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A Survey Study on some Halophytes Growing in the Damietta Coastal Area Referring to its Botanical and Ecological Significance

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ABSTRACT

A survey was made for ten sites dominated by halophytes and associated species during 2014- 2015. A total of 23 families, 48 genera and 58 species were recorded. Among families, 19 families belong to Dicotyledons of 35 genera and 44 species; 14 species of 11 genera belong to 4 families of Monocotyledons. The largest family was Asteraceae with 11 species followed by Chenopodiaceae and Poaceae with 7 species. Therophytes comprised 48.28%, Chamaephytes 13.79%, Geophytes 12.07%, Hemicryptophytes 10.34% , Phanerophtes 10.34% and Helophytes 5.17% of the associated flora of the salt marsh habitat. The most common halophytic communities growing in the study area dominated by: *Arthrocnemum macrostachyum* Moric., *Halocnemum strobilaceum* (Pallas) M. Bieb., *Inula crithmoides* L., *Phragmites australis* (Cav.) Trin. ex Steud., *Juncus rigidus C. A.* Mey, *Bassia indica* (Wight) A.J.Scott, *Suaeda pruinosa* Lange.and *Tamarix nilotica* (Ehrenb.) Bge. Field study and meetings with local people showed that the associated species of the salt marsh habitat provides a lot of goods and services and many species can be used for its medicinal, nutritional, industrial, ornamental and ecological value. This study showed halophytes species which are growing in the study area, common plant communities and the economic and ecological of it in order to stand on the current situation of halophytes and to maximize its utilization in the near future. The obtained results will be helpful and serve for the conservation and sustainable utilization of plant resources.

Keywords: Damietta coastal area; Halophytes; Life form; economic and ecological values.

INTRODUCTION

Floristic analysis of any area help to evaluate the plant wealth and its potential value (Wariss *et al.,* 2013). The local plants identification and introduction of an area is very important to introduce the specific species of the local area and their occurrence, growing season, finding new species and the effect of climatic conditions like drought and over grazing on vegetation (Ahmad, *et al.,* 2008 and Ali, 2008). Floristically, the Mediterranean coastal land of Egypt is one of the nation's richest phytogeographical regions. (Bidak *et al.,* 2015)

Halophytes are plants that survive to grow, reproduce and complete their life cycle in habitats with soil salinity around 200 mM NaCl or more (Flowers and Colmer , 2008). They are naturally found exclusively in habitats with high levels of soil salinity such as coastal swamps, coastal dunes, salt marshes, inland salt flats, playas and lands ruined by mal-agricultural practices (Hameed and Khan, 2011). Coastal environments were reported to be more stressful than inland due to higher soil salinity, greater light intensity and more frequent diurnal and seasonal climatic conditions (Gulzar and Khan, 1998).

Halophytes evolved a number of strategies range for numerous changes at cellular and molecular levels to several morpho-anatomical adaptations and by utilizing combinations of such strategies they can survive and reproduce under highly saline conditions (Hameed and Khan, 2011). However, Grigore *et al.,* (2012) found that some of them such as *Inula crithmoides* L. and *Plantago crassifolia* Forssk. do not require salt for their growth and development; in fact, they grow better in the presence of salt on non-saline and nutrient-rich substrates.

A number of these highly salt tolerant plants have several economic utilities and could be cultivated as food, forage, fuel and medicinal crops on saline lands with the help of salty water irrigation. Several studies such as (Heneidy and Bidak 2004; Aslam *et al.,* 2011; Koyro *et al.,* 2011; Mahmoud and Gairola 2013 and Bidak *et al.,* 2015) have documented that many of salt tolerant plants can be used as medicinal, food, grazing, fodder /forage fuel, ornamental crops and can be used in making hand crafts in addition to their ecological and agricultural benefits.

The major aim of the present study was an extensive survey of the floristic analysis of ten sites dominated by halophytic plants in the coastal area of Damietta. Furthermore, ethnobotanical study was made to explore the economic value of these plant species and the current status of salt- tolerant plants of the study area to maximize their utilization.

MATERIALS AND METHODS

A survey was made during the two seasons 2014-2015 to collect plant specimens by many field trips to 10 selected sites which are dominated with halophytes with minimum human disturbance in Damietta coastal area. The major halophytic species were recorded . During field trips, plant specimens had been collected, pressed, dried and mounted on herbarium sheets. The life form of all plants determined and classified followed after Raunkiaer (1934). The collected specimens were nomenclature according to (Tackholm, 1974 and Boulos, 1995, 2009). The life form, Habit, life cycle and vernacular name were also described. Herbarium specimens were kept at the Herbarium of the Agricultural Botany Department, Faculty of Agriculture, Damietta University.

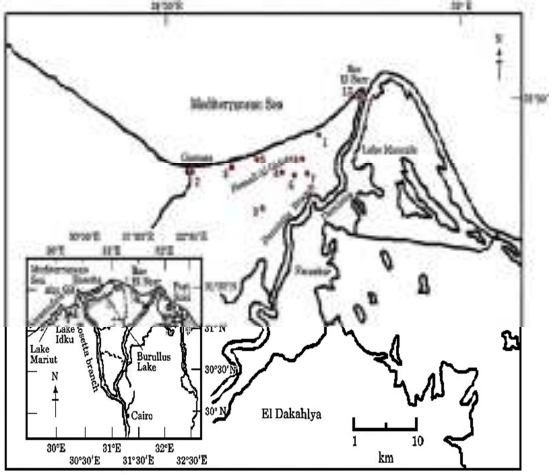

Figure 1. Location map showing the location of Damietta Governorate for the Arab Republic of Egypt and the selected sites.

Study area The coastal zones of Egypt extend for over 3,500 km in length along the Mediterranean and Red Sea coasts ElRaey (2010) and the Nile Delta coast extends about 240 km alongshore from Alexandria to Port-Said. (Iskander, 2013).

This zone consists of sandy and silty shores of greatly varying lateral configurations, depending on where the old branches of the Nile have had their outlets (ElRaey, 2010). It includes several cities and one of the most important economic centers of these cities is Damietta. Damietta governorate has a unique geographical location overlooking the sea, Nile river and lake.

Damietta total area is 910,3 km^2 that is equivalent to about 0.1% of Egypt's total area and 5% of Delta (Alboo-Hassan *et al.*, 2015).

Damietta coastal area extends from Gamasa to Eldeba for about 42 km. It enjoys a typically Mediterranean climate type which is hot and dry in summer and moderate in winter with little rain and it is belongs to the arid province and it is belongs to the arid province (Mashaly, *et al.,* 2001). The air temperature varies from a minimum of 15 °C to a maximum of 35 °C. However, the average annual rain fall amount at Damietta was 225 mm, and cloud average varies between 3 and 31 %. Humidity varies from a minimum of 63% to a maximum of 72% (Table 1).

Table 1. Climatic data along the study area during 2015 at Damietta coastal area (source: www.world weather online.com)

Month	Temperature (C°)			Average rain fall amount (mm)	Average Cloud %	Average Humidity %	Avg wind speed (kmph)
	Min.	Max.	Mean				
January	15	19	17	35.62	27	63	17.6
February	15	19	17	34.87	31	63	17.3
March	18	22	20	6.61	18	67	13.7
April	20	23	22	14.98	11	63	15.5
May	24	28	26	4.2	9	67	13.3
June	26	30	28	0.2	10	69	14
July	29	33	31	0	3	72	12.6
August	31	35	33	0.2	5	70	12.6
September	30	33	32	10.21	5	68	13
October	26	29	28	42.43	21	65	12.6
November	22	25	24	29.51	21	65	13.3
December	17	21	19	46.61	28	63	13.7

RESULTS AND DISCUSSION

The Deltaic Mediterranean coastal of Egypt belongs to the Mediterranean climate type. (Mashaly, 2001). The present study examines the halophytic flora of Damietta coastal area, which indicates that the halophytic flora of Damietta coastal area belongs to 58 plant species of 46 genera and 23 families. Among the existing families , 19 families are dicotyledons, 4 families of monocotyledons (Table 2). The largest family of the area is Asteraceae with 11 species (19%). Chenopodiaceae and Poaceae are with 7 species (12%). Cyperaceae, Fabaceae, Juncaceae and Polygonaceae are represented with 3 species each (5%). Aizoaceae, Brassicaceae, Plantagaceae, Tamarixaceae and Zygophyllaceae are represented by 2 species (3%). The rest of 23 families are represented with 1 species. Those results agree with Heneidy and Bidak (2004) whose reported that the high presented family in the coastal Mediterranean region of Egypt was Compositae (Asteraceae) (17%) followed by Leguminosae (Fabaceae) (11.4%), Gramineae (Fabaceae) (10.5%) and Chenopodiaceae (7.9%). In contrast, when Mashaly *et al*., (2015) studied plant communities floristic features in the Nile Delta found that Poaceae was the main leading family with (21.29%) followed by Chenopodiaceae and Brassicaceae (7.74% and 6.45% respectively).

In the study area the following genera were containing more than one number of species. The genus *Juncus* was with 3 species. *Mesembryanthemum, Sonchus, Chenopodium, Cyperus, Plantago, Rumex, Tamarix and Zygophyllum* each was with 2 species (Table 3)

Floristically, the life-form spectra have widely been used by the ecologists and chorologists in the vegetation and floristic studies Cain and de oliveira Castro (1959) and provide information which may help in assessing the response of vegetation to variations in environmental factors (Ayyad and El- Ghareeb, 1982) and also indicate climate and microclimates (Kershaw and Looney, 1985). Raunkiaer (1934) designated the Mediterranean climate types as " therophytes climate" because of the high percentage (more than 50% of the total species) of this life form in the Mediterranean floras.

In the present study, plant life form spectrum distribution at Damietta coastal area were found as Therophytes 28 species (48.28%), Chamaephytes 8 species (13.79%), Geophytes 7 species (12.07%), Hemicryptophytes 6 species (10.34%) , Phanerophtes 6 species (10.34%) and Helophytes 3 species (5.17%). (Figure 2) indicated that the most frequent type in the study area was therophytes and helophytes was the least frequent type . These results are consistent with the results obtained by Abd El-Fatah (2012) when studying some weeds and associated species in Damietta and the life form spectrum in the study area indicated that therophytes was the most frequent type (33.33%) followed by Chamaephytes (25.93%), Geophytes-helophytes (14.81%), nanophanerophytes, hemicryptophytes, geophytes (7.41% each) and helophytes which was the least frequent type represented by (3.70%) and it is also consistent with the results obtained from the present study.

The habits of plant species found as , 43 species (74%) were herbs, 13 species (22%) were shrubs and 2 species (4%) were trees (Figure 3). Mahmoud and Gariola (2013) recorded 70 species of medicinal plants in the Desert of Egypt (Wadi El-Gemal National Park) and found that most of the recorded species were herbs (27) when shrubs, trees, ferns were (31, 11 and 1 species respectively)

Table 2. A List of species encountered in the study area.

Families	Species	Life form	Habit	Life Cycle	Vernacular name
Aizoaceae	*Mesembryanthemum nodiflorum* L.	Th.	H.	A.	Gasool
	Mesembryantemum crystallinum L.	Th.	H.	A.	Samh
Asclepiadaceae	*Cynanchum acutum* L.	Ph.	H.	P.	Moddeid
Asparagaceae	*Asparagus stipularis* Forssk.	Geo.	Sh.	P.	Shook
	Carduus getulus Pomel.	Th.	H.	A.	Hoshroof
	Pluchea discoridis (L.) DC.	Ph.	Sh.	P.	Barnoof
	Echinops spinosus L.	Hemi.	H.	P.	Shoak el-gamal
	Ifloga spicata (Forssk.) Sch.-Bip.	Th.	H.	A.	Kreishit el-gadye
	Inula crithmoides L.	Ch.	Sh.	P.	Hatab zeiti, Zeiti,
Asteraceae	*Launaea nudicaulis* (L.) Hook. F.	Hemi.	H.	P.	Howa
	Reichardia tingitana (L.) Roth.	Th.	H.	A.	Howei kelaab
	Senecio desfontainei Druce	Th.	H.	A.	Omm Lonein
	Sonchus oleraceus L.	Th.	H.	A.	Go'odied
	Sonchus asper (L.) Hill	Th.	H.	A.	Elgodeed elkheshn (elmor)
	Urospermum picroides (L.) F.W. Schmidt	Th.	H.	A.	Galawein
Boraginaceae	*Heliotropium curassavicum* L.	Ch.	Sh.	P.	Ghobbeira
Brassicaceae	*Cakile maritima* Scop. *ssp. aegyptiaca* (Willd.) Nyman	Th.	H.	A.	Rashaad el-bahr
	Lepidium sativum L.	Th.	H.	A.	Habb El-Rashaad
Caryophyllaceae	*Spergularia marina* (L.) Griseb.	Th.	H.	A.	Abo gholaam
	Arthrocnemum macrostachyum Moric.	Ch.	Sh.	P.	Hatab ahmar
	Chenopodium album L.	Th.	H.	A.	Fiss el-Kelb
	Chenopodium murale L.	Th.	H.	A.	Abu 'efeina
Chenopodiaceae	*Atriplex portulacoides* L.	Ch.	Sh.	P.	Hatab abiad
	Halocnemum strobilaceum (Pallas) M. Bieb.	Ch.	Sh.	P.	Hatab haddadi
	Bassia indica (Wight) A.J.Scott	Th.	H.	A.	Kochia
	Suaeda pruinosa Lange.	Ch.	Sh.	P.	Soweid
	Cyperus laevigatus L.	Geo.	H.	P.	Borbeit
Cyperaceae	*Cyperus rotundus* L.	Geo.	H.	P.	Sa'd el-homaar
	Scirpus tuberosus Defs.	Helo.	H.	P.	Dees
	Alhagi graecorum Boiss.	Hemi.	Sh.	P.	Aqool
Fabaceae	*Lotus creticus* L.	Hemi.	H.	P.	Oshb
	Melilotus indicus (L.) All.	Th.	H.	A.	Hendaqooq helw
Frankeniaceae	*Frankenia pulverulenta* L.	Th	H.	A.	Molleih
Geraniaceae	*Erodium laciniatum* (Cav.) Willd.	Th.	H.	A.	Rqrna.
Illecebraceae	*Paronychia arabica* (L) DC.	Th.	H.	A.	Bseisa.
	Juncus acutus L.	Helo.	H.	P.	Samaar morr, 'Asal'
Juncaceae	*Juncus rigidus* C. A. Mey.	Geo.	H.	P.	Samaar morr
	Juncus bufonius L.	Th.	H.	A.	Sha'ar el-qird
Malvaceae	*Malva parviflora* L.	Th.	H.	A.	Khobbeeiza
Plantaginaceae	*Plantago crypsoides* Boiss.	Th.	H.	A.	Plantago
	Plantago major L.	Hemi.	H.	P.	Lisaan hamal
	Avena fatua L.	Th.	H.	A.	Saboos
	Cynodon dactylon (L.) Pers.	Geo.	H.	P.	Nigeel (baladi)
	Imperata cylindrica (L.) Beauv.	Hemi.	H.	P.	Halfa
Poaceae	*Leptochloa fusca* (L.) Kunth	Geo.	H.	P.	Heesh.
	Phragmites australis (Cav.) Trin. ex Steud.	Helo.	H.	P.	Hagna, Ghaab, Ghaab reehi, Boos.
	Polypogon monspeliensis (L.) Desf.	Th.	H.	A.	Deil el-qott
	Sporobolus spicatus (Vahl) Kunth	Geo.	H.	P.	Nigeel shetaani
	Calligonum polygonoides L.	Ph.	Sh.	P.	Arta
Polygonaceae	*Rumex dentatus* L.	Th.	H.	A.	Khilla
	Rumex vesicarius L.	Th.	H.	A.	Hanbeit
Portulacaceae	*Portulaca oleracea* L.	Th.	H.	A.	Rigla
Primulaceae	*Anagallis arvensis* L. Flowers red in spp. arvensis (= *A. phoenicea* Scop.) or blue in spp. latifolia (L.) Arcangeli (*A. coerulea* many authors, vix L.)	Th.	H.	A.	Ain el-gamal
Solanaceae	*Lycium shawii* Roem. Et Sch.	Ph.	Sh.	P.	Awsaag
Tamaricaceae	*Tamarix nilotica* (Ehrenb.) Bge	Ph.	T.	P.	Tarfa-a
	Tamarix tetragyna Ehrenb.	Ph.	T.	P.	Tarfa-a
Zygophyllaceae	*Zygophyllum aegyptium* A. Hosny	Ch.	Sh.	P.	Ratrayt masry
	Zygophyllum album L. f.	Ch.	Sh.	P.	Tarteer

Th= Therophytes, Ch= Chamaephytes, Geo= Geophyte, Hemi= Hemicryptophytes, Ph= Phanerophyte, Helo= Helophyte, H= Herb, Sh= Shrub, T= Tree, A= Annual, P= Perennial.

Table 3. Species total of the largest genera.

No.	Genus	No. of species
1	*Mesembryanthemum*	2
2	*Sonchus*	2
3	*Chenopodium*	2
4	*Cyperus*	2
5	*Juncus*	3
6	*Plantago*	2
7	*Rumex*	2
8	*Tamarix*	2
9	*Zygophyllum*	2

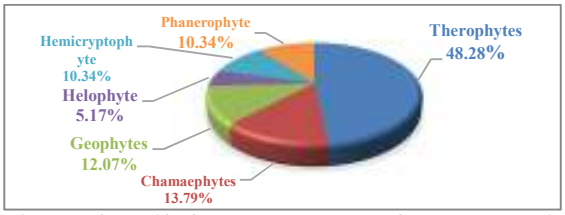

Figure 2. Life-form spectrum of plant species encountered in the study area.

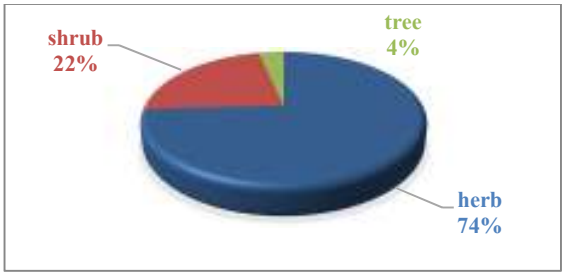

Figure 3. Pie structure of Habit of plant species encountered in the study area.

Plant life cycle distribution was found as perennials 30 species (52%) and 28 species (48%) were annuals (Figure 4). These results agree with Mashaly *et al*., (2008) results which obtained that perennials were more than annuals (41.54% annuals, 2.31% biennials and 56.15% perenials) when studying habitats and plant communities in Deltaic Mediterranean coastal habitats of Egypt. The obtained results agree also with Maswada and Elzaawely (2013) results when investigated three geophyte and their associated species in the Deltaic Mediterranean coastal of Egypt.

Figure 4. Pie structure of life cycle of plant species encountered in the study area.

Major halophytic communities in the study area

The present study documenting the floristic composition of the communities dominated by halophytes and the associated species halophytes in the Damietta coastal area and the obtained results agree with Serag (1999) who studied the floristic composition of *Arthrocnemum macrostachyum* (Moric) C. Koch., *Halocnemum strobilaceum* (Pallas) M. Bieb., *Inula crithmoides* L. and *Zygophyllum aegyptium* communities in Domiat Al-Gadida. The major halophytic communities in the study area was as follows:

***Arthrocnemum macrostachyum* community.**

***Arthrocnemum macrostachyum* Moric.:** leafless, densely branched, Woody perennial , robust Succulent plants common occurs in salt places of the Nile Delta and the Mediterranean coastal strip from El-Sallum to Rafah. *Arthocnemum* occur on Salt marshes, Hammocks (Sand flats), High salinity (Salt crust) of the coastal area of Damietta governorate. The most common associated species with *Arthrocnemum* in the study area are: *Halocnemum strobilaceum* (Pallas) M. Bieb., *Bassia indica* (Wight) A.J.Scott , *Suaeda pruinosa* Lange , *Zygophyllum aegyptium* A. Hosny, *Juncus acutus* L., *Juncus rigidus* C. A. Mey., *Phragmites australis* (Cav.) Trin. ex Steud., *Inula crithmoides* L.and *Tamarix nilotica* (Ehrenb.) Bge.

Figure 5. Growth of *Arthrocnemum macrostachyum* Moric. Collected from Damietta coastal area.

***Halocnemum strobilaceum* community**

***Halocnemum strobilaceum* (Pallas) M. Bieb.:** Woody Perennial Shrub with continuous branches and rudimentary leaves common occurs in the Nile Delta around the lakes and in the Mediterranean coastal strip from El-Sallum to Rafah. *Arthocnemum* occur on Salt marshes of the coastal area of Damietta governorate. The most common associated species with *Halocnemum* in the study area are: *Arthrocnemum macrostachyum Moric.*, *Phragmites australis* (Cav.) Trin. ex Steud., *Bassia indica* (Wight) A.J.Scott, *Zygophyllum aegyptium* A. Hosny, *Juncus rigidus* C. A. Mey., *Inula crithmoides* L. and *Tamarix nilotica* (Ehrenb.) Bge.

Figure 6. Growth of *Halocnemum strobilaceum* (Pallas) M. Bieb. Collected from Damietta coastal area.

***Inula crithmoides* community**

***Inula crithmoides* L:** Woody perennial shrub with spathulate fleshy leaves common occurs in the Nile Delta and in the Mediterranean coastal strip from El-Sallum to Rafah in salty places. *Inula* occur on Salt marshes, Hammocks (Sand flats), High salinity (Salt crust) of the coastal area of Damietta governorate. The most common associated species with *Halocnemum* in the study area are: *Arthrocnemum macrostachyum Moric*., *Halocnemum strobilaceum* (Pallas) M. Bieb., *Phragmites australis* (Cav.) Trin. ex Steud., *Bassia indica* (Wight) A.J.Scott, *Zygophyllum aegyptium* A. Hosny, *Juncus rigidus* C. A. Mey., *Suaeda pruinosa* Lange, *Tamarix nilotica* (Ehrenb.) Bge., *Cakile maritima* Scop. *ssp. aegyptiaca* (Willd.) Nyman, *Spergularia marina* (L.) Griseb. and *Cynanchum acutum* L.

Figure 7. Growth of *Inula crithmoides* L. Collected from Damietta coastal area.

***Phragmites australis* community**

***Phragmites australis* (Cav.) Trin. ex Steud.:** Perennial plant and very common Robust reed occurs in the Nile region. *Phragmites* occur on Salt marshes, Hammocks (Sand flats), High salinity (Salt crust) of the coastal area of Damietta governorate. The most common associated species with *Phragmites* in the study area are: *Halocnemum strobilaceum* (Pallas) M. Bieb., *Bassia indica* (Wight) A.J.Scott, *Suaeda pruinosa* Lange , *Zygophyllum aegyptium* A. Hosny, *Juncus rigidus* C. A. Mey., *Inula crithmoides* L, *Arthrocnemum macrostachyum Moric., Tamarix nilotica* (Ehrenb.) Bge , *Cakile maritima* Scop. *ssp. aegyptiaca* (Willd.) Nyman, *Spergularia marina* (L.) Griseb. and *Imperata cylindrica* (L.) Beauv.

Figure 8. Growth of *Phragmites australis* (Cav.) Trin. ex Steud Collected from Damietta coastal area.

***Juncus rigidus* community**

Juncus rigidus C. A. Mey.: Marsh Perennial herbs very common ocuuurs in the Nile Delta and in the Nile Delta and in the Mediterranean coastal strip from El-Sallum to Rafah in marshes , salty land and occasionally along courses of fresh water. *J.rigidus* occur on Salt marshes, and High salinity (Salt crust) of the coastal area of Damietta governorate. The most common associated species with *J.rigidus* in the study area are: *Arthrocnemum macrostachyum Moric.*, *Halocnemum strobilaceum* (Pallas) M. Bieb., *Phragmites australis* (Cav.) Trin. ex Steud., *Tamarix nilotica* (Ehrenb.) Bge, *Suaeda pruinosa* Lange , *Cynanchum acutum* L. and *Zygophyllum aegyptium* A. Hosny.

Figure 9. Growth of *Juncus rigidus* C. A. Mey. Collected from Damietta coastal area.

***Bassia indica* community**

***Bassia indica* (Wight) A.J.Scott:** Richly branched annual herb common occurs in the Nile Delta and in the Nile Delta and in the Mediterranean coastal strip from El-Sallum to Rafah a casual of frequent occurrence under more moist coditions. . *Bassia* occur on Salt marshes and Hummocks (Sand flats) of the coastal area of Damietta governorate. The most common associated species with *Bassia* in the study area are: *Arthrocnemum macrostachyum* Moric., *Inula crithmoides* L. and *Phragmites australis* (Cav.) Trin. ex Steud.

Figure 10. Growth of *Bassia indica* (Wight) A.J.Scott Collected from Damietta coastal area.

***Sueada pruinosa* community**

***Suaeda pruinosa* Lange:** Woody Perennial Shrub occurs in the Nile Delta and in the Mediterranean coastal strip from El-Sallum to Rafah. Suaeda occur on Salt marshes and High salinity (Salt crust) of the coastal area of Damietta governorate. The most common associated species with *Bassia* in the study area are: *Arthrocnemum macrostachyum* Moric., *and Phragmites australis* (Cav.) Trin. ex Steud. *and Juncus rigidus* C. A. Mey.

Figure 11. Growth of *Suaeda pruinosa* Lange *C*ollected from Damietta coastal area.

***Tamarix nilotica* community**

***Tamarix nilotica* (Ehrenb.) Bge:** Woody Perennial shrub occurs very common in the Nile region, including the Delta and in in the Mediterranean coastal strip from El-Sallum to Rafah especially in salty places. *Tamarix* occur on Salt marshes of the coastal area of Damietta governorate. The most common associated species with *Tamarix* in the study area are: *Arthrocnemum macrostachyum* Moric*., Phragmites australis* (Cav.) Trin. ex Steud., *Juncus rigidus* C. A. Mey., *Inula crithmoides* L. and *Cynanchum acutum* L.

Figure 12. Growth of *Tamarix nilotica* (Ehrenb.) Bge Collected from Damietta coastal area.

Goods and services provided by some halophytic Species

Although a lot of plant species uses still unknown many substances that we use in our daily lives are plant products as medicines and industrial products. Heneidy and Bidak (2004). Halophytes are plants of significant economic potential which can contribute tremendously toward the environmental restoration besides a potential source of medicine. (Qasim, *et al.,* 2011)

It holds out promise as a sustainable approach to crop production under saline conditions near the sea and in inland salt affected regions as well and it can be used in seawater based agriculture. Thus, we need increasingly to frame new ways of thinking about salt and new strategies for the management of local and global saline (or salinized) resources (Aronson, 1980). Use of saline and brackish water resources has been recommended for growing cash crop as food, fuel, fiber, fodder and medicine for the ever increasing human population (Rozema and Flowers, 2008).

The obtained results revealed also that the presented halophytic species in the study area have many economic and ecological uses such as food production, fuel, fiber producing, fodder, medicine, Shading, Sand stabilization, refuge and windbreak…etc., so we need to conduct further studies in preparation for the use of plants as cash crops and to spread awareness to be used on a large scale in Egypt. (Table 4) shows the multipurpose uses of the encountered species in the study area.

Table 4. Ecological and economic services provided by the halophytic species recorded in the study area.

Economic value	No. of species	Ecological value	No. of species
Edible	24	Weed	2
Medicinal	48	Sand stabilization	27
Ornamental	9	Sand accumulation	21
Aromatic source	3	Consolidating the banks of water courses,	1
Grazing	43	Valuable for soil conservation due to its long runners	2
Fodder	5	Shading	10
Forage	1	Wind break	15
Hand crafts	6	Fencing	2
Rope and textile production	1	Esthetic value	6
Timber	2	Salt tolerance	6
wood production	1	Water storage	9
Fuel wood	13	Soil fertility	3
Insecticidal activity	3	Soil management	1
Fly repellant	1	Erosion control	1
used to produce biomass	1	Control erosion along stream banks	1
Antioxidant	1	Re-vegetator	1
Antimicrobial	2	purifying Nile water	1
Antifungal	2	Stifles harmful weeds	1
Antibacterial	1	Reclamation of salt land and to supportive cultivation in lower Egypt,	1
Dye resourse	1	Wastewater treatment	2
Tanning skin	1	Food and cover for wildlife,	1
Manufacture of soap and glass	1	animal feed supplement	1
		provides some cover for livestock and wildlife and nesting sites for many bird species	1
soap substitute	2	Shelter	1
		Refuge	11
		provision of pollen to bees and bioremediation potential	16

Most of the represented species in the study area are medicinal plants such as: *Mesembryanthemum crystallinum* L., *Echinops spinosus* L. , *Ifloga spicata* (Forssk.) Sch.-Bip. Bidak *et al*. (2015) and *Zygophyllum aegyptium* A, Hosny (Salama, 1993). Furthermore, 24 species are edible like: *Sporobolus spicatus* (Vahl) Kunth (El-Shaer and El-Khouly, 2016), while 43 plants could be used for grazing like: *Urospermum picroides*

(L.) Scop. Ex F.W.Schmidt. (Shaltout and Khalil, 2005). These are in addition to many other economical uses.

On the other hand, many halophytic species in the study area used for its ecological benefits like sand stabilization such as: *Juncus acutus* L. (Al- Qudat and Qadir, 2011)

Moreover, it was found that one plant species could have more than one use e.g. *Cakile maritima* Scop. ssp. aegyptiaca (Willd.) Nyman (could be used for its medicinal, grazing, aromatic, nutrition, sand accumulation, windbreak, salinity tolerant, sand stabilization, shading and provision of pollen to bees and bioremediation potential value) (Facciola, 1990; Heneidy and Bidak, 2004; Al-Oudat and Qadir, 2011 and Bidak *et al*., 2015).

Bassia indica (Wight) A.J.Scott also could be used as Grazing, Medicinal, Fuel wood, Edible, Sand accumulation, Sand stabilization and Shading plant. While *Suaeda pruinosa* Lange could be used for grazing, medicinal purposes, fuel wood resource, sand accumulation, sand stabilization, wind break, water storage and as provision of pollen to bees and bioremediation potential. (Heneidy and Bidak, 2004; Shaltout and Khalil, 2005 and Bidak *et al,* 2015)

In conclusion, A total number of recorded plant species surveyed in the present study was 58 species belonging to 46 genera and related to 23 families. These species include 52% perennials and 48% annuals. Asteraceae, Chenopodiaceae and Poaceae were the main leading families. Life form spectrum was mainly represented by Therophytes and partly by Chamaephytes, Geophytes, Hemicryptophytes, Phanerophytes and Helophytes. Most of the recorded species were herbs by (74%) while, 22% were shrubs and 4% only were tress. The major halophytic communities in the study area were dominated by *Arthrocnemum macrostachyum*, *Halocnemum strobilaceum*, *Inula crithmoides*, *Phragmites australis*, *Juncus rigidus, Bassia indica, Suaeda pruinosa* and *Tamarix nilotica*. Finally, Halophytes can be cultivated as cash crops for its economic value and can be cultivated for its ecological value. The above information on halophytes may be useful in practical application under field conditions.

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دراسة مسحية على بعض النباتات الملحية النامية في المنطقة الساحلية بدمياط وعلاقة ذلك بأهميتها النباتية والبيئية

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أجريت الدراسة خلال العامين 2014- 2015 لعمل حصر للنباتات الملحية النامية بالمنطقة الساحلية بدمياط باختيار 10 مواقع تنمو فيها النباتات الملحية مع مراعاة خلو منطقة الدراسة من الأضرار التي تسببها الممارسات البشرية. وقد تم رصد 23 عائلة و46 جنس و58 نوع نباتي بواقع 19 عائلة من ذوات الفلقتين و4 عائلات من ذوات الفلقة الواحدة. وكانت أهم المجتمعات التي يسودها نباتات ملحية هي عشيرة الحطب الأحمر *Arthrocnemum macrostachyum* وعشيرة الحطب الحدادي *Halocnemum strobilaceum* وعشيرة الحطب الزيتي *Inula crithmoides* وعشيرة الحجنة *Phragmites australis* وعشيرة السمار المر *Juncus rigidus* وعشيرة الكوخيا *Bassia indica* وعشيرة السويد *Suaeda pruinosa* وعشيرة الطرفة *Tamarix nilotica* مع بيان أهمية الأنواع التي وجدت من النباتات الملحية بمنطقة الدراسة من الناحية الاقتصادية والبيئية وذلك بهدف رصد الأنواع النباتية النامية بمنطقة الدراسة والوقوف على الوضع الحالي للنباتات الملحية بالمنطقة الساحلية بدمياط واستخداماتها حيث تم رصد العديد من الأنواع النباتية التي تستخدم في الطب الشعبي مثل نبات الرطريط المصري *Zygophyllum aegyptium* هذا بالإضافة إلى أن العديد منها يعد مرعي طبيعي كما أنها صالحة للأكل ويمكن استخدامها لتثبيت الرمال ومازلنا في حاجة لإجراء مزيد من الدراسات عليها لزراعتها واستخدامها في حياتنا اليومية.