The analysis of the transact at Abu Lahw El-Bahary revealed the presence of eleven perennial species representing all seasonal aspects of vegetation and one annual species *Erodium laciniatum* (Table 6). Meanwhile, in the habitat of Cleopatra, the analysis of a transact revealed the presence of seven perennial species representing all seasonal aspects of vegetation (Table 7).

It is obvious that one of the dominant species is *P. arabicum* with the frequency indeces of 100%, 100%, 90% and 90% in winter, spring, summer and autumn, respectively with class 5 for each in Abu Lahw El-Bahary. Meanwhile, the frequency indices were 100%, 90%, 100% and 100% in winter, spring, summer and autumn, respectively with class 5 for each in the habitat of Cleopatra.

3.2. Eco-physiological studies

The investigated leaves and bulbs of *Pancratium arabicum* were collected during the years (1998 - 1999) from two natural habitats at Marsa Matruh (Abu Lahw El-Bahary and the sea shore of Cleopatra habitats).

3.2.1. Water content

Concerning the eco-physiological study, *Pancratium arabicum* stores water in its tissues to overcome the dry weather conditions, where the percentages of water contents of leaves reached their maximum values of 80% and 74.0% in winter and minimum values of 74.0% in winter and minimum values of 74.0% and 68.7% in autumn at Abu Lahw El Bahary and Cleopatra habitat, respectively. The same trend with a different percentage was clear in bulbs at the two locations. The percentages of water content of bulbs attained a maximum value of 77.0% and 71.5% in winter and their minimum values of 66.0% and 61.5% in autumn. These results show that, the moisture contents in winter were higher than that of spring, summer and autumn.

It was clear that Abu Lahw El-Bahary habitat was suitable for the plant than that of Cleopatra as a result of high soil moisture contents, and chemical constituents of the soil (anion, cation content and E.C.) than that of Cleopatra habitat. It had been observed also that the heights and foliage diameter of *P. arabicum* at Abu Lahw were larger than that of Cleopatra habitat during the growth season of the plant.

3.2.2. Metabolic products

3.2.2.1. Ash content

The total ash content of *P. arabicum* leaves decreased from 24.5 % during winter to 13.4 gm in spring at Abu Lahw, and from 14.1 % during winter to 7.7 % in spring at Cleopatra habitat. The same trend with a different percentage was clear in the bulbs at the two locations. The obtained results showed a positive relation between the plant ash content and the T.S.S. in the supporting soils. Luttge and Smith (1984) reported that succulent organs of xerophytes possess internal or peripheral water storage tissues, though these tissues are nonphotosynthetic.

3.2.2.2. Carbohydrates

The maximum values of the total carbohydrates of leaves were 3.0 and 2.8 % in spring and the minimum values were 2.1 and 2.0% in winter at Abu Lahw El-Bahary and Cleopatra habitats, respectively. The same trend with a higher percentage was clear in bulbs at the two localities than leaves.

Under spring conditions plants tended to increase their photosynthetic rates and therefore increased the accumulation of carbohydrates in their leaves.The percentage of soluble carbohydrates in both leaves and bulbs (Table 8) clearly revealed the same previous trend drawn from the results of total carbohydrates.

Table (5): Chemical analysis of the soil associated with *Pancratium arabicum* at two habitats.

Locality	**Soil** depth **(cm)**	pH	**EC** mmhos/ **(cm)**	T.S.S **Gm%**	**Soil solution extract analysis**							
					Cations meq/100g				Anions meq/100g			
					Ca^{++}	**Mg^{++}**	**Na^{+}**	**K^{+}**	**CO_3^{--}**	**HCO_3^{-}**	**Cl^{-}**	**SO_4^{--}**
Abu Lahw habitat	0-20	7.8	0.38	0.24	0.60	0.27	2.90	0.12	-	0.72	2.30	0.81
	20-40	8.0	0.28	0.18	0.57	0.31	1.34	0.08	-	0.48	1.70	0.62
	40-60	8.1	0.28	0.18	0.51	0.34	1.74	0.11	-	0.49	1.81	0.63
	60-80	8.2	0.34	0.22	0.63	0.34	2.3	0.13	-	0.59	2.16	0.68
Cleopatra habitat	0-20	7.9	0.12	0.08	0.31	0.17	0.66	0.11	-	0.36	0.61	0.28
	20-40	7.9	0.11	0.07	0.27	0.18	0.58	0.08	-	0.31	0.56	0.24
	40-60	8.0	0.11	0.07	0.23	0.22	0.58	0.08	-	0.31	0.56	0.27
	60-80	8.2	0.14	0.09	0.38	0.23	0.71	0.14	-	0.33	0.77	0.34

Table (6): Floristic composition of 20 quadrates (10x10 m) representing a stand of *P. arabicum* studies at Abu Lahw El-Bahary on the year (1998 - 1999).

Species	Winter					Spring					Summer					Autumn				
	Total No.	Fr. %	Fr. C	D. %	R.D. %	Total No.	Fr. %	Fr. C	D. %	R.D. %	Total No.	Fr. %	Fr. C	D. %	R.D. %	Total No.	Fr. %	Fr. C	D. %	R.D. %
Ammophila arenaria	719	100	5	35.9	28.8	548	100	5	27.4	19	430	90	5	17	24	334	95	5	16.7	19.1
Pancratium arabicum	630	100	5	31.5	25.2	475	100	5	23.8	16.5	280	90	5	14	15.6	205	90	5	10.3	11.7
Lotus polyphyllos	340	90	5	17.0	13.6	530	100	5	26.5	18.4	260	85	5	13	14.5	280	85	5	14	16
Silene succulenta	310	70	4	15.5	12.4	370	80	4	18.5	12.8	180	80	4	9	10.0	200	70	4	10	11.4
Atractylis carduus	110	65	4	5.5	4.4	210	70	4	10.5	7.3	158	70	4	7.9	8.8	150	70	4	7.5	8.6
Crucianella maritima	110	50	3	5.5	4.4	175	75	4	8.75	6.0	130	60	3	6.5	7.2	150	60	3	7.5	8.6
Echinops spinosissimus	80	35	2	4.0	3.2	166	55	3	8.3	5.7	130	40	2	6.5	7.2	145	45	3	7.3	8.3
Hyoseris lucida	73	35	2	3.7	2.9	158	55	3	7.9	5.5	100	35	2	5	5.5	140	40	2	7	8
Teucrium polium	45	30	2	2.3	1.8	150	52	3	7.5	5.2	70	25	2	4	4.4	88	30	2	4.4	5
Suaeda pruinosa	45	25	2	2.3	1.8	50	25	2	2.5	1.7	30	25	2	1.5	1.6	40	30	2	2	2.2
Erodium laciniatum	20	15	1	1.0	0.8	25	25	2	1.3	0.8	-	-	-	-	-	-	-	-	-	-
Otanthus maritimus	10	5	1	0.5	0.4	15	15	1	0.8	0.5	10	5	1	0.5	0.5	10	10	1	0.5	0.5
Total No. of all species	2492						2872				1787					1742				

Table (7): Floristic composition of 20 quadrates (10x10 m) representing stand of *P. arabicum* studies at the sea shore of Cleopatra on the year (1998 - 1999).

Species	Winter					Spring					Summer					Autumn				
	Total No.	Fr. %	Fr. C	D. %	R.D. %	Total No.	Fr. %	Fr. C	D. %	R.D. %	Total No.	Fr. %	Fr. C	D. %	R.D. %	Total No.	Fr. %	Fr. C	D. %	R.D. %
Ammophila arenaria	500	100	5	25	23.4	550	100	5	27.5	25.3	550	100	5	27.5	29.8	460	90	5	23	24.2
Pancratium arabicum	460	100	5	23	21.5	460	100	5	23	21.1	350	90	5	17.5	19.0	420	100	5	21	22
Lotus polyphyllus	400	100	5	20	18.7	400	100	5	20	18.4	400	100	5	20	21.7	410	100	5	20.5	21.5
Ononis vaginalis	383	90	5	19.2	17.9	270	85	5	13.5	12.4	150	70	4	7.5	8.1	210	90	5	10.5	11.0
Zygophyllum album	230	80	4	11.5	10.7	300	80	4	15	13.8	200	65	4	10	10.8	250	66	4	12.5	13.1
Euphorbia paralias	110	65	4	5.5	5.1	130	70	4	6.5	5.9	130	60	3	6.5	7.0	100	50	3	5	5.2
Centaurea aegyptiaca	50	35	2	2.5	2.3	60	40	2	3	2.7	60	19	1	3	3.2	50	20	1	2.5	2.6
Total No. of all species	2133					2170					1840					1900				

Table (8): Mean values of water content, total ash, total and soluble carbohydrates and total nitrogen in *Pancratium arabicum* during the period of investigation (1998 - 1999).

Item	Season	Abu Lahw El-Bahary		Cleopatra	
		Leaves	bulbs	Leaves	bulbs
Water content %	Winter	80.0	77.0	74.0	71.5
	Spring	75.4	71.0	70.0	66.4
	Summer	76.5	75.5	71.0	70.3
	Autumn	74.0	66.0	68.7	61.5
Ash content %	Winter	24.5	12.0	14.1	9.6
	Spring	13.4	4.5	7.7	3.6
	Summer	13.6	6.5	7.8	5.2
	Autumn	15.9	7.5	9.3	6.0
Total carbohydrates gm/100gm dry wt.	Winter	2.1	4.1	2.0	3.0
	Spring	3.0	5.3	2.8	4.9
	Summer	2.5	4.2	2.3	3.2
	Autumn	2.9	5.0	2.4	4.4
Soluble carbohydrates gm/100gm dry wt.	Winter	1.2	2.5	1.0	1.9
	Spring	1.7	3.5	1.4	2.8
	Summer	1.3	3.0	1.1	2.3
	Autumn	1.6	3.2	1.3	2.4
Total Nitrogen %	Winter	3.4	2.2	3.2	2.0
	Spring	2.8	2.6	2.7	2.4
	Summer	2.6	2.8	2.4	2.5
	Autumn	2.4	3.0	2.2	2.7

The results of the present work revealed remarkable adaptive features in the response of the xerophyte *P. arabicum*. The plants tend to retain higher organic intermediates, particularly total carbohydrates under stress conditions. Under moisture stress conditions, insoluble carbohydrates are converted to sugars that lead to the increase in the osmotic potential and consequently the increase of water potential for plant cells. The differences in water potential gradients are responsible of water organic and inorganic solute transolocations (Stocker, 1961). Under drought stress conditions, *P. arabicum* accumulated higher level of total carbohydrates during spring season (El-Monayeri *et al.,* 1986).

3.2.2.3. Total nitrogen contents

The maximum values of the total nitrogen of leaves were 3.4 and 3.2 % during winter and the minimum values were 2.4 and 2.2 % in autumn at Abu Lahw El Bahary and Cleopatra habitats, respectively. On the other hand, the total nitrogen content in the bulb gradually increased from its minimum values of 2.2 % and 2.0 % in winter to reach its maximum values of 3.0% and 2.7% in autumn.

It may be concluded that the high amount of total nitrogen content in the leaves was due to higher metabolic rates which are attributed to the high water resources of the soil during winter months than during the dry periods which accounts to Stocker's (1960) assumption. This phenomenon may explain carbohydrate accumulations in the leaves in high proportions more than bulbs as a result of the higher rates of plant metabolic processes in the winter.

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دراسات على البيئة البريّة لنبات السوسن (*بانكراتيام أرابيكم*)

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تم دراسة البيئة البريّة للسوسن (بانكراتيام أرابيكم) أحد أنواع العائلة النرجسية، حيث تم دراسة بيئته الطبيعية بمنطقتى أبو لهو البحرى (طريق القصر) وكليوباترا بمحافظة مرسى مطروح. ومن تحليل التربة اتضح أنها رملية فى كليوباترا بينما كانت طفلية رملية فى أبولهو البحرى وتتدرج رطوبة التربة بالزيادة مع زيادة العمق فى التربة وازدادت نسبيا فى منطقة أبولهو البحرى عنها فى كليوباترا.

وقد تم تقدير المواد الصلبة الذائبة واتضح من الدراسة أن التربة قلوية ملحية وتحتوى على نسبة مرتفعة نسبيا من الكبريتات والكلوريدات والبيكربونات فى منطقة أبولهو عنها بمنطقة كليوباترا، بينما إتضح أن الصوديوم أعلى نسبة والبوتاسيوم أقل نسبة فى الكاتيونات فى كلا منطقتى الدراسة.

إتضح من دراسة الكساء الخضرى للنبات أن نبات السوسن (بانكراتيام ارابيكم) هو الثانى فى فصلى الشتاء والصيف وكان ترتيبه الثالث فى فصلى الربيع والخريف وذلك بمنطقة ابولهو البحرى بينما فى منطقة كليوباترا كان الثانى فى كل الفصول ماعدا الصيف كان ترتيبه الثالث. وبدراسة البيئة الفسيولوجية للنبات اتضح أن النبات يحتفظ بالماء فى خلاياه للتغلب على الظروف المناخية الصعبة. وبدراسة المحتوى النيتروجينى للنبات اتضح زيادة نسبة النيتروجين فى الأوراق فى فصل الشتاء عنها فى فصل الخريف. وتزداد فى الأبصال فى فصل الخريف عنها فى فصل الشتاء وذلك فى منطقة أبولهو وكليوباترا على التوالى. وبالنسبة لنسبة الكربوهيدرات فهى تنخفض فى فصل الشتاء عنها فى فصل الربيع وتقل عن فصل الربيع فى فصل الصيف، ثم تزيد فى فصل الخريف فى منطقة ابولهو البحرى وكليوباترا، وذلك بالنسبة للأوراق والأبصال بينما تزداد نسبة الرماد الكلى فى الشتاء عنها فى باقى الفصول وذلك بمنطقتى أبولهو البحرى وكليوباترا.

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