ECOLOGIA BALKANICA
2017, Vol. 9, Issue 1 June 2017 pp. 1-9

A Floristic Study of Hamun Lake Basin, South East of Iran

Maryam Keshavarzi[1*], Habibollah Ijbari[2], Samaneh Mosaferi[1,3], Farzaneh Ebrahimi[1]

1 - Alzahra University, Faculty of Biological Sciences, Plant Sciences Department, Tehran, IRAN
2 - University of Zabol, Faculty of Science, Department of Biology, Zabol, IRAN
3 - Shahid Beheshti University, Faculty of Biological Sciences, Department of Biology, Tehran, IRAN
* Corresponding author: neshat112000@yahoo.com, m.keshavarzi@alzahra.ac.ir

Abstract. Lake Hamun is the largest freshwater resource in Iran with area of about 3820 km². The present study aims to evaluate the floristic elements of the studied site. Plant samples were gathered from nature, from March to July at the growing season. Life form and chorotype of plants in Lake Hamun basin were investigated. Totally 128 plant species belonging to 80 genera and 30 families were identified. Families as *Poaceae*, *Amaranthaceae* and *Fabaceae* were the most dominant and frequent families. Considering biological types revealed that the most frequent forms were therophytes (61%) and hemicryptophytes (17%). Floristic elements of the area were mainly Irano-touranian mixed with Saharo-Arabian and Sindu-Sudanian types, although multi- and bi- regional elements were also frequent. As the lake has recently become an international conserved area, the complete biological and ecological study of the site is a necessity.

Key words: Hamun Lake, Sistan and Baluchestan, Iran.

Introduction

Iran is a country in the south-west of Asia with 1.648 million km² area. Sistan and Baluchestan province is located in the south-east of the country. Sistan receives the discharge of the Hamun River in the lower Hamun Basin, and was often described in different centuries as one of the harshest and bare deserts of the world. This large desert basin is mainly known for windstorms, extreme floods, and droughts. The closed basin receives the water of the Hirmand River. This river is the only major river in western Asia between the Tigris-Euphrates and Indus Rivers (SHIRDELI, 2014).

Sistan, which was historically known as the breadbasket of western Asia, is now covered with large sand dunes. The Hamun Basin with area of approximately 310,000 km² is limited at the East by Iranian highlands, at the North by the southern Hindu Kush ranges, on the west by the East Iranian ranges; and on the South by mountain ranges in Baluchestan province of Pakistan (WHITNEY, 2006).

This biosphere reservoir includes terrestrial and wetland ecosystems, with desert and semi-desert areas, as well as marshlands and watersheds of the lake. The Hamun have completely dried up at least three times during the 20th century (SHIRDELI, 2014). Floristic elements of the area have not been studied yet, despite some studies with limited scopes (IRANMANESH *et al.*, 2010; ALLAHDOU *et al.*, 2012; JABBARY *et al.*, 2013). A complete botanical study of the area is the first step in choosing conservation strategies.

Material and Methods

The studied area is located in the south-east of Iran in Sistan and Baluchestan province between 61°, 45′ to 61°, 09′ East longitude and 31°, 17′ to 30°, 47′ North latitude with altitude of 460-590 meters a.s.l. (Fig. 1). The lake basin was considered and about 7000 km² was sampled.

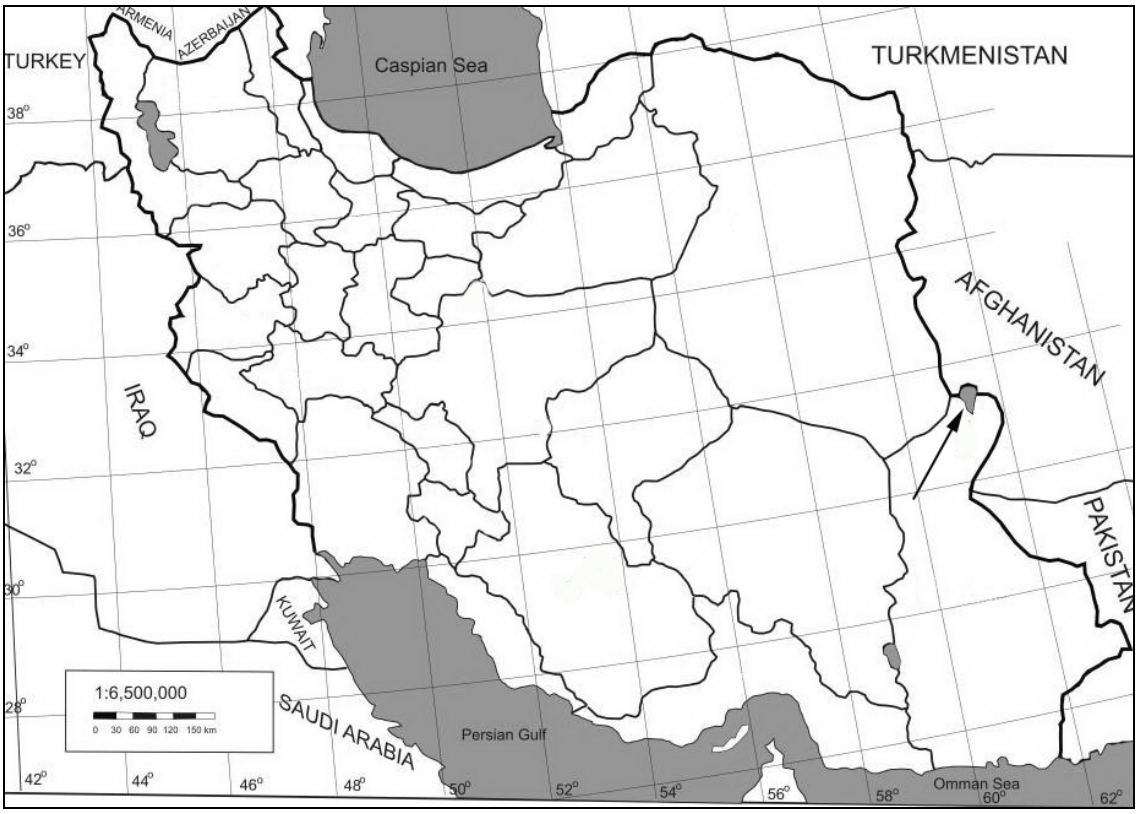

Fig. 1. Geographic map of the studied area.

As the studied area has a desert climate, the rainfall during the year is limited. The average annual temperature is 21.7 °C with average annual rainfall of 53 mm. July with temperatures of 34.4 °C and January with temperatures of 7.9 °C are the warmest and coldest months of the year respectively.

Plant specimens were collected between March to July at growth seasons during 2015-2016 and prepared according to standard herbarium techniques. All taxa were determined using Flora of Iran (ASSADI, 1988-2002), Flora Iranica (RECHINGER, 1963-2010), Flora of Turkey and the East Aegean Islands (DAVIS, 1965-1988), Flora of the USSR (KOMAROV, 1968–2001) and Flora of Pakistan (ALI & NASIR, 1990-1992; ALI & QAISER, 1992-2007). All vouchers were deposited at the herbarium of Alzahra University (ALUH), Tehran, Iran. Geographical data were collected by use of GPS and data of the nearby meteorological station. Ombrothermic diagram was drawn based on the meteorological data from IRIMO (2016) for 14 years (2000 to 2014) (Fig. 2).

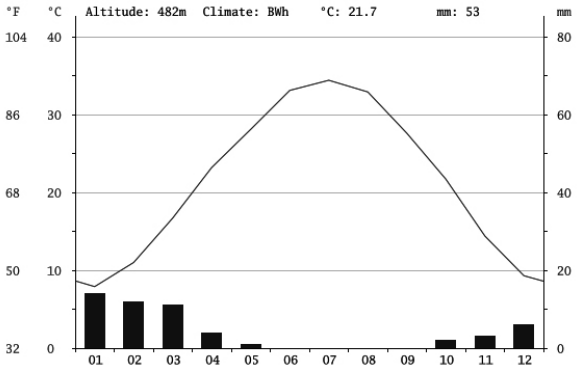

Fig. 2. The ombrothermic diagram of the Hamun Lake.

Life forms were recognized using Raunkiaer's classification (RAUNKIAER, 1934) comprising phanerophytes, geophytes, cryptophytes, hemi-cryptophytes, thero-

phytes and parasites. Chorology and phytogeographic areas of each taxon were determined using ZOHARY (1973), different floras and available literatures.

Results

In the studied area 128 taxa of 80 genera and 30 families were identified. Mainly plants were angiosperms elements except for *Ephedra* (Gnetophytes). Totally 42 samples were monocots and 86 ones were dicots. The largest family in the area was *Poaceae* with 39 species. Beside grass family, *Amaranthaceae* (12 species), *Asteraceae* (10 species) and *Fabaceae* (10 species) were frequent (Fig. 3 and Table 1).

Table 1. Checklist of taxa in the studied area. Abbreviations are based on Fig. 5-6, * - Medicinal plant based on MOZAFFARIAN (2015).

Family	Taxon	Biol. form	Phytochoria	Voucher no.
Amaranthaceae	**Amaranthus viridis* L.	Th	Cosm.	ALH- ha100
	**Amaranthus caudatus* L.	Th	Cosm.	ALH- ha101
	Amaranthus graecizans subsp. *graecizans* L.	Th	ES-M-SS	ALH- ha102
	**Atriplex halimus* L.	Ch	M-SA	ALH- ha103
	**Chenopodium album* L.	Th	IT	ALH- ha104
	Chenopodium badachschanicum Tzvelev.	Th	IT	ALH- ha105
	Chenopodium glaucum L.	Th	IT-ES	ALH- ha106
	**Chenopodium murale* L.	Th	Cosm.	ALH- ha107
	Chenopodium vulvaria L.	Th	IT-M	ALH- ha108
	Salsola aperta Paulsen.	Th	IT	ALH- ha109
	Salsola turkestanica Litv.	Th	IT	ALH- ha110
	**Suaeda fruticosa* Forssk. Ex J.F.Gmel.	Ch	IT	ALH- ha111
Asclepidiaceae	*Cynanchum acutum* L.	Ch	SA	ALH- ha112
Asteraceae	*Carduus hamulosus* Ehrh.	Th	EU	ALH- ha113
	**Cichorium intybus* L.	He	IT-ES-M	ALH- ha114
	**Carthamus oxycanthus* M. Bieb.	He	IT-SS	ALH- ha115
	Centaurea bruguierana subsp. *belangeriana* (DC.) Bornm.	He	IT-OS	ALH- ha116
	**Cirsium vulgare* (Savi) Ten.	He	Pl	ALH- ha117
	Lactuca scariola L.	He	IT-ES-M	ALH- ha118
	**Launaea mucronata* (Forssk.) Muschl.	Th	IT	ALH- ha119
	**Sonchus oleraceus* (L.) L.	Th	IT-M	ALH- ha120
	**Tragopogon graminifolius* DC.	Th	IT	ALH- ha121
	**Xanthium strumarium* L.	Th	IT-M	ALH- ha122
Boraginaceae	*Gastrocotyle hispida* (Forssk.) Bunge	G	IT-SA	ALH- ha123
	Heliotropium lasiocarpum Fisch. & C.A.Mey.	Ch	SA	ALH- ha124
Brassicaceae	*Brassica elongata* Ehrh.	He	IT-M	ALH- ha125
	**Cardaria draba* (L.) Desv.	He	IT	ALH- ha126
	**Descurainia sophia* (L.) Webb ex Prantl	Th	IT-ES-M	ALH- ha127
	**Erysimum repandum* L.	Th	IT-ES-M	ALH- ha128
	Lepidium aucheri Boiss.	He	IT	ALH- ha129
	**Malcolmia africana* var. *africana* (L.) R.Br.	Th	IT- M- SS	ALH- ha130
Capparaceae	**Capparis parviflora* Boiss.	Ch	IT	ALH- ha131

Caryophyllaceae	**Sagina saginoides* (L.) H.Karast.	Th	Cosm.	ALH- ha132
Convolvulaceae	*Convolvulus pentapetaloides* L.	Th	M	ALH- ha133
	**Cressa cretica* L.	He	IT	ALH- ha134
	Cuscuta campestris Yunck.	Parasite	Cosm.	ALH- ha135
Cucurbitaceae	**Citrullus colocynthis* (L.) Schrad.	He	M-SA	ALH- ha136
Cyperaceae	*Cyperus glaber* L.	G	IT-M	ALH- ha137
	Cyperus laevigatus L.	G	Cosm.	ALH- ha138
	Schoenus nigricans L.	G	Sub Cosm.	ALH- ha139
Dipsacaceae	*Pterocephalus brevis* Coult.	Th	IT- ES-M	ALH- ha140
Eleagnaceae	**Elaeagnus ungustifolia* L.	Ph	ES	ALH- ha141
Ephedraceae	**Ephedra strobilacea* Bunge	Ch	IT	ALH- ha142
Euphorbiaceae	**Chrozophora obliqua* (Vahl) A.Juss. ex Spreng.	Th	IT-M	ALH- ha143
	**Chrozophora hierosolymitana* Spreng.	Th	IT	ALH- ha144
	Euphorbia azerbajdzhanica Bordz.	Th	IT	ALH- ha145
	Euphorbia densa Schrenk	Th	IT- SS	ALH- ha146
	Euphorbia humifusa Willd.	Th	IT	ALH- ha147
	Euphorbia inderiensis Less. Ex Kar. & Kir.	Th	IT	ALH- ha148
	Euphorbia petiolata Banks & Sol.	Th	IT-M	ALH- ha149
	Euphorbia turcomanica Boiss.	Th	IT	ALH- ha150
Fabaceae	**Medicago sativa* L.	He	IT	ALH- ha151
	Melilotus dentatus (Waldsst. & Kit.) Pers	Th	M	ALH- ha152
	Melilotus indicus (L.) All.	Th	IT-SA	ALH- ha153
	**Melilotus officinalis* (L.) Pall.	Th	IT-ES-M	ALH- ha154
	**Pisum sativum* L.	Th	IT	ALH- ha155
	**Prosopis farcta* (Banks & Sol.) J.G.Macbor.	Ph	IT- SS	ALH- ha156
	**Trigonella monantha* C.A.Mey.	Th	IT-M	ALH- ha157
	**Vicia ervilia* (L.) Willd.	Th	M	ALH- ha158
	Vicia monantha Retz.	Th	IT	ALH- ha159
	Vicia peregrina L.	Th	IT-M	ALH- ha160
Malvaceae	**Malva pusilla* Sm.	Ch	IT-M	ALH- ha161
	**Malva verticillata* L.	Ch	IT-M	ALH- ha162
Moraceae	**Morus nigra* L.	Ph	IT-ES-M	ALH- ha163
Oleaceae	*Olea aucheri* A.Chev. ex Ehrend.	Ph	SU	ALH- ha164
Orobanchaceae	*Orobanche ramosa* L.	Parasite	IT- ES	ALH- ha165
Papaveraceae	*Papaver hybridum* L.	Th	IT-M	ALH- ha166
Plantaginaceae	**Plantago lanceolata* L.	He	IT-M	ALH- ha167
Poaceae	**Aeluropus lagopoides* (L.)Thwaites	He	IT	ALH- ha168
	Aeluropus littolaris (Gouan)Parl.	He	IT- M-Ss	ALH- ha169
	Aeluropus pungens (M.Bieb.)K.Koch	He	IT-M	ALH- ha170
	**Avena barbata* Pott ex Link	Th	M	ALH- ha171
	**Avena fatua* var. *fatua* L.	Th	Pl	ALH- ha172
	Avena ludoviciana Durieu	Th	IT-M	ALH- ha173
	Bromus arvensis L.	Th	IT	ALH- ha174
	Bromus danthoniae Trin.	Th	IT-M	ALH- ha175
	Bromus fasciculatus C.Presl	Th	M	ALH- ha176

	Bromus japonicus var. *velutinus* (W.D.J.Koch) Asch. & Graebn	Th	Pl	ALH- ha177
	Bromus madritensis L.	Th	IT-M	ALH- ha178
	Bromus tectorum L.	Th	IT- M –SS	ALH- ha179
	**Cynodon dactylon* (L.) Pers.	He	Cosm.	ALH- ha180
	Echinochloa colona (L.) Link	Th	IT-M	ALH- ha181
	**Echinochloa crus-galli* (L.) P.Beauv.	Th	IT	ALH- ha182
	Echinochloa stagnina (Retz.) P.Beauv.	Th	SS	ALH- ha183
	Eremopyrum confusum Melderis	Th	IT	ALH- ha184
	Henrardia pubescens (Bertol.) C.E.Hubb.	Th	SS	ALH- ha185
	Hordeum marinum Huds.	Th	M	ALH- ha186
	Hyparrhenia hirta (L.) Stapf	Ch- G-He	SA-M- IT	ALH- ha187
	Imperata cylindrica (L.) Raeusch.	Th	IT-SS	ALH- ha188
	Piptatherum barbellatum Mez	Th	IT	ALH- ha189
	**Piptatherum gracile* Mez	Th	IT	ALH- ha190
	Piptatherum microcarpum (Pilg.) Tzvelev	Th	IT	ALH- ha191
	Piptatherum molinioides Boiss.	Th	IT	ALH- ha192
	Phalaris brachystachys Link	Th	M	ALH- ha193
	Phalaris minor Retz.	Th	IT-M	ALH- ha194
	Phalaris paradoxa var. *paradoxa* L.	Th	IT	ALH- ha195
	Phalaris paradoxa var. *praemorsa* (Lam.) Coss. & Durieu	Th	IT	ALH- ha196
	Phleum pratense L.	Th	IT-ES-M	ALH- ha197
	**Phragmites australis* (Cav.) Trin. ex Steud.	He	IT	ALH- ha198
	Poa annua L.	Th	Cosm.	ALH- ha199
	**Poa bulbosa* L.	Th	IT-M	ALH- ha200
	Polypogon monspeliensis (L.) Desf.	Th	Pl	ALH- ha201
	Rostraria phleoides (Desf.) Holub	Th	IT-M	ALH- ha202
	**Saccharum griffithii* Munro ex Aitch.	He	IT	ALH- ha203
	Setaria glauca (L.) P.Beauv.	Th	IT-SS	ALH- ha204
	**Setaria viridis* (L.) P.Beauv	Th	IT- ES-M	ALH- ha205
	Vulpia ciliata Dumort.	Th	IT-M	ALH- ha206
	**Persicaria minor* (Huds.) Opiz	Th	IT- ES	ALH- ha207
	Polygonum argyrocoleon Steud. ex Kunze	Th	IT	ALH- ha208
	**Polygonum aviculare* L.	Th	Cosm.	ALH- ha209
	Polygonum olivascens Rech. F. & Schiman-Czeika	Th	IT	ALH- ha210
Polygonaceae	**Polygonum patulum* M.Bieb.	Th	IT	ALH- ha211
	Rumex angulatus Rech. F.	He	IT	ALH- ha212
	**Rumex dentatus* subsp. *halascyi* (Rech.) Rech.f.	He	M-SS	ALH- ha213
	**Rumex dentatus* subsp. *Klotzschianus* (Meisn.) Rech.f.	He	M-SS	ALH- ha214
	**Rumex obtusifolius* L.	He	IT-ES	ALH- ha215
Portulacaceae	**Portulaca oleracea* L.	Th	Cosm.	ALH- ha216
Rubiaceae	*Galium hirtiflorum* Req. ex DC.	Th	IT	ALH- ha217
Salicaceae	**Populus euphratica* Oliv.	Ph	IT	ALH- ha218
Solanaceae	**Solanum nigrum* L.	Th	IT-M	ALH- ha219

Tamaricaceae	**Tamarix aphylla* (L.)H.Karst.	Ph	SU	ALH- ha220
	Tamarix karakalensis Freyn	Ph	IT	ALH- ha221
	Tamarix kotschyi Bunge	Ph	IT-M	ALH- ha222
	**Tamarix stricta* Boiss.	Ph	IT	ALH- ha223
	Tamarix tetragyna Ehrenb.	Ph	IT-M	ALH- ha224
Vitaceae	**Vitis vinifera* L.	Ph	IT	ALH- ha225
Zygophyllaceae	**Peganum harmala* L.	Ch	IT- M- SS	ALH- ha226
	**Tribulus terrestris* L.	Th	IT-M	ALH- ha227

The Largest genera in the area were *Bromus* and *Euphorbia* each with six species and *Chenopodium* and *Tamarix*, each with five species (Fig. 4). In this study *Chenopodium badachschanicum* (KESHAVARZI *et al.*, 2016) and *Henrardia pubescens* were observed for the first time and were recorded for the flora of Iran.

Chenopodium badachchanicum Tzvelev

Annual herb up to 30 cm, sparsely farinose to sub-glabrous, yellowish-green, erect, angular, branched, lower branches sub-opposite. Petiole usually *c.* 1/3 of the length of leaf blade, blade thin, 3-8(-15) cm, lanceolate, with outward-projecting acute basal lobes and 0-2 lobe-like acute teeth on both sides, apex acute to acuminate, base sub-truncate to slightly cordate, bracts narrowly triangular, hastate, entire, uppermost lanceolate. Inflorescence narrow, lax, mostly leafless, terminal and axillary, cymose -dichasial, branches divaricate, solitary or several loosely together. Perianth segments 5, connate to below the middle, partly spreading in fruit, with a strong midrib visible especially inside, back apically keeled. Stamens 5. Stigmas 2-3. Pericarp persisting. Seeds horizontal, black, (1.2-)1.4-1.6(-2.0) mm in diameter, round in outline, margin somewhat acute, testa with large, irregular but mostly radially elongated pits and radial furrows, sometimes almost smooth.

Studied population. IRAN: Sistan & Baluchestan, 7 km south of Hirmand, Barahoii village (ALH – ha105).

General distribution. Central Asia, North-East Afghanistan, North of Pakistan, North of India, China, Nepal.

Henrardia pubescens (Bertol.) C.E.Hubb.

Annual herb up to 40 cm high, culms often decumbent at base, branched at base, linear leaves with 1-3 mm wide and 25-30 mm long, leaf blade linear, flat or rolled, pubescent; Inflorescence a single spike, spikelets 5-6 mm long, 1- flowered, glumes acute, subulate, with long and hispid hairs at the back.

Studied population. IRAN: Sistan & Baluchestan, 7 km south of Hirmand, Barahoii village (ALH – ha185).

General distribution. Syria, Jordan, Lebanon, Iraq.

Biological types of the area: The main biological form of the area was therophytes (61%). The frequency of other types were: hemicryptophytes (17%), phanerophyte (9%), cryptophyes (7%), geophytes (4%) and parasites (2%) (Fig. 5).

Chorotypes of the studied area. Distribution patterns of taxa revealed the power of Irano-Touranian elements in the area (with about 31%). Due to the penetration of the elements of other phytogeographic regions, there are somehow high percentages of multi- and bi-regional elements (33% and 12% respectively). In multiregional forms, the Irano-Touranian affinity is always present. The Hamun basin has also some Sindu Sudanian (3%) and Sahara-Arabian elements (2%). Plants with Mediterranean affiliation showed 6% of chorotypes. Some cosmopolitan plants as *Chenopodium album*, *Portulaca oleracea*, *Cuscuta campestris*, *Cyperus laevigatus*, *Poa annua*, *Polygonum aviculare*, *Cynodon dactylon*, *Amaranths caudatus* and *Amaranths viridis* were also observed (8%). Even Euro-Siberian elements were present in the area (2%) (Fig. 6).

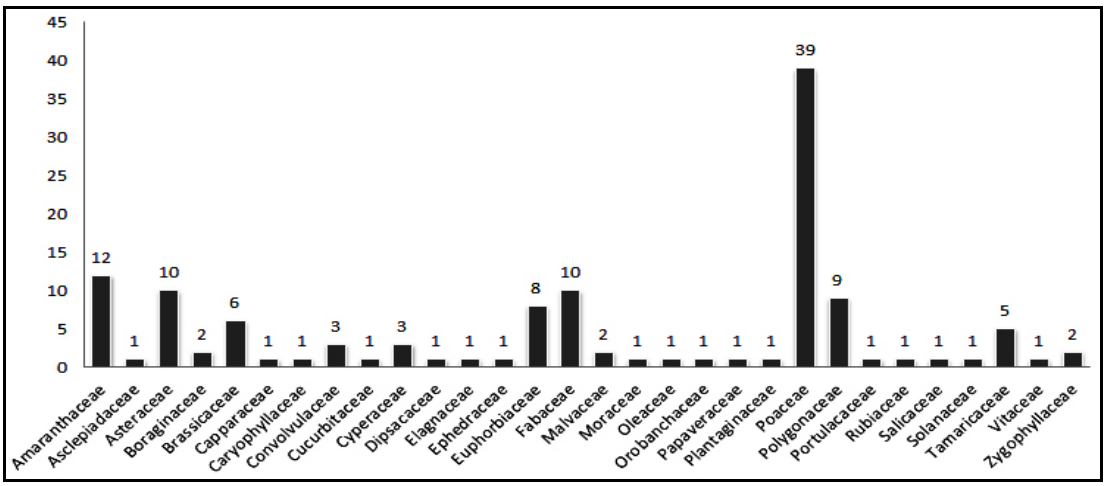

Fig. 3. Frequency of the families in the studied area.

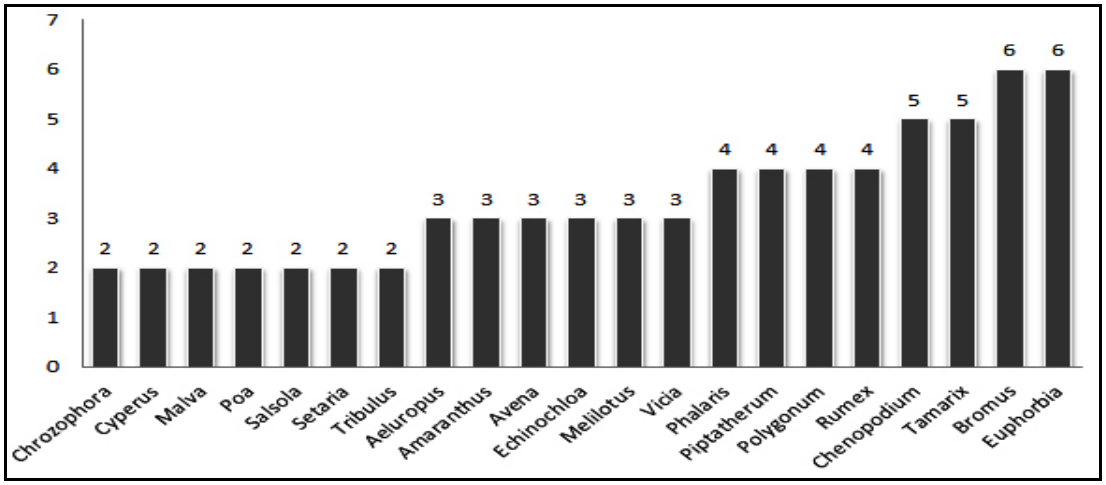

Fig. 4. Frequency of non-monotypic genus in the studied area.

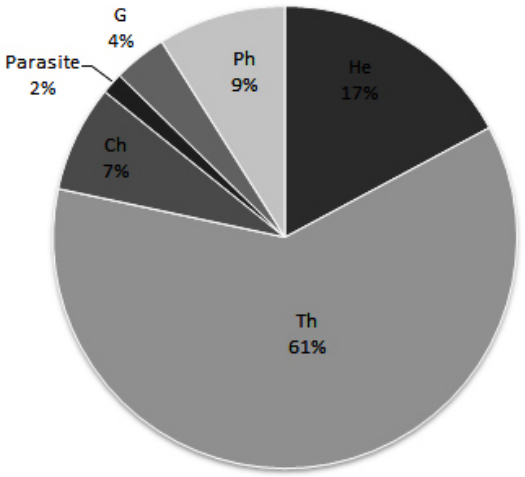

Fig. 5. The percentage of each biological type in the studied area. (Th: Therophyte, He: Hemicryptophyte, Ph: Phanerophyte, G: Geophyte, Ch: Chryoptophyte).

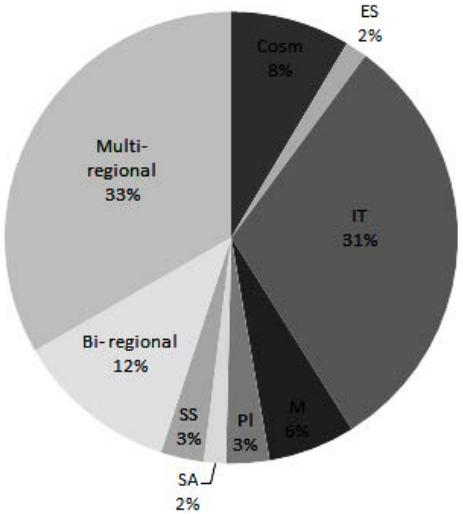

Fig. 6. The percentage of each chorotype in the studied area. (IT: Irano-Touranian; M: Mediterranean; SA: Sahara-Arabian; SS: Sindu-Sudanian; ES: Euro-Siberian; Cosm: Cosmopolite; multi- regional: IT-ES-M, ES-M-SS, IT-M-SS, IT-M-SA; bi- regional: IT-SS, IT-ES, IT-M, IT-SA, M-SA, M-SS).

Discussion

Knowing the floristic composition of a habitat is valuable for environmental and ecological research, and also for choosing management and conservation strategies (DAR & KHUROO, 2013). In the present research, 128 plant species were identified in the south-eastern border of Iran. Studying the chorology and life forms of these taxa is of great importance for the further ecological investigation, conservation and management.

The results of floristic study in Hamun Lake basin showed that the area is located in the transitional zone between the Irano-Touranian and Saharo-Arabain and Sindu-Sudanian regions. The studied area is not rich in endemic species and showed some affinities with the taxa in neighboring floras (Afghanistan and specially Flora of West Pakistan).

The Iranian flora is the intersection of different phytochoria as Irano-Touranian, Euro-Siberian, Sindu-Sudanian, Saharo-Arabian and also Mediterranean elements (ZOHARY, 1973). The chorological studies showed that 31% of species belong to the Irano–Touranian zone and 33% to multi-regional chorotype. In floristic projects in many other parts of Iran with great amount of human disturbance, multi- regional species make a significant portion of the studied flora (SOLTANIPOOR, 2006; NAQINEZHAD *et al.*, 2006; JANKJU *et al.*, 2011). Cosmopolitan, invasive and ruderals or weeds mainly reflect the anthropogenic origin of some habitats in the area. In the present study, *Portulaca oleracea*, *Polygonum aviculare*, *Poa annua* and *Cynodon dactylon* were the famous cosmopolitan taxa.

Life-forms in fact show the strategy of plant for obtaining resources. Therophytes are frequent in desert and arid lands. NAQINEZHAD *et al.* (2006) pointed an increase in therophytes with anthropogenic and grazing effects. The frequency of therophytes in the studied area revealed that Mediterranean climate condition is not dominant in this area (MOBAYEN, 1996). Hemicryptophytes are plants, which are resistant to cold climatic condition and developed their life by using ground water or reduced their water needs by shading. In the studied area, therophytes are plants, which are adapted to the dryness and the shortage of rainfall. The complex presence of therophytes and hemicryptophytes is an indicator of arid lands (ALSHERIF *et al.*, 2013).

The wetlands play essential role of ecology, economy and culture of the inhabitants in the Sistan basin. Drought have made problems more serious in this area and the floristic elements have catastrophically decreased. Many people have lost their income and had to migrate to other areas through drought periods of recent years. Local inhabitants basically rely on Hamun Lake for their food (fishery and agriculture).

The presence of annual (therophytes) is an indicator of anthropogenic pressure and overgrazing. The high amount of *Asteraceae* elements in the area is an alarm for the vegetation destroys.

In the studied area, 59 taxa such as *Melilotus officinalis, Malva pusilla, Cynodon dactylon, Polygonum aviculare* and *Medicago sativa* are of known medicinal importance.

Based on IUCN red list, *Cynanchum acutum, Cressa cretica, Cyperus glaber, Cyperus laevigatus, Ephedra strobilacea, Phragmites australis, Poa annua, Polypogon monspeliensis, Polygonum argyrocoleon, Schoenus nigricans, Tamarix kotschyi, Tamarix tetragyna* and *Vitis vinifera* are in status of least concern (LC).

Low rainfall, high temperature and evaporation and 120-day winds of Sistan are particular factors affecting the floristic composition of the studied area as mentioned by JABBARY *et al.* (2013). The present study is the first floristic study of the Hamun Lake basin and reflects the importance of the plant diversity of this area. Perhaps some plant species were left unrecorded so a comprehensive study in this field will be continued to identify and protect the genetic resource of this area.

Acknowledgements

We are indebted to the Vice President of Research and Technology of Alzahra University for their financial Supports.

References

ALI S.I., Y.J. NASIR. 1990-1992. *Flora of Pakistan.* Vols. 191-193. Department of Botany, University of Karachi and National Herbarium, PARC, Islamabad, Pakistan.

ALI S.I., M. QAISER. 1992-2007. *Flora of Pakistan.* Vols. 194-208. Department of Botany, University of Karachi, and National Herbarium, PARC, Islamabad, Pakistan.

ALLAHDOU M., A. A. NOURI SADEGH, M. MOHAMADI. 2012. The study of Flora, biological form and the chorology of plant covering in Sistan region – IRAN. – *International Research Journal of Applied and Basic Sciences*, 3(s): 2567-2571.

ALSHERIF E. A., A. M. AYESH, S. M. RAWI. 2013. Floristic composition, life form and chorology of plant life at Khulais region, Western Saudi Arabia. – *Pakistan Journal of Botany*, 45(1): 29-38.

ASSADI M. 1988-2002. *Flora of Iran*. Vols. 1-38. Research Institute of Forests and Rangelands, Tehran.

DAR G. H., A. A. KHUROO. 2013. Floristic Diversity in the Kashmir Himalaya: Progress, Problems and Prospects. – *Sains Malaysiana*, 42(10): 1377–1386.

DAVIS P.H. 1965-1988. *Flora of Turkey and the East Aegean Islands*. Vols. 1-11. University of Edinburgh, Edinburgh.

GHAHREMAN A, F. ATTAR. 1999. *Biodiversity of plant species in Iran*. Vol. I. Tehran University, Tehran.

IRANMANESH M., SH. NAJAFI, M. YOUSEFI. 2010. Ethnobotanical study of medicinal plants of Sistan region. – *Herbal drugs*, 2: 61-68.

IRIMO. 2016. I.R. of Iran Meteorological Organization, Available at: [irimo.ir]

JABBARY M. A. R. SHAHRIARI, F. ZOLFAGHARI. 2013. Evaluation of flora and life forms and chorology of plant species in Sistan region, Iran. – *Advanced Crop Science*, 3(4): 273–279.

JANKJU M., F. MELLATI, Z. ATASHGAHI. 2011. Flora, life form and chorology of winter and rural range plants in the Northern Khorasan Province, Iran. – *Journal of Rangeland Science*, 1(4): 269-284.

KESHAVARZI M., S. MOSAFERI, H. IJBARI, F. EBRAHIMI, M. KHAJEH. 2016. *Chenopodium badachschanicum* (Amaranthaceae), New record for Iran. – *Modern Phytomorphology*, 10(Suppl.): 31-36. [DOI]

KOMAROV V. L. 1968-2001. *Flora of USSR*. Vols. 1-30. Israel Program for Scientific Translations.

MOBAYEN S. 1996. *Flora of Iran*. Vols. 1-4, Tehran University Press, Tehran, Iran.

MOZAFFARIAN V. 2015. *Identification of medicinal and aromatic plants of Iran*, Farhang Moaser, Tehran.

NAQINEZHAD A., SH. SAEIDI MEHRVARZ, M. NOROOZI, M. FARIDI. 2006. Contribution to The vascular and bryophyte flora as well as habitat diversity of the Boujagh national Park, N. Iran, – *Rostaniha*, 7: 83 –105.

RAUNKIAER C. 1934. *The life forms of plants and statistical plant geography*. Clarendon, Oxford.

RECHINGER K. H. 1963-2010. *Flora Iranica*. Vols. 1-178. Akademische Druck-U Verlagsanstalt, Graz.

SHIRDELI A. 2014. Hydropolitics and hydrology issues in Hirmand/Helmand international river basin. – *Management Science Letters*, 4: 807–812. [DOI]

SOLTANIPOOR M. A. 2006. Introduction to the flora, life form and chorology of Hormoz island plants, S. Iran. – *Rostaniha*, 7(1): 19-32.

WHITNEY J. W. 2006. Geology, water, and wind in the lower Helmand Basin, southern Afghanistan: U.S. Geological Survey Scientific Investigations Report: 2006–5182.

ZOHARY M. 1973. *Geobotanical Foundations of the Middle East*. Germany: Gustav Fischer Verlag.

Received: 17.06.2016
Accepted: 02.03.2017