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# Floristic and Inventory Study of Mallaha Wetland Tripoli – Libya

**Mohammed Hadi Mahklouf [1,*], Fathi G. Al-Sghair [1]**

[1] *Botany Department, Faculty of Sciences, Tripoli University, Tripoli, Libya*

* *Corresponding author: Mohammed Hadi Mahklouf, Botany Department, Faculty of Sciences, Tripoli University, Tripoli, Libya. E-mail: mahklouf64@yahoo.com*

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**Abstract**

The aim of this study is to investigate the biodiversity status of Mallaha wetland, the study was carried out in the period between February and July 2016, with one trip per week, the result of the survey let to collection and identification of 90 plant species belonging to 24 families and 76 genera, of which 24 species are belonging to monocotyledons and 66 belonging to dicotyledons. Floristic analysis were carried out which showed the predominance of the family Poaceae with 18 species followed by the family Asteraceae with 16 species, the result was also showed the predominance of the genus juncus with 4 species. Life forms and chorological spectra were analyzed as well which showed predominance of Therophytes with 59 species and Mediterranean chorotypes with 29 species.

## INTRODUCTION

The total coastline of Libya is about 1975 km long, numerous salt marshes bordered by sabkhas occur along the coast, these sabkhas cover some a very large area on the coast line and most of them are completely dry during the summer season. The sabkha has been identified as a natural biotope for special poor vegetation cover composed mainly of halophytes and desert plant taxa around the sabkha due to coarse sand texture and prevailing semiarid conditions [1]. Salt pans (sabkhas) and salt-marshes occur along the coastal strip, formed by the ponding and subsequent evaporation of water behind the coastal dunes. These arise where run-off collects, but the capillary rise of groundwater from a shallow water table has also contributed to the development of these features. One of the largest sabkhas is located in the western part of Libya and is called "the Abu Kammash salt marsh (Abu Kammash subkha)" and it is found along the coastal Libyan-Tunisian highway about 150 km west of Tripoli in the Abu Kammash area near the Tunisian border, carry salt-marsh vegetation. In addition, there are saline marshes on the Plain of Gefara inland. To the east of Tripoli there are some water bodies so formed may persist from year to year. The most important of these are in the Wadi Kaam between Al Khums and Zlitan, and in the Wadi Turhat some 50 km east of Tripoli, these water bodies are brackish and fringed by reeds, rushes and sedges. To the east of Mistratah is the great sabkhat of Tawurgha which extends along shore behind the sand beach for 100 km between Misratah and Bu'ayrat al Hasun. Other salt pans, some of considerable extent, occur inland on the Plain of Sirt. the Sabkhat al Qunayyin, and the great marsh behind the coastal dunes at Ajdabiya, this is 70 km long and 12 km wide in places, and carries typical salt-marsh vegetation. North of this, continuing up the eastern side of the Gulf of Sirt towards Banghazi, there is a series of salt pans subject to temporary inundation behind the barrier beach. Immediately north of Qaminis, a system of pans reaches 40 km inland from the sea carry halophytic vegetation. Others north of Banghazi have fresh water pools, but these particular sites are very much disturbed and threatened by the encroachment of urban development. To the south of the country also there are several oases and wetlands such as oases of the Ghat region, oases of Sebha district, the lakes of Wau En Namus, the oases of Kufrah and others. All these wetlands with special halophytic and desert vegetation [1].

In Libya there are no adequate floristic studies on such saline habitats, except the study of Kikili & Erteb [2] on the flora of Farwa island, so one of the important coastal salt marches is Mallaha wetland in the North east of Tripoli, the diversity of Mallaha which is mainly characterized as a salt-marsh habitat suitable for halophytic and salt tolerant plants, it is still floristically unexplored and this work is the first floristic and inventory study in this wetland, so it may provide new contribution to the biodiversity status of such habitats.

### Study Area

Mallaha is a wetland located in northeastern Tripoli (32° 53' 58" N, 13° 17' 15" E) (Fig 1). The site is about 2.5 km in length with a maximum width of about 1.5 km. It has a surface area of about 3.75 ha. It is a salt marsh, fed by a canal from the sea year round and by rainfall during winter. The northern part of Mallaha is dominated by dry sandy areas, grasses, dry and wet streams, canals, and brackish and salty pools. It also contains trees and shrubs, dumping yards for garbage and waste materials, the ruins of old residential and military buildings, and gravel and dust roads. There are salt marshes in the south western portion that considered suitable for halophytic plants and provide food and shelter for a variety of aquatic birds [3, 4] (Fig 1).

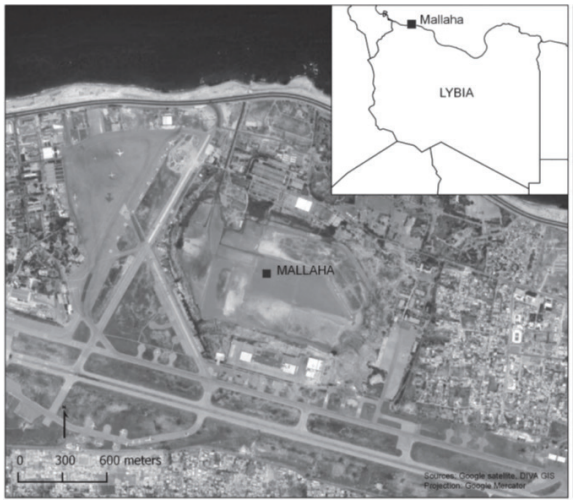


**Figure 1:** Satellite Image of the Study Area (via http://maps.google.com.ly).

## METHODS

The study was conducted during growing season 2016, in the period between February and July for one trip a week, collected plants were brought to herbarium and subjected ordinary herbarium procedures such as drying, pressing, mounting, labeling and identification. Identification of plant species were done using data from literatures provided such as [5-8] the collected and identified plant species were deposited at national herbarium, Botany department, Faculty of Sciences, Tripoli University.

## RESULTS

At the end of the survey a total of 90 plant species belonging to 24 families (3 families belonging to monocotyledons and 21 families belonging to dicotyledones) and 76 genera were collected and identified, of which 24 species and 19 genera are belong to monocotyledons, and 66 species and 57 genera are belonging to dicotyledons (Tables 1 and 2).

Floristic analysis were carried out which showed the predominance of the family Poaceae with 18 species, followed by the family Asteraceae with 16 species, the result was also showed the predominance of the genus *Juncus* with 4 species, followed by genus *Bromus* and *Lotus* with 3 species each, then the genera *Senecio*, Hypochoeris, *Acacia, Erodium, Mesembryanthemum* and *Malva* with 2 species each.

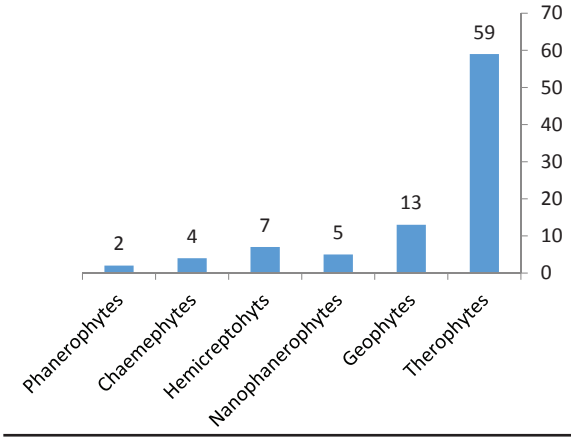


**Figure 2:** Shows the Number of Species According to Their Life Forms.

| Family | Species | Life Form | Choptype |
|---|---|---|---|
| Juncaceae | | | |
| | *Juncus acutus L.* | G | Med./ Ir-Tu. |
| | *Juncu bufonius L.* | G | Cos. |
| | *Juncus maritimus Lam.* | G | Med./ Eru-Si. |
| | *Juncus subulatus Lam.* | G | Med. |
| Liliaceae | | | |
| | *Allium ampeloprasum L.* | G | Med./ Ir-Tu. |
| | *Asphodellus festulosus L.* | G | Med. |
| Poaceae | | | |
| | *Avena barbata Pott ex Link.* | Th | Med. |
| | *Bromus diandrus Roth.* | Th | Med. |
| | *Bromus molliformis Lloyd* | Th | Med./ Eru-Si. |
| | *Bromus rigidus Roth.* | Th | Med./ Eru-Si. |
| | *Cenchrus ciliaris L.* | Th | Sah-Ar. |
| | *Cutandia maritima (L.) Barbey.* | G | Med. |
| | *Cyrodon dactylon (L.)Pers.* | G | Plu. |
| | *Elytrigia juncea (L.) Nevskli in Acta.* | G | Med./ Eru-Si. |
| | *Hordeum marinum Hrds* | Th | Plu. |
| | *Hyparrhenia hirta (L.) Stapf.* | Th | Plu. |
| | *Lagurus ovatus L.* | Th | Med./Eru-Si. |
| | *Lophochloa cristata (L.) Hyl.* | Th | Plu. |
| | *Parapholis incurva (L.) C. E. Hubbard* | Th | Med./ Ir-Tu./ Er-Si |
| | *Phalaris minor Retz.* | Th | Med./ Ir-Tu. |
| | *Phragmitis australis (Cav.) Trin ex Steud.* | G | Cos |
| | *Piptatherum meliaceum (L.) Coss.* | H | Med. |
| | *Polypogon monspeliensis (L.) Desf.* | Th | Plu. |
| | *Stipa capensis Thunb* | Th | Med./ Ir-Tu./ Sah-Ar. |

Th: Therophytes; H: Hemicryptyphyes; G: Geophytes; NP: Nanophanerophytes; P: Phanerophytes; Ch: Chaemephytes.

Life form spectrurm of collected species were analyzed according to Raunkiae system [9] as modified by Govaerts et al.[10] , which showed absolute dominance of Therophytes with 59 species, followed by Geophytes with 13 species, the rest of life forms were with little appearance, that Hemicryptophytes with 7 species and Nanophanerophytes with 5 species, then Chaemephytes with 4 species and Phanerophytes 2 species (Tables 1, 2 and 3) (Fig 2).

| Family | Species | Life Form | Chorotype |
|---|---|---|---|
| Aizoaceae | | | |
| | *Carpobrotus edulis* (L.) Bolus. | G | Plu. |
| | *Mesembryathemum chrystallinum* L. | Th | Med./ Eru-Si. |
| | *Mesembryathemum nodiflorum* L. | Th | Med. /Eru-Si./ Sah-Ara. |
| Apiaceae | | | |
| | *Daucus carota* L. | H | Med./ Ir-Tu. |
| Asteraceae | | | |
| | *Aetheorrhiza bulbosa* (L.) Cass. | G | Med. |
| | *Amberboa libyca* (Viv.) Alavi. | Th | Med. |
| | *Atractylis serratuloides* Cass. | Ch | Sah-Ara. |
| | *Carduus argentatus* L. | Th | Med. |
| | *Calenula arvensis* L. | Th | Med./ Ir-Tu. |
| | *Chrysanthemum coronarium* L. | Th | Med. |
| | *Hypochoeris achyrophoprus* L. | Th | Med. |
| | *Hypochoeris* L. | Th | Med./ Ir-Tu./ Eru-Si |
| | *Launaea resedifolia* (L.) kuntze. | Th | Med. |
| | *Leontodon simplex* | Th | Med./ Eru-Si. |
| | *Phagnalon rupestre* (L.) DC. | Th | Med./ Ir-Tu. |
| | *Reichardia tingitana* (L.) Roth. | Th | Sah-Ar./ Ir-Tu |
| | *Senecio gallicus* Chiax vin. | Th | Med. |
| | *Senecio vulgaris* L. | Th | Med./ Ir-Tu./Eru-Si |
| | *Sonchus oleraceus* L. | Th | Cos. |
| | *Urospermum picroides* (L.) F.W.Schmidt | Th | Med./ Ir-Tu. |
| Boraginaceae | | | |
| | *Echium angustifolium* Mill. | H | Med. |
| | *Heliotropium curassavicum* L. | Th | Cos. |
| Brassicaceae | | | |
| | *Brassica tournefortii* Goun. | Th | Med./ Sah-Ara. |
| | *Sisymbrium irrio* L. | Th | Med./ Ir-Tu. |
| Caryophyllaceae | | | |
| | *Silene gallica* L. | Th | Cos. |
| | *Spergularia marina* (L.) Griseb. | Th | Plu. |
| Chenopodiaceae | | | |
| | *Arthrocnemum macrostachyum* (Moric.) K.Koch | Ch | Med. |
| | *Beta vulgaris* L. | Th | Med./ Ir-Tu./ Eru-Si. |
| | *Chenopodium murale* L. | Th | Plu. |
| | *Kochia indica* Wight. | Th | Med./ Ir-Tu. |
| | *Salsola kali* auct. non L. | Th | Plu. |
| | *Suaeda vera* Forssk. ex J.F.Gmel. | Ch | Med./ Sah.-Ara. |
| Euphorbiaceae | | | |
| | *Euphorbia terracina* L. | H | Med./ Eru-Si. |
| | *Ricinus communis* L. | N | Ir-Tu. |
| | *Astragalus stella* L. | Th | Med. |
| Fabaceae | | | |
| | *Hippocrepis bicontorta* Loisel. | Th | Sah-Ara. |
| | *Hippocrepis multiseliquosa* L. | Th | Med. |
| | *Lotus edulis* L. | Th | Med. |
| | *Lotus halophilus* Boiss. & Spruner | Th | Med. |
| | *Lotus cytisoides* L. | H | Med. |
| | *Medicago polymorpha* L. | Th | Med./ Ir-Tu. |
| | *Melilotus sulcatus* Desf. | Th | Med. |

| | | | |
|---|---|---|---|
| | *Retama raetam* (Forssk.) Webb | N | Sah-Ara. |
| | *Scorpiurus muricatus* L. | Th | Med. |
| | *Trigonella maritima* Delile ex Poir. | Th | Med. |
| Gentianaceae | *Centaurium pulchellum* (Swartz.) Druce. | Th | Med. |
| Geraniaceae | | | |
| | *Erodium laciniatum* (Cav.) Willd. | Th | Med. |
| | *Erodium glaucophyllum* (L.) L'Her. | Th | Sah-Ara. |
| Lyhraceae | *Lythrum* sp | Th | Med. |
| Malvaceae | | | |
| | *Lavatera* sp | Th | Med./ Ir-Tu. |
| | *Malva parviflora* L. | Th | Med./ Eru-Si. |
| | *Malva sylvestris* L. | H | Med./ Ir-Tu. |
| Memosaceae | | | |
| | *Acacia karroo* Hayne | P | Plu. |
| | *Acacia cyanoplhylla* Lindl. | P | Ir-Tu. |
| Oxalidaceae | *Oxalis pes-caprae* L. | G | Plu. |
| Plantaginaceae | *Plantago coronopus* L. | Th | Med./Er-Tu./Sah-Ar. |
| plumpaginaceae | | | |
| | *Limonium sibthorpianum* (Guss.) Kuntze | H | Med. |
| | *Polygonum equisetiforme* L. | Ch | Plu. |
| Primulaceae | *Anagalis arvensis* L. | Th | Med. /Ir-Tu/ Eru-Si. |
| Solanaceae | | | |
| | *Datura innoxia* Mill. | Th | Plu. |
| | *Hyoschyamus albus* L. | Th | Med. |
| | *Lycium schweinfurthii* Dammer. | N | Med. |
| | *Nicotiana glauca* Graham. | N | Plu. |
| | *Solanum nigrum* L. | Th | Cos. |
| Tamaricaceae | *Tamarix aphylla* (L.) Karsten | N | Sud./Sah-Ara. |
| Tetragoniaceae | *Tetragonia teragonoides* (Pallas) O. Kuntze | Th | Sud. |

Th: Therophytes; H: Hemicryptyphyes; G: Geophytes; NP: Nanophanerophytes; P: Phanerophytes; Ch: Chaemephytes.

**Table 3:** Shows the Number of Species According to Their Life Forms

| Life form | No of Species |
|---|---|
| **Therophytes** | 59 |
| **Geophytes** | 13 |
| **Nanophanerophytes** | 5 |
| **Hemicreptohyts** | 7 |
| **Chaemephytes** | 4 |
| **Phanerophytes** | 2 |

**Table 4:** Shows the Number of Species According to Their Chorotypes

| Chorotype | No of Species |
|---|---|
| **Med.** | 29 |
| **Med./ Ir-Tu.** | 12 |
| **Plu.** | 14 |
| **Cos.** | 6 |
| **Sah-Ara.** | 5 |
| **Med./ Eru-Si.** | 9 |
| **Eru-Si./Ir-Tu/ Med.** | 5 |
| **Med./ Sah.-Ara.** | 2 |
| **Sah-Ara./Eru-Si./ Med.** | 2 |
| **Ir-Tu.** | 2 |
| **Med./Er-Tu./Sah-Ar.** | 1 |
| **Sah-Ar./ Ir-Tu** | 1 |
| **Sud./Sah-Ara.** | 1 |
| **Sud.** | 1 |

## DISCUSSION

Chorological spectrum of collected and identified plant species were analyzed as well, the results have shown absolute predominance of Mediterranean species with 29 species, followed by Pluri-regional species with 14 species, then Mediterranean / Iranu-Turanean species with 12 species, the rest of chorological spectra were with little appearance as shown in Tables 1, 2 and 4 and Fig 3.

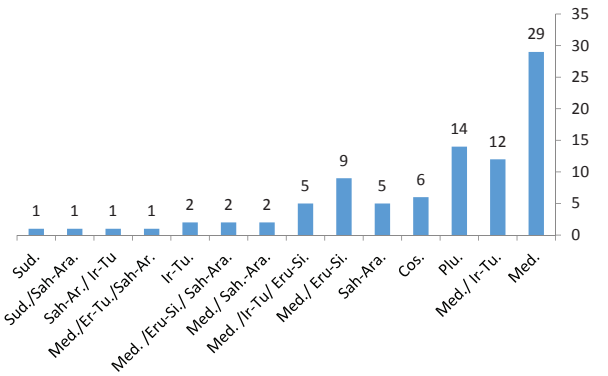


**Figure 3:** Shows the Number of Species According to Their Chorotypes

The dominance of the family Poaceae and Asteraceae were expected because these families are dominated the Mediterranean climate conditions, in addition, these families are cosmo-

politan in distribution, and the dominance of Therophytes and Mediterranean chorotypes were expected as well because the study area is located within the coastal Mediterranean region in which the Mediterranean Therophytes are dominating.

As expected, most of the study area are covered and dominated by true halophytic vegetation, such species are *Suaeda vera, Arthrocnemum macrostachyum, Tamarix aphyla, Kochia indica, Phragmitis australis, Beta vulgaris, Heliotropium curassavicum, Mesembryanthemum crystallinum, Mesembryanthemum nodiflorum, Juncus spp, Lotus cytisoides, Limonium sibthorpianum, Salsola kali, Trigonella maritima, Tetragonia tetragonoides*, and many others which considered as Euhalophytic species.

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