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# FLORISTIC FEATURES OF THE CANAL BANK HABITATS, EGYPT

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## ABSTRACT

*The present study provides an investigation of the floristic features, including distribution of plant species, life-span, life-form spectra and floristic analysis of the plant life in the canal bank habitats of Egypt. The total number of the recorded plant species surveyed in the study area is 115 species belonging to 90 genera and related to 29 families. These species are classified into three major groups according to their duration (life - span) as follows: 58 perennials, 4 biennials and 53 annuals. The main families are: Gramineae, Compositae, Chenopodiaceae and Cyperaceae. The recorded species are grouped under five types of life forms as follows: therophytes, cryptophytes (comprising geophytes, helophytes and hydrophytes), hemicryptophytes, chamaephytes and nanophanerophytes. Out of the recorded species 49 taxa (about 42.61 % of the total number) are Mediterranean which are either Pluriregional, Biregional or Monoregional. The remaining 58 species (about 50.44 % of the total number) are Cosmopolitan (17.39 %), Pantropical (16.52 %), Palaeotropical (12.17 %) and Neotropical (4.35 %).*

***Key words:*** *Nile region, Wadi El-Natrun, canals, drains, vegetation, life form, chorotype*

## INTRODUCTION

In Egypt, the River Nile is the primary source of fresh water but in some desert areas underground water is the only source of irrigation water. The Nile water in Egypt is fed by a network of irrigation and drainage canals over the broad alluvial expanses of the Nile Valley, Nile Delta and Nile Fayium. Khattab (1992) stated that the total length of the irrigation and drainage systems of Egypt is about 48,000 km, distributed according to the width of the bases of irrigation and drainage canals respectively as follows: 3,260 km and 850 km for > 10 m base width; 2,880 km and 1,440 km for 5-10 m base width and 25,500 km and 14,100 km for < 5 m base width.

The vegetation of Egypt may be classified into 7 major types: desert vegetation, salt marsh vegetation, mountain vegetation, sand dune vegetation, reed swamp vegetation, fresh- water vegetation and saline water vegetation (Zahran and Willis, 2009). Reed swamp and the aquatic vegetation types are greatly developed in fresh and brackish water habitats in the Nile region (Hassib, 1951). The Nile system of Egypt includes a number of habitats formed and/or greatly influenced by the water of the River Nile. These are: the aquatic habitat, the swampy habitat, the canal bank habitat, the cultivated lands, the northern lakes, the artificial lakes and the Nile Islands (Zahran and Willis, 2009).

The vegetation analysis of the canals and drains in the Nile region was carried out by

Simpson (1932) who studied the weed flora of irrigation canals, this was the earliest ecological study followed by many others, e.g. Hassib (1951), Täckholm (1974), Boulos and El-Hadidi (1967), El-Hadidi and Ghabbour (1968). Shaltout and El-Sheikh (1993) studied the vegetation of the canals and drains in the middle of the Nile Delta. Zahran *et al.* (1995) studied the ecology of canal bank vegetation in the Nile Delta region. Mashaly et al. (2003) studied the biodiversity and phytochemistry of the weed flora of different habitats in the Nile Delta region. Mashaly and El-Amier (2007) studied the hydrophytic vegetation in the irrigation and drainage canal system of the River Nile in Egypt. Tork (2007) studied the ecology of aquatic vegetation in north-east Nile Delta of Egypt.

The banks of canals and drains in Egypt are usually cleared of weeds once or twice a year. Soon after clearance the weeds start to appear again. The vegetation on the banks arises from the banks themselves, from windborne seeds and from the water. There is competition between the plants already on the banks and those reaching the banks. High on the bank *Cynodon dactylon* is out competed by *Arundo donax* which, in turn, may be replaced by *Imperata cylindrica* or perhaps by *Saccharum spontaneum* (Zahran and Willis, 2009).

The present work aims at recognition of the major habitat types in the Nile region of Egypt, to investigate the floristic features, including record of weed flora, distribution pattern, life-span, life-form spectra and floristic categories of the plant species in canal bank habitats of the Nile region to detect the taxonomic and phytogeographical significance of its floristic components.

**Study Area:**

The study area is located in some selected governorates in the Nile region of Egypt, which comprises different type of habitats. The study area includes many sites (stands) in the following five types of habitats (Figure 1):

1- The River Nile system: Damietta branch, Rosetta branch and River Nile stream.
2- Northern Deltaic natural lakes: Lake Manzala, Lake Borollus and Lake Idku.
3 - Drainage canals were selected in the eleven representative governorates of the Nile regions namely: Damietta, El-Dakahlyia, Kafr El-Sheikh, El-Gharbia, El-Sharkia, El-Behira, El-Menofyia, El-Kaluobya (Nile Delta), El-Fayium (Nile Fayium), El-Giza and Beni Sueif (Nile Vally).
4- Irrigation canals in the above mentioned Nile Delta governorates.
5- Wadi El-Natrun (El-Behira Governorate) in the Western Desert.

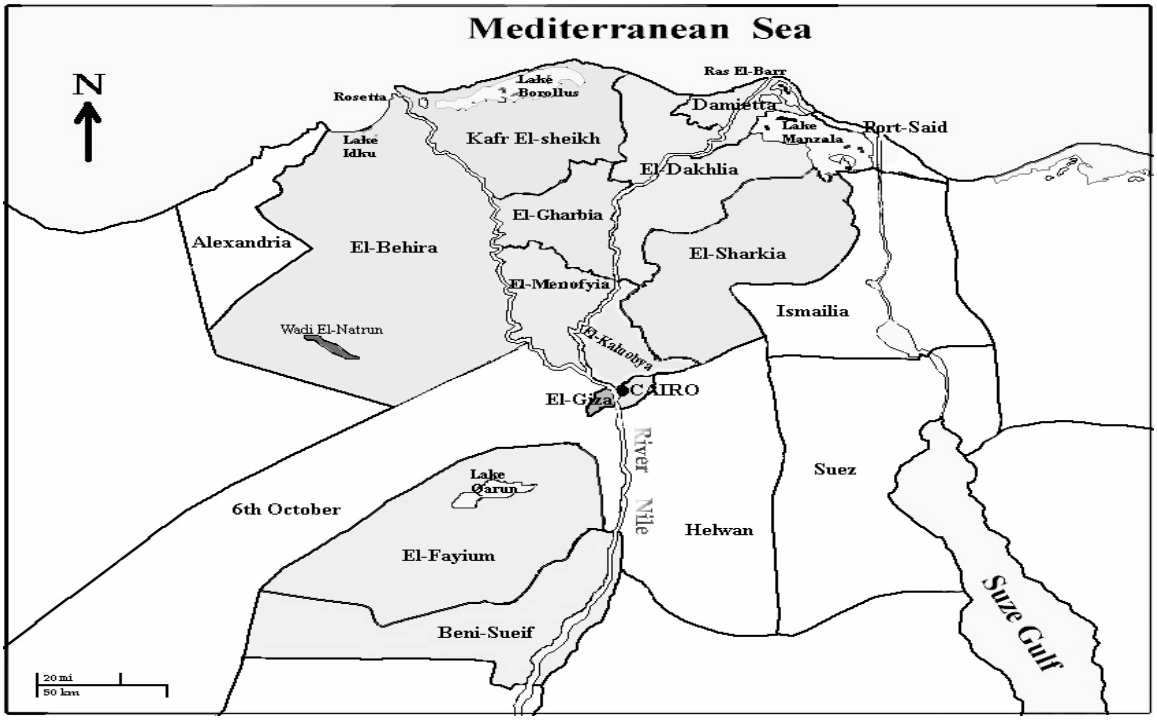


**Figure (1) :** Location map showing the study area.

## MATERIALS AND METHODS

After a regular visits to the different sites of the study area, a number of stands were selected for sampling vegetation in the various recognized habitat types. The stands were distributed in the study area to cover all apparent physiographic variations in each habitat types and to ensure sampling of wide range of vegetational variations. Each stand is obtained as a sum of four plots (1x2 $m^2$ each).

The plant species were recorded during regular visits to the study area throughout two years of survey (2006-2008). The presence and distribution of species in the different stands (115) of various habitat types in the study area, there are five categories are used according to (Shukla and Chandel, 1989) as follows: Very abundant (P=100%), abundant (P=80%), frequent (P= 60%), common (P=40%), and rare (P=20%). The description and classification of life-forms in the present study were according to Raunkiaer (1934). The classification, identification and floristic categories were according to Tutin et al. (1964-1980), Davis (1965 - 1985), Zohary (1966 & 1972), Täckholm (1974), Meickle (1977 & 1985), Feinbrun-Dothan (1978 & 1986) and up to date by Boulos (1999-2005).

## RESULTS AND DISCUSSION

### A- Floristic Composition and Distribution of the Recorded Species in the Different habitats of Study Area:

In the present study, the species recorded in the different habitats of the study area are shown in Table (1). It presents the floristic

**Table ( 1) :** Floristic Composition of the recorded species in the different habitats of the study area.

| No. | Taxon | Life form | Floristic Category | Canal Bank Habitat Types | | | | | Presence | Presence Percentage |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Drainage canal | Irrigation canal | Northern lakes | River Nile system | Wadi El-Natrun | | |
| **Perennials :** | | | | | | | | | | |
| 1 | *Cynodon dactylon* (L.) Pers. | G | PAN | + | + | + | + | + | 5 | 100 |
| 2 | *Phragmites australis* (Cuv.) Trin. ex Steud. | G , He | COSM | + | + | + | + | + | 5 | 100 |
| 3 | *Cynanchum acutum* L. | H | ME+IR-TR | + | + | + | + | + | 5 | 100 |
| 4 | *Typha domingensis* (Pers.) Poir ex Steud. | He | PAN | + | + | + | + | + | 5 | 100 |
| 5 | *Cyperus articulatus* L. | G , He | PAN | + | + | + | + | - | 4 | 80 |
| 6 | *Cyperus alopecuroides* Rottb. | He | PAN | + | + | + | + | - | 4 | 80 |
| 7 | *Echinochloa stagnina* (Retz.) P. Beauv. | G , He | PAL | + | + | + | + | - | 4 | 80 |
| 8 | *Imperata cylindrica* (L.) Raeusch. | H | ME+PAL | + | + | + | + | - | 4 | 80 |
| 9 | *Juncus acutus* L. | He | ME+IR-TR+ER-SR | + | - | + | + | + | 4 | 80 |
| 10 | *Leersia hexandra* Sw. | He | PAN | + | + | + | + | - | 4 | 80 |
| 11 | *Ludwigia stolonifera* (Guill. et Perr.) Raven | He | S-Z | + | + | + | + | - | 4 | 80 |
| 12 | *Oxalis corniculata* L. | H | COSM | + | + | + | + | - | 4 | 80 |
| 13 | *Panicum repens* L. | G | PAN | + | + | + | + | - | 4 | 80 |
| 14 | *Persicaria lapathifolia* Willd. | G | PAL | + | + | + | + | - | 4 | 80 |
| 15 | *Persicaria salicifolia* Brouss. ex Willd. | G | PAL | + | + | + | + | - | 4 | 80 |
| 16 | *Pluchea dioscoridis* (L.) DC. | Nph | S-Z+SA-SI | + | + | + | + | - | 4 | 80 |
| 17 | *Saccharum spontaneum* L. | G , He | ME+PAL | + | + | + | + | - | 4 | 80 |
| 18 | *Tamarix nilotica* (Ehrenb). Bunge | Nph | SA-SI+S-Z | + | + | + | - | + | 4 | 80 |
| 19 | *Alternanthera sessilis* (L.) DC. | He | PAN | + | + | - | + | - | 3 | 60 |
| 20 | *Brachiaria mutica* (Forssk.) Stapf. | H | PAN | + | + | - | + | - | 3 | 60 |
| 21 | *Convolvulus arvensis* L. | H | COSM | + | + | - | + | - | 3 | 60 |
| 22 | *Cyperus laevigatus* L. | G , He | PAN | + | - | - | + | + | 3 | 60 |

**Table ( 2 ) : Continued.**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 23 | *Cyperus rotundus* L. | G | PAN | + | + | - | + | - | 3 | 60 |
| 24 | *Ipomoea carnea* Jacq. | G | PAN | + | + | - | + | - | 3 | 60 |
| 25 | *Juncus rigidus* Desf. | G , He | ME+SA-SI+IR-TR | + | - | + | - | + | 3 | 60 |
| 26 | *Mentha longifolia* (L.) Huds. | He | PAL | + | + | - | + | - | 3 | 60 |
| 27 | *Paspalum distichum* L. | G | PAN | + | - | + | + | - | 3 | 60 |
| 28 | *Pennisetum setaceum* (L.) R.Br. | H | ME+PAL | + | + | - | + | - | 3 | 60 |
| 29 | *Sorghum virgatum* (Hack.) Stapf. | G | SA-SI | + | + | - | + | - | 3 | 60 |
| 30 | *Symphyotrichum squamatum* (Spreng.) Nesom | Ch | NEO | + | + | - | + | - | 3 | 60 |
| 31 | *Alhagi graecorum* Boiss. | H | PAL | + | - | - | + | - | 2 | 40 |
| 32 | *Arthrocnemum macrostachyum* (Moric.) K.Koch. | Ch | ME+SA-SI | + | - | + | - | - | 2 | 40 |
| 33 | *Arundo donax* L. | G , He | Cult. & Nat. | + | + | - | - | - | 2 | 40 |
| 34 | *Atriplex halimus* L. | NPh | ME + SA-SI | + | + | - | - | - | 2 | 40 |
| 35 | *Atriplex portulacoides* L. | Ch | ME+IR-TR+ER-SR | + | + | - | - | - | 2 | 40 |
| 36 | *Bolboschoenus glaucus* (Lam.) S.G.Smith | G | COSM | + | - | + | - | - | 2 | 40 |
| 37 | *Desmostachya bipinnata* (L.) Stapf . | G ,He | S-Z+ME+SA-SI+IR-TR | + | - | - | - | + | 2 | 40 |
| 38 | *Limbarda crithmoides* (L.) Dumort. | Ch | ME+ER-SR+SA-SI | + | - | + | - | - | 2 | 40 |
| 39 | *Paspalidium geminatum* (Forssk.) Stapf. | He | PAL | + | + | - | - | - | 2 | 40 |
| 40 | *Persicaria lanigera* (R. Br.) Sojak | G | PAL | - | + | - | + | - | 2 | 40 |
| 41 | *Phyla nodiflora* (L.) Greene | Ch | PAN | + | + | - | - | - | 2 | 40 |
| 42 | *Plantago major* L. | H | COSM | + | + | - | - | - | 2 | 40 |
| 43 | *Polygonum equisetiforme* Sibthi & Sm. | G | ME+IR-TR | + | + | - | - | - | 2 | 40 |
| 44 | *Suaeda pruinosa* Lange | Ch | ME | + | + | - | - | - | 2 | 40 |
| 45 | *Vigna luteola* (Jacq.) Benth | H | PAL | + | + | - | - | - | 2 | 40 |
| 46 | *Atriplex semibaccata* R. Br. | H | AUST | - | - | + | - | - | 1 | 20 |
| 47 | *Cyperus alternifolius* L. | G, He | PAN | - | - | - | + | - | 1 | 20 |
| 48 | *Cyperus papyrus* L. | G, He | PAL | - | - | - | + | - | 1 | 20 |
| 49 | *Juncus subulatus* Forssk. | G , He | ME+IR-TR+SA-SI | - | - | - | - | + | 1 | 20 |
| 50 | *Launaea mucronata* (Forrsk.) Muschle. | H | ME+SA-SI | - | - | - | - | + | 1 | 20 |
| 51 | *Lycium europaeum* L. | Nph | ME | - | + | - | - | - | 1 | 20 |

**Table (2) : Continued.**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 52 | *Polypogon viridis* (Gouan) Breistr. | H | ME+IR-TR | + | - | - | - | - | 1 | 20 |
| 53 | *Samolus valerandi* L. | H | COSM | - | - | - | - | + | 1 | 20 |
| 54 | *Schoenoplectus litoralis* (Schrad.) Palla. | G | ME+PAL | - | - | + | - | - | 1 | 20 |
| 55 | *Suaeda vera* Forssk. ex J.F. Gmel. | Ch | ME+SA-SI+ER-SR | - | - | + | - | - | 1 | 20 |
| 56 | *Typha elephantina* Roxb. | He | PAN | - | - | - | - | + | 1 | 20 |
| 57 | *Veronica anagallis-aquatica* L. | He | COSM | + | - | - | - | - | 1 | 20 |
| 58 | *Verbena officinalis* L. | Ch | COSM | - | - | - | + | - | 1 | 20 |
| **Biennials :** | | | | | | | | | | |
| 1 | *Rorripa palustris* (L.) Besser | Th | ER-SR+IR-TR+ME | + | + | + | - | - | 3 | 60 |
| 2 | *Beta vulgaris* L. | Th | ME+IR-TR+ER-SR | + | + | - | - | - | 2 | 40 |
| 3 | *Spergularia marina* (L.) Griseb | Th | ME+IR-TR+ER-SR | + | + | - | - | + | 2 | 40 |
| 4 | *Sida alba* L. | Th | PAN | + | - | - | - | - | 1 | 20 |
| **Annuals :** | | | | | | | | | | |
| 1 | *Polypogon monspeliensis* (L.) Desf. | Th | COSM | + | + | - | + | + | 4 | 80 |
| 2 | *Rumex dentatus* L. | Th | ME+IR-TR+ER-SR | + | + | + | + | - | 4 | 80 |
| 3 | *Amaranthus lividus* L. | Th | ME+IR-TR | + | + | - | + | - | 3 | 60 |
| 4 | *Ammi majus* L. | Th | ME+IR-TR+ER-SR | + | + | - | + | - | 3 | 60 |
| 5 | *Anagallis arvensis* L. | Th | COSM | + | + | - | + | - | 3 | 60 |
| 6 | *Avena fatua* L. | Th | PAL | + | + | - | + | - | 3 | 60 |
| 7 | *Cenchrus biflorus* Roxb | Th | NEO | + | + | - | + | - | 3 | 60 |
| 8 | *Chenopodium album* L. | Th | COSM | + | + | - | + | - | 3 | 60 |
| 9 | *Chenopodium murale* L. | Th | COSM | + | + | - | + | - | 3 | 60 |
| 10 | *Conyza bonariensis* (L.) Cronquist | Th | NEO | + | + | - | + | - | 3 | 60 |
| 11 | *Eclipta prostrata* (L.) L. | Th | NEO | + | + | - | + | - | 3 | 60 |
| 12 | *Euphorbia peplus* L. | Th | ME+IR-TR+ER-SR | + | + | - | + | - | 3 | 60 |
| 13 | *Malva parviflora* L. | Th | ME+IR-TR | + | + | - | + | - | 3 | 60 |
| 14 | *Portulaca oleracea* L. | Th | COSM | + | + | - | + | - | 3 | 60 |
| 15 | *Ranunculus sceleratus* L. | Th | ME+IR-TR+ER-SR | + | + | - | + | - | 3 | 60 |
| 16 | *Silybum marianum* (L.) Gaertn. | Th | ME+IR-TR+ER-SR | + | + | - | + | - | 3 | 60 |
| 17 | *Solanum nigrum* L. | Th | COSM | + | + | - | + | - | 3 | 60 |

**Table (2). Continued.**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 18 | *Sonchus oleraceus* L. | Th | COSM | + | + | - | + | - | 3 | 60 |
| 19 | *Urtica urens* L. | Th | ME+IR-TR+ER-SR | + | + | - | + | - | 3 | 60 |
| 20 | *Urospermum picroides* (L.) F.W. Schmidt | Th | ME+IR-TR | + | + | - | + | - | 3 | 60 |
| 21 | *Amaranthus viridis* L. | Th | ME+IR-TR | + | + | - | - | - | 2 | 40 |
| 22 | *Atriplex prostrata* DC. | Th | ME+IR-TR+ER-SR | + | + | - | - | - | 2 | 40 |
| 23 | *Bidens pilosa* L. var. *radiata* Sch. Bip. | Th | PAN | + | + | - | - | - | 2 | 40 |
| 24 | *Conyza aegyptiaca* (L.) Dryand | Th | ME | + | + | - | - | - | 2 | 40 |
| 25 | *Coronopus didymus* (L.) Sm. | Th | COSM | - | + | - | + | - | 2 | 40 |
| 26 | *Echinochloa colona* (L.) Link | Th | PAN | + | + | - | - | - | 2 | 40 |
| 27 | *Ethulia conyzoides* L.F. | Th | PAL | + | + | - | - | - | 2 | 40 |
| 28 | *Lactuca serriola* L. | Th | ME+IR-TR+ER-SR | + | + | - | - | - | 2 | 40 |
| 29 | *Melilotus indicus* (L.) All. | Th | ME+IR-TR+SA-SI | + | + | - | - | - | 2 | 40 |
| 30 | *Poa annua* L. | Th | COSM | + | + | - | - | - | 2 | 40 |
| 31 | *Sisymbrium irio* L. | Th | ME+IR-TR+ER-SR | + | + | - | - | - | 2 | 40 |
| 32 | *Torilis arvensis* (Huds) Link | Th | ME+IR-TR+ER-SR | + | + | - | - | - | 2 | 40 |
| 33 | *Vicia sativa* L. | Th | ME+IR-TR+ER-SR | + | + | - | - | - | 2 | 40 |
| 34 | *Ammania baccifera* L. | Th | S-Z+IR-TR | + | - | - | - | - | 1 | 20 |
| 35 | *Capsella bursa-pastoris* (L.) Medik. | Th | COSM | + | - | - | - | - | 1 | 20 |
| 36 | *Carthamus tenuis* (Boiss.& Blanche) Bornm. | Th | ME | - | + | - | - | - | 1 | 20 |
| 37 | *Chenopodium ficifolium* Sm. | Th | ME+ER-SR | - | + | - | - | - | 1 | 20 |
| 38 | *Chenopodium glaucum* L. | Th | ME+ER-SR | - | + | - | - | - | 1 | 20 |
| 39 | *Cyperus difformis* L. | Th | PAL | - | + | - | - | - | 1 | 20 |
| 40 | *Datura stramonium* L. | Th | NEO | - | + | - | - | - | 1 | 20 |
| 41 | *Eruca sativa* L. | Th | Cult. and Nat. | + | - | - | - | - | 1 | 20 |
| 42 | *Euphorbia helioscopia* L. | Th | ME+IR-TR+SA-SI | + | - | - | - | - | 1 | 20 |
| 43 | *Euphorbia heterophylla* L. | Th | PAN | + | - | - | - | - | 1 | 20 |
| 44 | *Lavatera cretica* L. | Th | ME | - | + | - | - | - | 1 | 20 |
| 45 | *Medicago intertexta* L. | Th | ME+ER-SR | + | - | - | - | - | 1 | 20 |
| 46 | *Parietaria alsinifolia* Delile | Th | ME+ SA-SI | - | + | - | - | - | 1 | 20 |
| 47 | *Pennisetum glaucum* (L.) R.Br. | Th | PAL | - | + | - | - | - | 1 | 20 |
| 48 | *Picris longirostris* Sch. Bip. | Th | ME+ IR-TR | - | + | - | - | - | 1 | 20 |

**Table (2). Continued.**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 49 | *Pseudognaphalium luteo-album* (L.) Hilliard & L. | Th | COSM | - | + | - | - | - | 1 | 20 |
| 50 | *Raphanus raphanistrum* L. | Th | ME+ER-SR | - | + | - | - | - | 1 | 20 |
| 51 | *Senecio aegyptius* L. | Th | ME+IR-TR+ER-SR | + | - | - | - | - | 1 | 20 |
| 52 | *Sesbania sericea* (Willd.) Link | Th | PAL | + | - | - | - | - | 1 | 20 |
| 53 | *Xanthium strumarium* L. | Th | COSM | + | - | - | - | - | 1 | 20 |

## Abbreviations:

**Legend to life-form:**

Nph : Nanophanerophytes
Ch : Chamaephytes
H : Hemicryptophytes
G : Geophytes
He : Helophytes
Hy : Hydrophytes
Th : Therophytes

**Legend to floristic categories:**

COSM : Cosmopolitan
PAN : Pantropical
PAL : Palaeotropical
NEO : Neotropical
ME : Mediterranean
AUST : Australia
ER-SR : Euro-Siberian
SA-SI : Saharo-Sindian
IR- TR : Irano-Turanian
S-Z : Sudano-Zambezian
Cult. & Nat. : Naturalized & Cultivated

composition of the plant species in the surveyed five habitats, namely: drainage canals, irrigation canals, northern lakes, River Nile system (River Nile stream, Damietta branch and Rosetta branch) and Wadi El-Natrun habitats. The total number of species recorded in the study area is 115 species. These species can be classified into three major groups according to their duration (life - span) as follows: 58 perennials, 4 biennials and 53 annuals.

As shown in Table (1), four very abundant perennial species have a very wide ecological amplitude, where they were recorded in the five habitats (P=100%). These perennials comprise *Phragmites australis*, *Cynodon dactylon, Cynanchum acutum* and *Typha domingensis*.

Fourteen abundant perennials have also a wide ecological amplitude, which attained presence percentage of about 80%. These include *Cyperus articulatus, Cyperus alopecuroides, Echinochloa stagnina, Persicaria lapathifolia, Pluchea dioscoridis, Saccharum spontaneum,* etc.

Twelve frequent perennials attained presence percentage of 60%. These perennials comprise *Alternanthera sessilis, Convolvulus arvensis, Cyperus rotundus, Ipomoea carnea, Pennisetum setaceum,* etc.

Fifteen common perennials attained presence percentage of 40%. These species include *Alhagi graecorum , Arthrocnemum macrostachyum, Arundo donax, Atriplex halimus, Atriplex portulacoides, Bolboschoenus glaucus,* etc.

Thirteen rare perennials were recorded with relatively low presence percentage (P=20%). These species comprise *Atriplex semibaccata, Cyperus alternifolius, Cyperus papyrus, Juncus subulatus, Launaea mucronata, Lycium europaeum,* etc.

The list of floristic composition includes only four biennial species, namely: *Rorripa palustris* recorded in three habitats (P=60%), *Beta vulgaris* and *Spergularia marina* recorded in two habitats (P=40%), and *Sida alba* recorded in one habitat (P= 20%).

The recorded annual species (53) can also be classified according to their presence percentages (ecological amplitude) as follows:

a) Two abundant species with presence estimate of 80% namely *Polypogon monspeliensis* and *Rumex dentatus*.

b) Eighteen frequent species have presence percentage of 60%. These species comprise *Chenopodium murale, Conyza bonariensis, Malva parviflora, Amaranthus lividus, Eclipta prostrata, Solanium nigrum, Ranunculus sceleratus, Silybum marianum, Urospermum picroides,* etc.

c) Thirteen common species have presence percentage of 40%. These species include *Amaranthus viridis, Atriplex prostrata, Bidens pilosa, Conyza aegyptiaca, Coronopus didymus, Echinochloa colona, Ethulia conyzoides,* etc.

Rare annual species (20) attained presence percentage of 20%. These species comprise *Ammania baccifera, Capsella bursa-pastoris, Carthamus tenuis, Chenopodium fici-*

*folium, Chenopodium glaucum, Cyperus difformis,* etc.

**B - Plant Life-Span in the Study Area**

According to the duration (life-span) and as shown in Figure (2), the plant life in the study area can be distinguished into three major groups: annuals, biennials and perennials. As mentioned before, the total number of species recorded in the study area is 115 taxa, these species are classified into 53 annuals (46.09%), 4 biennials (3.48%) and 58 perennials (50.43%). The plant life of the drainage canals are floristically considered the richest habitat type in the study area, where 91 species were recorded which can be categorized into 46 perennials, 4 biennials and 41 annuals. Whereas in the irrigation canals 84 species were recorded which can be divided into 37 perennials, 3 biennials and 44 annuals. The northern lakes include 28 species, which can be classified into 26 perennials, one biennial and one annual. In the site of Wadi El-Natrun 15 species were recorded which can be grouped into: one annual, one biennial and 13 perennials. The River Nile system includes 54 species which can be distinguished into 33 perennials and 21 annuals.

It is interested to denote that, the drainage canals are floristically the richest habitats in the study area (79.13%), followed by the irrigation canals (73.04%), then the River Nile system (46.97%), the northern lakes (24.35%) and finally Wadi El-Natrun habitat (13.04%). It is also obvious that, the perennials are the most frequent species in the different five habitats (50.43%), followed by the annual species (46.09%) and then the very rare biennial species (3.48%).

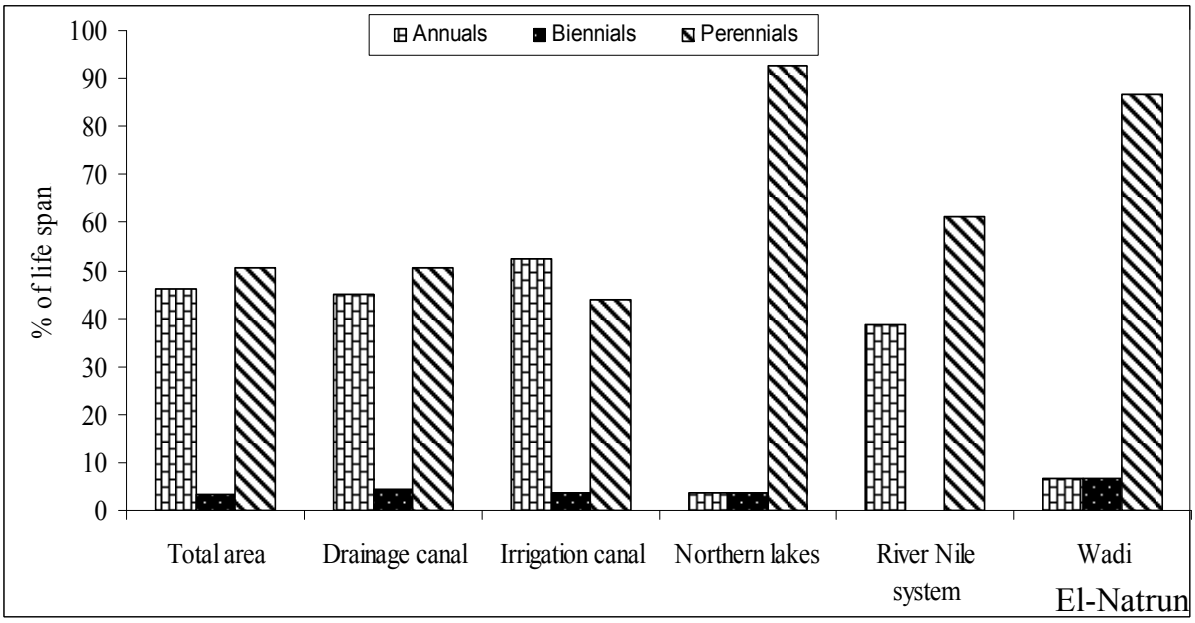


**Figure (2) :** Plant life span spectra in the total area and in the different habitats of the study area.

**C - Plant Life - Forms in the Study Area**

The recorded species (115) in the study area and their life - forms are listed in Table (1). According to Raunkiaer (1934) for description and classification of life - forms, the recorded species in the present study are grouped under five types of life forms as follows: therophytes (57 species = 49.57%), cryptophytes (comprising geophytes, helophytes and geophytes collectively attained 33 species = 28.7%), hemicryptophytes (13 species = 11.3%), chamaephytes (8 species = 6.96%), nanophanerophytes (4 species = 3.48%) as shown in Figure (3).

It is evident that, the percentages of the life-form spectra vary from one habitat to the other (Figure 3). In the drainage canals, the recorded species (91) can be grouped into the following five types of life forms: therophytes (49.45%), cryptophytes (29.67%), hemicryptophytes (10.99%), chamaephytes (6.59%) and nanophaneropytes (3.3%). In the irrigation canals, the recorded species (84) can be classified into the following life-forms: therophytes (55.95 %), cryptophytes (25%), hemicryptophytes (9.52%), chamaephytes and nanophaneropytes (4.76 % each). While in the northern lakes, the life-forms of the recorded specie (28) are distinguished into: cryptophytes (60.71%), hemicryptophytes (14.29%), chamaephytes (10.71%), therophytes and nanophanerophytes (7.14% each). In the River Nile system, the recorded species (54) are classified into the following life-forms: cryptophytes (42.59%), therophytes (38.89%), hemicryptophytes (12.96%), chamaephytes (3.7%) and nanophanerophytes (1.85%). In Wadi El-Natrun, the recorded species (15) are grouped into: cryptophytes (60%), hemicryptophytes (20%), therophytes (13.33%) and nanophanerophytes (6.67%). It is worth to mention that,

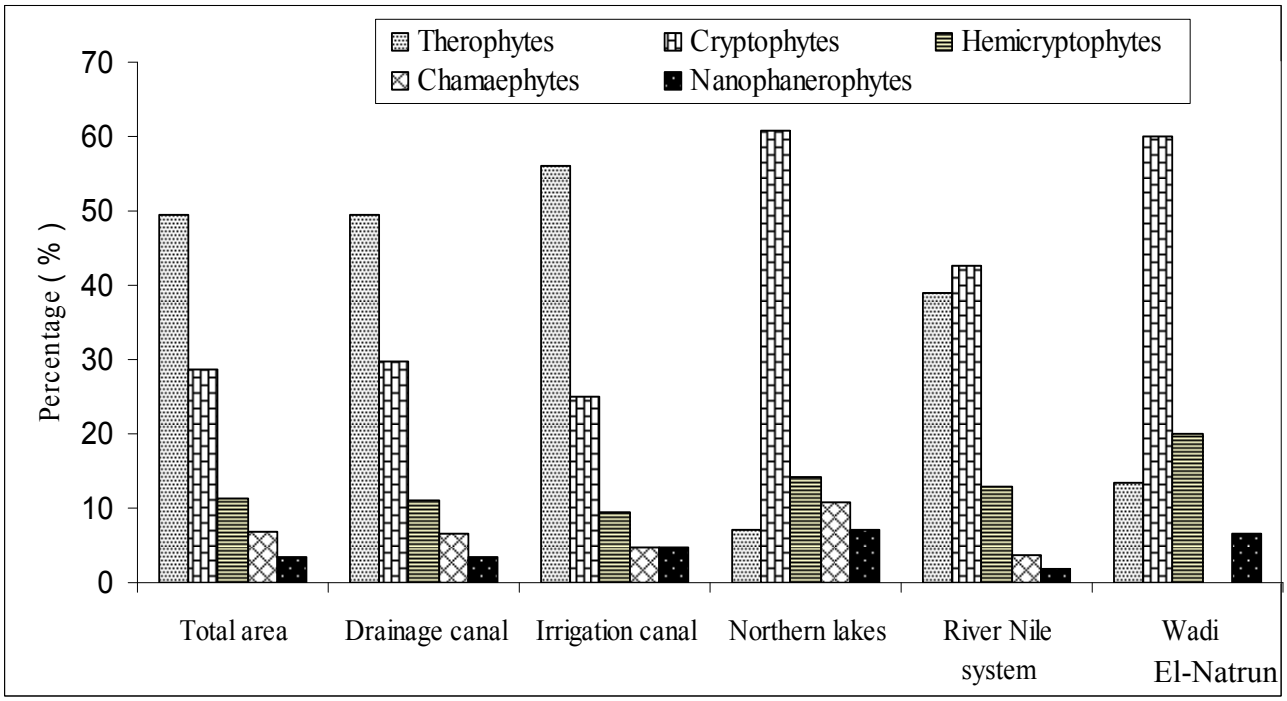


**Figure (3) :** Plant life span spectra in the total area and in the different habitats of the study area.

the life-form spectra in all five water bodies of the study area is mainly represented by cryptophytes and partly by therophytes, chamaephytes and nanophanerophytes. The group of hemicryptophytes is obviously represented by the lowest values among all water bodies of the study area.

It is also interested to denote that, the life - form spectra in all five habitats of the study area are mainly represented by therophytes (49.57%), and cryptophytes (28.7%), hemicryptophytes (11.3%), and partly by chamaephytes (6.96%) and nanophanerophytes (3.48 %).

**D - Floristic Analysis of the Study Area**

The total number of the recorded plant species surveyed in the present study is 115 species belonging to 90 genera and related to 29 families. Table (2) showed that, family Gramineae comprise 21 species (18.26%) of the total recorded plant species, followed by family Compositae 18 species (15.65%), Chenopodiaceae 12 species (10.43%), Cyperaceae 9 species (7.83%), Cruciferae and Leguminosae comprise 6 species each (5.22%), Polygonaceae 5 species (4.35%), Amaranthaceae, Euphorbiaceae, Juncaceae, Malvaceae and Solanaceae comprises 3 species each (2.61%), Convolvulaceae, Primulaceae, Typhaceae, Umbelliferae, Urticaceae and Verbenaceae comprise two species each (1.74%). The remaining families which include, Asclepiadaceae, Caryophyllaceae, Labiatae (Lamiaceae), Lythraceae, Onagaraceae, Oxalidaceae, Plantaginaceae, Portulacaceae, Ranunculaceae, Scrophulariaceae and Tamaricaceae comprise only one species each (0.87%).

The floristic categories of the plant life in the study area are shown in Table (2). The most common floristic elements of the family Gramineae are Pantropical (6 species), Palaeotropical and Biregional (4 species each), Cosmopolitan (3 species), while Pluriregional, Neotropical, Saharo-Sindian and Cultivated & Naturalized are represented by one species each. In Compositae, the most common chorotypes are: Pluriregional and Biregional (4 species each), Neotropical and Cosmopolitan (3 species each), Mediterranean (2 species) while, Palaeotropical and Pantropical elements are represented by one species each. The most abundant floristic elements in Chenopodiaceae are Pluriregional and Biregional (4 species each), Cosmopolitan (2 species), whereas Mediterranean and Australian chorotypes are represented by one species each. The floristic elements in family Cyperaceae are Pantropical (5 species), Palaeotropical (2 species), Cosmopolitan and Biregional elements (one species each). The floristic elements in Cruciferae are Pluriregional and Cosmopolitan (2 species each), whereas Biregional and Cultivated & Naturalized are represented by one species each. The most common floristic elements in family Leguminoseae are Palaeotropical (3 species), Pluriregional (2 species) and Biregional (one species). The floristic elements in Polygonaceae are Palaeotropical (3 species), Pluriregional and Biregional elements (one species each). While, other families (with less than 4 species) comprise different types of floristic elements which are generally represented by a few number of species.

The floristic analysis of the study area as shown in Table (3) reveals that, 52 species or

**Table ( 3) :** The principal floristic categories of the families of the study area.

| No. | Family | Genera | Species | COSM | PAN | PAL | NEO | Pluri-regional | Bi-regional | ME | SA-SI | S -Z | AUST | Cult. & Nat. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | *Gramineae (Poaceae)* | **18** | **21** | 3 | 6 | 4 | 1 | 1 | 4 | - | 1 | - | - | 1 |
| **2** | *Compositae (Asteraceae)* | **17** | **18** | 3 | 1 | 1 | 3 | 4 | 4 | 2 | - | - | - | - |
| **3** | *Chenopodiaceae* | **5** | **12** | 2 | - | - | - | 4 | 4 | 1 | - | - | 1 | - |
| **4** | *Cyperaceae* | **3** | **9** | 1 | 5 | 2 | - | - | 1 | - | - | - | - | - |
| **5** | *Cruciferae (Bressicaceae)* | **6** | **6** | 2 | - | - | - | 2 | 1 | - | - | - | - | 1 |
| **6** | *Leguminosae (Fabaceae)* | **6** | **6** | - | - | 3 | - | 2 | 1 | - | - | - | - | - |
| **7** | *Polygonaceae* | **3** | **5** | - | - | 3 | - | 1 | 1 | - | - | - | - | - |
| **8** | *Amaranthaceae* | **2** | **3** | - | 1 | - | - | - | 2 | - | - | - | - | - |
| **9** | *Euphorbiaceae* | **1** | **3** | - | 1 | - | - | 2 | - | - | - | - | - | - |
| **10** | *Juncaceae* | **1** | **3** | - | - | - | - | 3 | - | - | - | - | - | - |
| **11** | *Malvaceae* | **3** | **3** | - | 1 | - | - | - | 1 | 1 | - | - | - | - |
| **12** | *Solanaceae* | **3** | **3** | 1 | - | - | 1 | - | - | 1 | - | - | - | - |
| **13** | *Convolvulaceae* | **2** | **2** | 1 | 1 | - | - | - | - | - | - | - | - | - |
| **14** | *Primulaceae* | **2** | **2** | 2 | - | - | - | - | - | - | - | - | - | - |
| **15** | *Umbelliferae (Apiaceae)* | **2** | **2** | - | - | - | - | 2 | - | - | - | - | - | - |
| **16** | *Urticaceae* | **2** | **2** | - | - | - | - | 1 | 1 | - | - | - | - | - |
| **17** | *Verbenaceae* | **2** | **2** | 1 | 1 | - | - | - | - | - | - | - | - | - |
| **18** | *Typhaceae* | **1** | **2** | - | 2 | - | - | - | - | - | - | - | - | - |
| **19** | *Asclepiadaceae* | **1** | **1** | - | - | - | - | - | 1 | - | - | - | - | - |
| **20** | *Caryophyllaceae* | **1** | **1** | - | - | - | - | 1 | - | - | - | - | - | - |
| **21** | *Labiatae (Lamiaceae)* | **1** | **1** | - | - | 1 | - | - | - | - | - | - | - | - |
| **22** | *Lythraceae* | **1** | **1** | - | - | - | - | - | 1 | - | - | - | - | - |
| **23** | *Onagaraceae* | **1** | **1** | - | - | - | - | - | - | - | - | 1 | - | - |
| **24** | *Oxalidaceae* | **1** | **1** | 1 | - | - | - | - | - | - | - | - | - | - |
| **25** | *Plantaginaceae* | **1** | **1** | 1 | - | - | - | - | - | - | - | - | - | - |
| **26** | *Portulacaceae* | **1** | **1** | 1 | - | - | - | - | - | - | - | - | - | - |
| **27** | *Ranunculaceae* | **1** | **1** | - | - | - | - | 1 | - | - | - | - | - | - |
| **28** | *Scrophulariaceae* | **1** | **1** | 1 | - | - | - | - | - | - | - | - | - | - |
| **29** | *Tamaricaceae* | **1** | **1** | - | - | - | - | - | 1 | - | - | - | - | - |
| **Total** | | **90** | **115** | **20** | **19** | **14** | **5** | **24** | **23** | **5** | **1** | **1** | **1** | **2** |
| **Percentage** | | | | **17.39** | **16.52** | **12.17** | **4.35** | **20.87** | **20** | **4.35** | **0.87** | **0.87** | **0.87** | **1.74** |

**Table (4) :** Number of species and percentage of various floristic categories of the different habitats in the study area.

| Floristic category | Total area | | Water body | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Drainage canal | | Irrigation canal | | Northern lakes | | River Nile system | | Wadi El-Natrun | |
| | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| COSM | 20 | 17.39 | 16 | 17.58 | 14 | 16.67 | 3 | 10.71 | 12 | 22.22 | 3 | 20.00 |
| PAN | 19 | 16.52 | 17 | 18.68 | 13 | 15.48 | 7 | 25.00 | 13 | 24.07 | 4 | 26.67 |
| PAL | 14 | 12.17 | 10 | 10.99 | 11 | 13.10 | 3 | 10.71 | 8 | 14.81 | - | - |
| NEO | 5 | 4.35 | 4 | 4.40 | 5 | 5.95 | - | - | 4 | 7.41 | - | - |
| ME+IR-TR+ER-SR | 17 | 14.78 | 17 | 18.68 | 15 | 17.86 | 3 | 10.71 | 7 | 12.96 | 2 | 13.33 |
| ME+IR-TR+SA-SI | 5 | 4.35 | 3 | 3.30 | 1 | 1.19 | 1 | 3.57 | - | - | 2 | 13.33 |
| ME+SA-SI+ER-SR | 1 | 0.87 | 1 | 1.10 | - | - | 2 | 7.14 | - | - | - | - |
| S-Z+ME+IR-TR+SA-SI | 1 | 0.87 | 1 | 1.10 | - | - | - | - | - | - | 1 | 6.67 |
| ME+IR-TR | 8 | 6.96 | 7 | 7.69 | 7 | 8.33 | 1 | 3.57 | 4 | 7.41 | 1 | 6.67 |
| ME+ER-SR | 4 | 3.48 | 1 | 1.10 | 3 | 3.57 | - | - | - | - | - | - |
| ME+PAL | 4 | 3.48 | 3 | 3.30 | 3 | 3.57 | 3 | 10.71 | 3 | 5.56 | - | - |
| ME+SA-SI | 4 | 3.48 | 2 | 2.20 | 2 | 2.38 | 1 | 3.57 | - | - | 1 | 6.67 |
| S-Z + SA-SI | 2 | 1.74 | 2 | 2.20 | 2 | 2.38 | 2 | 7.14 | 1 | 1.85 | 1 | 6.67 |
| S-Z+IR-TR | 1 | 0.87 | 1 | 1.10 | - | - | - | - | - | - | - | - |
| AUST | 1 | 0.87 | - | - | - | - | 1 | 3.57 | - | - | - | - |
| ME | 5 | 4.35 | 2 | 2.20 | 5 | 5.95 | - | - | - | - | - | - |
| SA-SI | 1 | 0.87 | 1 | 1.10 | 1 | 1.19 | - | - | 1 | 1.85 | - | - |
| S-Z | 1 | 0.87 | 1 | 1.10 | 1 | 1.19 | 1 | 3.57 | 1 | 1.85 | - | - |
| Cult. & Nat. | 2 | 1.74 | 2 | 2.20 | 1 | 1.19 | - | - | - | - | - | - |
| **Total** | **115** | **100** | **91** | **100** | **84** | **100** | **28** | **100** | **54** | **100** | **15** | **100** |

about 45.22 % of the total number of recorded species are Mediterranean taxa. These taxa are either Pluriregional (24 species =20.87%), Biregional (23 species = 20.00%) or Monoregional (5 species = 4.35 %). It has been also found that, 58 species or about 50.44% of the total number of the recorded species are either Cosmopolitan (17.39%), Pantropical (16.52%), Palaeotropical (12.17%) or Neotropical (4.35 %). The other floristic categories are poorly represented where each chorotype is represented by a few numbers of species (Table 3). In general, the percentages of the Cosmopolitan, Pantropical, Palaeotropical and Neotropical elements are obviously comparable in all surveyed habitats of the study area. While, the Mediterranean element is highly represented in the drainage canals (37 taxa), followed by the irrigation canals (36 taxa), then River Nile system (14 taxa), northern lakes (11 taxa) and finally Wadi El-Natrun (7 taxa). This indicates that, the chorological analysis of the study area is relatively compatible with the north-southward distribution of the climatic belts in Egypt.

The hydrophytic vegetation is growing so rapidly and densely representing an acute problem causing tremendous loss of water from water bodies like canals and drains through evapo-transpiration, clog gates, pump, etc. Aquatic weeds have been found to severely reduce the flow capacity of irrigation canals there by reducing the availability of water to the farmer's field. On the other hand, macrophytes are considered as important component of the aquatic ecosystem not only as food source for aquatic invertebrates, but also act as an efficient accumulator of heavy metals(Janauer, 2001; Pajevi_ et al., 2001; Samecka-Cymerman and Kempers, 2002 and Samecka-Cymerman et al., 2005).

In the present investigation, the floristic structure agrees with findings of Quezel (1978) concerning the floristic structure of the Mediterranean Africa, El-Sheikh (1989) on the canal-drain vegetation in the middle Delta region, Mashaly *et al.* (2001 & 2009) on the weed vegetation of the cropland and canal bank habitats in the north east Nile Delta region, and El-Halawany (2002) on the wetland habitats along side the fish farms in the north Nile Delta region.

It can be concluded that, Egypt is the meeting point of the floristic elements belonging to at least four phytogeographical regions: the African Sudano-Zambesian, the Asiatic Irano-Turanian, the Afro-Asiatic Sahro-Sindian and the Euro-Afro-Asiatic Mediterranean (El-Hadidi, 1993). The floristic analysis of the study area revealed that 52 species or about 45.22 % of the total number of recorded species are Mediterranean taxa. These taxa are either Pluriregional, Biregional and Monoregional. It has been also found that, 58 species or about 50.44% of the total number of the recorded species are either Cosmopolitan, Pantropical, Palaeotropical and Neotropical. Similar investigations have been described by many authers e.g. Khedr and El-Demerdash (1997), Mashaly *et al.* (2001, 2003 & 2009), Mashaly (2001, 2002, 2003 & 2006), El-Halawany (2002), Maswada (2004), Omar (2006), Mashaly and El-Ameir (2007). Tork (2007) and El-Halawany *et al.* (2009).

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# الملخص العربى

## المـلامـح الفلوريـــة لموائـــل الجسـور فى مصـــر

إبراهـيـم مشـالى عمـــر الشـــهابى ياســر الأمــير

قسم النبات - كلية العلوم - جامعة المنصورة - المنصورة - مصر

فى هـذه الدراسـة تم تسـجيل 115 نوعـاً من النبـاتـات الزهـرية التى تنتـمى إلى 90 جنس صنفت تحت 29 فـصـيلة حيث اتضح أن الفصيلة النجيلية والمركبـة والرمرامـية والسـعدية هى الفصائـل السائـدة فى منطقـة الدراسـة، كمـا أن النباتـات المسجلة بمنطقـة الدراسة إشتملت على 58 نوعاً من النباتات المعمرة و 4 أنواع من النباتات ثنائية الحول و 53 نوعاً من النباتـــات الحوليـة، وقد تم وصف طـــرز الحيـاة النباتيـــة إلى خمس مجمـوعـــات وهى : طـــرز Therophytes وطـرز Crypyophytes وطـــرز Chamaeophytes وطـرز Hemicryptophytes وطرز Nanohanerophytes ولقـد أوضح التـــحليل الفلورى أن هناك 49 نوعـــاً من النبـــاتات (42.61%) المسجلة تتبع عنصر البحر المتوسط، كما وجد أن العنصر العالمى يشمل 17.39% والعنصر الاستوائى القديم على 15.62% والعنصر الاستوائى على 12.17% والعنصر الاستوائى الحديث (4.35%).

JOESE 5

# FLORISTIC FEATURES OF THE CANAL BANK HABITATS, EGYPT

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