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Plant diversity of five important wetlands of Babol Mazandaran province, Iran

Farrokh Ghahremaninejad [1]*, Alireza Naqinezhad [2] and Vahid Amirgholipour Kasmani [1]

[1] Department of Plant Biology, Faculty of Biological Sciences, Kharazmi University, Tehran, Iran
[2] Department of Biology, Faculty of Basic Sciences, University of Mazandaran, Babolsar, Iran

Abstract
This study deals with the flora of five important wetlands namely Marzoonabad, Langoor, Bosra, Ramenet and Aghoozbon and their surroundings in Babol, Mazandaran province. In order to carry out a floristic survey in these wetlands, all vascular plants were collected during two growing seasons (2010-2011). We encountered 196 species belonging to 138 genera and 58 families. The largest families in the studied area were Poaceae with 24 species, Cyperaceae with 19 species, Asteraceae with 16 species, Fabaceae with 13 species and Polygonaceae with 9 species, respectively. Genera represented by the greatest number of species were *Cyperus* (8), *Polygonum* (7) and *Potamogeton* (4). Classification based on life form indicated that the therophytes (37%) comprised the largest proportion of the plants in the studied area. From chorological point of view, the largest proportion of the flora belonged to the pluriregional elements (54.5%). Various habitats of the wetland are discussed. Among the five wetlands of Babol, Marzoonabad had the highest number of species (111) and Langoor with 63 species placed on second. Moreover, a comparison between the data collected here and other northern Iranian wetlands has been provided which indicated some similarities and dissimilarities between different studied wetlands. According to Sørensen's (1948) similarity index, there are less similarities between the species of the five wetlands of Babol because they have different surface area and there is no relation between them.
Key words: Aquatic plants, Babol wetlands, Chorology, Flora, Life form, Mazandaran province

Introduction

Wetlands are valuable ecosystems which provide abundant services and materials with economic value, not only to the adjacent local populations but also to regional communities, providing valuable services such as water quality improvement, flood mitigation, erosion control and recreational enrichment (Mitsch and Gosselink, 2000). Destroying wetlands by means of drainage and pollution, which have derived from wastewater of agriculture and industries are substantial problems for the world wetlands. The occurrence of exotic species such as *Azolla filliculoides* on the water surface of wetlands is the major concern in these aquatic ecosystems in the north part of Iran. The wetlands of Babol namely Marzoonabad,

* Corresponding Author: ghahremaninejad@khu.ac.ir

Langoor, Bosra, Ramenet and Aghoozbon are important ecosystem in the north of Iran. Studying these wetlands is very important because they serve as a very valuable resting, nesting and wintering places for a wide variety of waterfowls. These wetlands also play the critical role in restoring water, which is required for cultivating activities in summer. Because of variety in the climatic conditions, there are rather remarkable and unique wetlands with exclusive characteristic in different parts of Iran. Some floristic and ecological studies have been conducted on these vaulable ecosystems e.g. Hashilan wetland (Karami *et al.*, 2001) in the west and Parishan wetland (Dolatkhahi *et al.*, 2010) in the south of Iran. Nevertheless, many floristic and vegetation studies of the wetland habitats in Iran were concentrated along the southern Caspian shore, i.e. Amirkelayeh lagoon and coasts of Lahijan-Langerud (Asri and Moradi, 2004; Ghahreman *et al.*, 2004), Anzali lagoon (Ghahreman and Attar, 2003; Asri and Eftekhari, 2002), Miankaleh wildlife refuge (Sharifnia *et al.*, 2007; Ejtehadi *et al.*, 2003; Asri *et al.*, 2007), Boujagh National Park (Naqinezhad *et al.*, 2006) , Estil wetland (Khodadadi *et al.*, 2009, Solukli wetland in Golestan national Park (Akhani, 1998), Gomishan lagoon (Karimi, 2010). The aims of the study were to present: (1) a checklist of all vascular plants found in these five wetlands, (2) spectrum of life form and phytogeographical data across the whole wetlands together with detailed information about the habitats, life form and chorology for each species, (3) a comparison between the results of Babol wetlands and other wetlands and (4) a solution for protecting these wetlands from serious destruction.

Materials and Methods

Study area

The wetlands of Babol are located in Mazandaran province, northern Iran, between 52° 35' - 52° 45' E and 36° 31' - 36° 37' N. The studied area covers five wetlands namely Marzoonabad, Langoor, Bosra, Ramenet and Agoozbon. Marzoonabad and Basra wetlands are located beside Babol-Amol road. Langoor and Agoozbon wetlands are near Babol-Bahnamir road and finally Ramenet wetland is placed beside Babol-Kiakola road. All these wetlands are located in the plain part of Babol (Figure 1). There are many cultivated places and also some canals around of the studied wetlands. These canals carry water from wetland to cultivated farms. The total surface and the mean altitude of the Babol wetlands are 1470 ha and 14.7 m respectively. The rainiest month is October. The mean annual precipitation is 738.7 mm and the mean annual temperature is 16.3 °C. The maximum and minimum mean temperatures are 29.3 °C, and 4.5 °C, respectively. The ombrothermic diagram of the studied area was prepared according to climate data obtained from the Gharakheil meteorological station (Figure 2). Three rivers namely Talar, Babol and Haraz provide water for these five wetlands and then empty their water into the Caspian sea.

Data collection and Analyses

In order to survey the flora of Babol wetlands, topographic maps were provided at first. Then, the specimens were collected in different seasons. The collected samples were then identified and named based on the classification and terminology applied to various Flora, such as: Flora Iranica (Rechinger, 1963-1998), Flora of Iran (Assadi, 1988-2007) and Flora of Turkey (Davis, 1965-1988). All plant specimens were deposited in the Farabi Herbarium (FAR), Tehran. Life forms were named following the Raunkiaer's classification (Raunkiaer, 1934) and chorology of species is based on Zohary (1973) and Takhtajan (1986) viewpoints. The habitat and color flower of each species were carefully noted while collecting the samples.

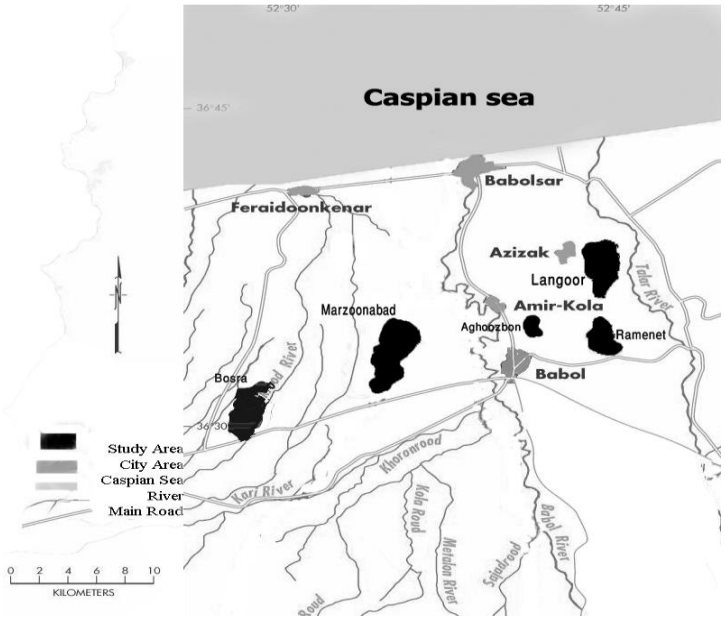

Figure 1. Location map of the five important wetlands of Babol

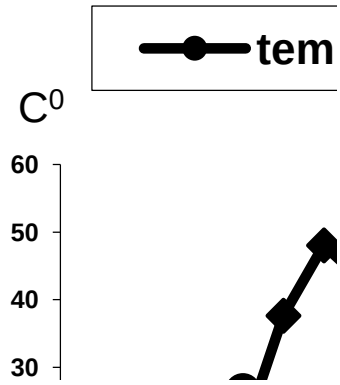

Figure 2. The climatic diagram based on the data from Gharakheil meteorological station covering the years 1979-2004

Results and Discussion

In this study, a total of 196 species of vascular plants were identified from Babol wetlands, which belonged to 58 families and 138 genera. There were different number of families, genera and species amoung various taxonomic groups (Table 1). The richest families in terms of the number of taxa were Poaceae (24), Cyperaceae (19), Asteraceae (16) and Fabaceae (13) respectively. Nine families possessesed two taxa and the remaining 28 families had just one taxon. As for the species richness, genera with four and exceeding species were: *Cyperus* (eight species), *Polygonum* (seven species), *Potamogeton* (four species), *Juncus* (four species), *Carex* (four species), *Trifolium* (four species) and *Typha* (four species). The most species-rich wetland was Marzoonabad with 111 plant taxa and the lowest species-rich wetland was Aghoozbon with 30 plant taxa. This could be due to the occurrence of more divers' habitats and different surface area in the Marzoonabad wetland. In Langoor wetland, there were 63 taxa from 56 genera and 31 families. There were 111 plant taxa from 86 genera and 45 families in the Marzoonabad wetland. In Bosra wetland, there were 51 plant taxa from 42 genera and 26 families. In Ramenet wetland, 43 plant taxa from 38 genera and 21 families were collected and determined. In a study on Aghoozbon wetland, 30 plant taxa within 27 genera and 18 families were determined. The ratios of species/genera and genera/families for the Babol wetlands indicated a higher taxonomic diversity as compared to other wetland areas, but these wetlands had fewer species than others, because of lower surface area and higher habitat homogeniety (Table 2).

Table 1. The number of families and genera in the taxonomic groups

	Pteridophyta	Angiospermae	
		Monocotyledones	Dicotyledones
Family	6	11	41
Genus	6	38	94
Species	8	62	126

Table 2. Comparative floristic richness and taxonomic diversity. Myankaleh (Ejtehadi *et al*., 2003); Anzali (Ghahreman and Attar, 2003); Amirkelayeh (Ghahreman *et al*., 2004); Boujagh (Naqinezhad *et al*., 2006); Fereydoonkenar (Hoseinzadeh, 2007).

	Present study	Myankaleh	Anzali	Amirkelayeh	Boujagh	Fereydoonkenar
Total number of taxa (T)	196	242	291	320	248	247
Total number of genera (G)	138	169	194	213	164	176
Total number of families (F)	58	48	68	76	62	73
T/G	1.4	1.4	1.8	1.5	1.5	1.4
G/F	2.4	3.5	2.9	2.8	2.6	2.4

Vegetation of the wetlands

The main structure of vegetation of whole areas of the studied wetlands were relatively similar to the vegetation of other wetlands of the northern Iran (e.g. Naqinezhad *et al*., 2006; Asri and Eftekhari, 2002). The vegetation of these five wetlands were also relatively different from each other. The Langoor wetland which had the surface area more than 700 ha was the largest wetland in Babol. *Nymphaea alba* was the dominant aquatic plant in this wetland. This plant was considered as a monodominant vegetation in this wetland in the area. The Marzoonabad wetland which had the surface area as much as 400 ha was located in second status. There were many plant communities such as *Nymphaea alba-Nelumbium nuciferum* and *Phragmites australis-Sparganium erectum* in the wetland. The Bosra wetland which was more than 150 ha had the marshy mood in some parts. The special characteristic of this wetland was the occurrence of high density of *Phragmites australis* that served as a very valuable nesting places for lots of waterfowls. There was an obvious community of *Typha domingensis-Sparganium erectum* in the Ramenet wetland. Finally, one of the major characteristics of the Aghoozbon wetland was the occurence of *Paspalum distichum* vegetation in its Islands.

A floristic resemblance study was done to show the level of similarity between the five wetlands, using Sørensen's (1948) similarity index (Table 3). Based on the obtained results the similarity level varied between 4.1% (Ramenet-Aghoozbon) to 29.8% (Marzoon abad-Langoor). This revealed that the floristic similarity was related to each wetland surface area and immigration of the variety of waterfowl that was carried plants seeds from other wetlands (Naqinezhad *et al*., 2006). It can be seen frequently between Marzoonabad and Langoor wetlands. Furthermore, less similarity between Ramenet and Aghoozbon wetlands was derived mostly from human activities and their relatively far distance. Moreover, frequency of species in each wetland indicated that with the increase in wetland surface, the number of species increases except for the Langoor wetland. This could be due to water deficiency, human interference and lack of migratory waterfowls in the Langoor wetland (Figure 3).

Table 3. Comparison of the flora of the five wetlands with each other using Sørensen's coefficient (references are as Table 1) (in percentage).

	Langoor	Bosra	Ramenet	Aghoozbon
Marzoonabad	29.8	27.1	20.7	15.7
Langoor		17.5	24.5	21.7
Bosra			17	7.5
Ramenet				4.1

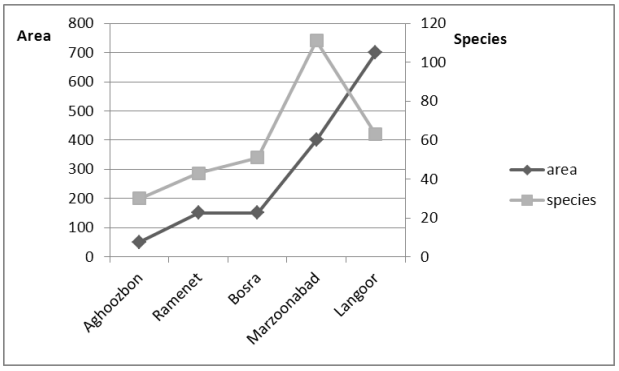

Figure 3. The number of species according to their surface area in the five wetlands of study area

Life forms

In the total assessment of life from spectrum, therophytes made up 37% of the vegetation and were the dominant biological type in the studied area, followed by hemicryptophytes with 20%, as the second dominant life form (Figure 4). Although, therophytes occurred abundantly in desert areas (Archibold, 1995), its high presence was attributed to human activities and extensive grazing. This effect was previously observed in other studied ecosystems as well (Ghahreman *et al*., 2006; Ejtehadi *et al*., 2003; Khodadadi *et al*., 2009).

Chorological spectrum

The chorotype distributions of species in these five wetlands are as given (Figure 5). As it is shown, the flora of the study areas is much affected by pluriregional elements due to two reasons. First, the humid and wet habitats dominating the area, that harbor the bulk of the pluriregional plants adapted to wet places. Second, human activities that are responsible for the establishment of widespread weeds (Archibald, 1995; Naqinezhad *et al*. 2006).

Habitat

The results of this study showed the existence of three different habitats in the studied area as follows (Figure 7):

1-Habitat for marginal plants: These habitats were usually situated on wet places near to wetlands, plains, rivers, etc. i.e. *Euphorbia helioscopia*, *Marrubium vulgare*, *Fimbristylis bisumbellata*, *Silene latifolia*, *Juncus acutus*, *Lathyrus hirsutus*, *Bupleurum marschallianum*, *Polygonum lapathifolium*, *Ranunculus marginatus*, *Verbascum punalense.*

2-Habitat for the emergent plants, these habitats contained marshlands and places out of open water area. Plants of this habitat had the high ability to absorb large amount of water. These habitats placed at second status after marginal habitats. Some species of this habitat were: *Hydrocotyle vulgaris*, *Oenanthe aquatica*, *Eclipta prostrata*, *Nasturtium microphyllum*, *Lythrum salicaria*, *Samolus valerandi*, *Ranunculus ophioglossifolius*, *Carex songorica*, *Sparganium erectum*, *Sagittaria sagittifolia*, *Phragmites australis.*

3-Habitat for open water plants: These parts were characterized with some floating and submerged plants. There were fewer species existed in this habitat. Species adapted to these habitats were: *Ceratophyllum demersum*, *Salvinia natans*, *Callitriche brutia*, *Batrachium trichophyllum*, *Lemna minor*, *Nympha alba.*

A column in Table 4 is relevant to habitat diversity of plant species.The number of plant species (in number) which can be found in each habitat is summarized in Figure 6.

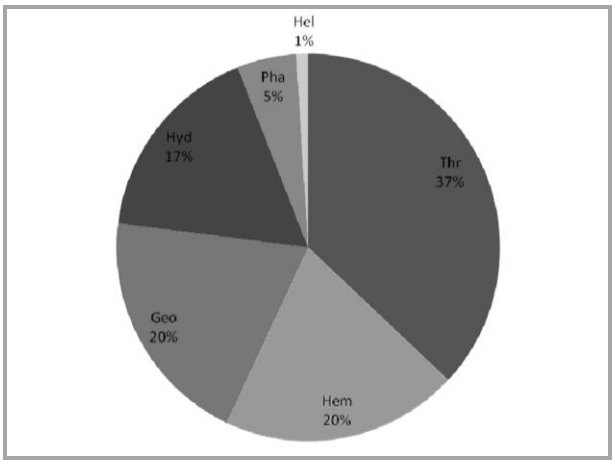

Figure 4. Proportion of different life forms (%) identified in the five important wetlands of Babol. Abbreviations:
Thr=Therophyte,
Hem=Hemicryptophytes,
Pha=Phanerophytes,
Hel=helophytes,
Geo=geophyte.

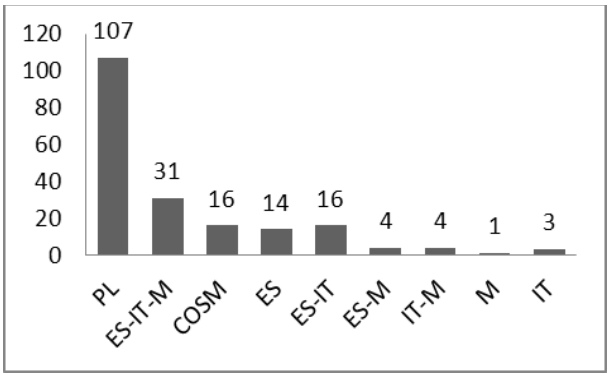

Figure 5. Proportion of various chorotypes (%) in the studied wetland sites. Abbreviations:
IT=Irano-Turanian,
M=Mediteranean,
ES=Euro-Siberian,
PL=Pluriregional,
COSM=Cosmopolitan.

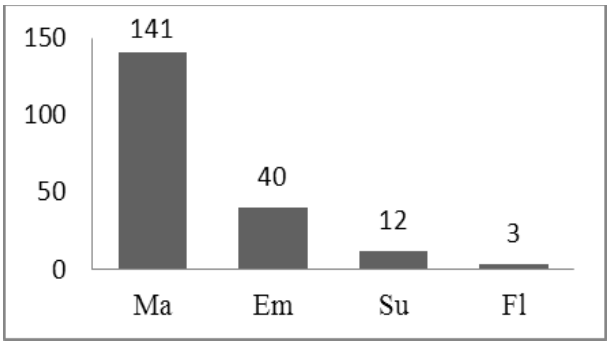

Figure 6. Proportion of species richness in different habitats of Babol wetlands.
Em (emergent plants),
Fl (floating plants),
Ma (marginal plants),
Su (submerged plants).

Table 4. Floristic list of the five important wetlands of Babol.

Symbols and abbreviations used in the table:

Life form: Geo (Geophyte), Hel (Helophyte), Hem (Hemicryptophyte), Hyd (Hydrophyte), Pha (Phanerophyte), Thr (Therophyte)

Chorotype: COSM (Cosmopolitan), ES [Euro-Sibirian (Eux-Hyr=Euxino-Hyrcanian, Hyr=Hyrcanian], IT (Irano-Turanian), M (Mediterranean), PL (Pluriregional)

Habitat and Ecology: Aq (Aquatic habitats), Em (Emergent plant), Fl (Floating plant), Hyg (Hygrophyte), Ma (Marginal plant), Su (Submerged plant)

Location: AW (Aghoozbon wetland), BW (Bosra wetland), LW (Langoor wetland), MW (Marzoonabad wetland), RW (Ramenet wetland).

Taxa	Habitat	Life form	Chorotype	Locality	Hb. No. (FAR)
Pteridophyta					
Adiantaceae					
Adiantum capillus veneris L.	Ma	Geo	PL	MW	13523
Azollaceae					
Azolla filiculoides Lam.	Su	Hyd	PL	LW, AW	13690

Taxa	Habitat	Life form	Chorotype	Locality	Hb. No. (FAR)
Dennstaedtiaceae					
Pteridium aquilinum (L.) Kuhn	Ma	Geo	COSM	MW	13778
Equisetaceae					
Equisetum arvense L.	Em	Geo	PL	MW	13506
Equisetum ramosissimum Desf.	Ma	Geo	PL	MW	13678
Equisetum telmatia Ehrh.	Ma	Geo	PL	BW	13600
Salviniaceae					
Salvinia natans (L.) All.	Su	Hyd	PL	RW, BW	13573
Woodsiaceae					
Athyrium filix-femina (L.) Roth	Ma	Geo	COSM	MW	13524
Spermatophyta					
Angiospermae					
Dicotyledones					
Amaranthaceae					
Alternanthera sessilis (L.) R. Br.	Ma	Thr	PL	BW, MW	13698
Amaranthus blitoides S.Watson var. *blitoides*	Ma	Thr	PL	MW, BW	13669
Amaranthus retroflexus L.	Ma	Thr	PL	BW	13800
Amaranthus viridis L.	Ma	Thr	PL	MW	13668
Apiaceae					
Berula angustifolia F. K. Mertens et W. D. J. Koch	Ma	Hyd	PL	BW	13769
Bupleurum marschallianum C.A. Mey.	Ma	Thr	ES-IT	MW	13749
Daucus carota L. var *sativus*	Ma	Hem	IT-M	LW, RW	13570
Eryngium caucasicum Trautv.	Ma	Hem	ES, IT, M	MW, LW	13673
Hydrocotyle vulgaris L.	Em	Geo	ES	AW	13529
Oenanthe aquatica (L.) Poir.	Em	Hem	ES-IT	MW, RW	13629
Pimpinella affinis Ledeb.	Ma	Hem	PL	MW	13648
Turgenia latifolia (L.) Hoffm.	Ma	Thr	ES- M-IT	RW	13718
Asteraceae					
Artemisia annua L.	Ma	Thr	ES, IT, M	MW	13779
Bidens tripartita L.	Ma	Thr	PL	MW, BW	13701
Carduus arabicus Jacq.	Ma	Thr	ES, IT, M	RW	13714
Centaurea iberica Trevir. ex Spreng.	Ma	Thr	PL	LW, RW	13692
Cirsium vulgare (Savi) Ten.	Ma	Hem	PL	RW	13715
Conyza bonariensis (L.) Cronquist.	Ma	Thr	COSM	MW, BW	13753
Conyzanthus squamatus (Spreng.) Tamamsch.	Ma	Hem	PL	MW	13747
Crepis pulchra L.	Ma	Thr	ES, IT, M	LW	13562
Cichorium intybus L.	Ma	Hem	PL	MW	13649
Eclipta prostrata (L.) L.	Em	Thr	PL	RW, MW, BW	13565
Lactuca serriola L.	Ma	Hem	PL	LW	13691
Senecio vernalis Waldst. & Kit.	Ma	Thr	ES , IT, M	RW	13719
Sonchus asper (L.) Hill. subsp. *glaucescens* (Jordan) Ball.	Ma	Hem	PL	LW, RW	13541
Sonchus oleraceus L.	Ma	Thr	PL	BW	13735
Xanthium spinosum L.	Ma	Thr	PL	MW	13674
Xanthium strumarium L.	Ma	Thr	PL	BW, LW	13762
Boraginaceae					
Heliotropium europaeum L.	Ma	Thr	ES, IT	MW	13661
Myosotis palustris Lam.	Em	Geo	COSM	AW	13530
Brassicaceae					
Capsella bursa-pastoris (L.) Medicus	Ma	Hem	PL	MW	13645
Cardamine hirsuta L.	Em	Thr	COSM	MW	13780
Nasturtium microphyllum Boenn. ex Rchb.	Em	Hyd	PL	AW	13531
Nasturtium officinale W.T.Aiton	Em	Hyd	PL	AW, MW, LW	13504
Raphanus raphanistrum L. subsp. *raphanistrum*	Ma	Thr	PL	LW	13624

Taxa	Habitat	Life form	Chorotype	Locality	Hb. No. (FAR)
Rorripa islandica (Oeder) Borbas	Em	Geo	PL	AW, LW	13528
Sisymbrium irio L.	Ma	Thr	PL	MW, BW	13641
Callitrichaceae					
Callitriche brutia Petagna	Su	Hem	ES-M	AW, MW	13538
Campanulaceae					
Campanula rapunculus L.	Ma	Hem	ES (Hyr)	MW	13510
Caprifoliaceae					
Sambucus ebulus L.	Ma	Geo	PL	LW, MW, RW	13611
Caryophyllaceae					
Silene latifolia Poir.	Ma	Hem	ES, IT, M	MW	13514
Ceratophyllaceae					
Ceratophyllum demersum L.	Su	Hyd	PL	MW, LW, RW, BW	13730
Chenopodiaceae					
Chenopodium ambrosioides L.	Ma	Hem	PL	MW	13781
Chenopodium album L.	Ma	Thr	COSM	BW, MW	13766
Chenopodium rubrum L.	Ma	Thr	PL	BW	13761
Convolvulaceae					
Calystegia sepium (L.) R. Br.	Ma	Geo	PL	LW	13552
Convolvulus arvensis L.	Ma	Hem	COSM	LW	13685
Cuscutaceae					
Cuscuta campestris Yunck.	Ma	Thr	COSM	MW	13672
Euphorbiaceae					
Acalypha australis L.	Ma	Thr	PL	MW, AW	13782
Chrozophora oblique (Vahl) Juss. ex Spreng.	Ma	Thr	IT	MW, BW	13666
Euphorbia helioscopia L.	Ma	Thr	ES, IT, M	MW	13520
Euphorbia peplus L.	Ma	Thr	ES, IT, M	MW, BW	13750
Euphorbia virgata Waldst. & Kit.	Ma	Hem	ES-IT-M	MW, BW	13654
Ricinus communis L.	Ma	Hem	PL	MW	13783
Fabaceae					
Sequigera varia Lassen	Ma	Hem	IT	BW, LW	13597
Glycyrrhiza echinata L.	Ma	Geo	ES, IT, M	BW	13705
Lathyrus aphaca L.	Ma	Thr	ES, IT, M	MW	13503
Lathyrus hirsutus L.	Ma	Hem	ES-IT-M	RW	13572
Lotus corniculatus L.	Ma	Hem	PL	LW, MW	13689
Medicago lupulina L.	Ma	Hem	PL	BW	13602
Medicago polymorpha L.	Ma	Thr	IT, M	LW	13563
Melilotus indicus (L.) All.	Ma	Thr	PL	MW	13660
Trifolium campestre Schreb.	Ma	Thr	ES-IT-M	BW	13595
Trifolium lappaceum L.	Ma	Thr	ES-IT-M	MW	13764
Trifolium repens L.	Ma	Geo	ES, IT, M	MW	13770
Trifolium resupinatum L.	Ma	Thr	ES, IT, M	MW, LW	13509
Vicia sativa L.	Ma	Thr	ES, IT, M	MW	13505
Halorragaceae					
Myriophyllum verticillatum L.	Su	Hyd	COSM	LW, MW	13626
Hypericaceae					
Hypericum perforatum L.	Ma	Hem	PL	LW, BW	13628
Lamiaceae					
Lycopus europaeus L.	Ma	Geo	PL	MW	13748
Marrubium vulgare L.	Ma	Geo	PL	LW	13546
Mentha aquatica L.	Em	Geo	ES	MW	13774
Mentha langifolia (L) Hudson	Ma	Hem	PL	LW	13775
Teucrium hyrcanicum Steud.	Ma	Geo	ES (Hyr)	LW, MW	13619
Lentibulariaceae					
Utricularia australis R. Br.	Su	Hyd	PL	MW	13637
Lythraceae					
Ammania baccifera L.	Ma	Thr	PL	BW	13706

Taxa	Habitat	Life form	Chorotype	Locality	Hb. No. (FAR)
Lythrum salicaria L.	Em	Hel	PL	MW, BW, RW	13756
Malvaceae					
Abutilon theophrasti Medik.	Ma	Thr	PL	MW, RW	13670
Moraceae					
Ficus carica L. subsp. *carica*	Ma	Pha	IT-M	AW	13786
Morus alba L.	Ma	Pha	IT	AW	13785
Nelumbonaceae					
Nelumbium nuciferum Gaertn.	Fl	Hyd	PL	MW	13788
Nymphaceae					
Nympha alba L.	Fl	Hyd	ES-M	AW, MW, BW, LW, RW	13787
Onagraceae					
Epilobium hirsutum L.	Ma	Geo	PL	LW, AW	13734
Oxalidaceae					
Oxalis corniculata L.	Ma	Thr	PL	RW, BW	13571
Phytolaccaceae					
Phytolacca americana L.	Ma	Hem	PL	MW	13789
Plantaginaceae					
Plantago major L.	Ma	Hem	PL	LW, BW	13540
Polygonaceae					
Polygonum aviculare L.	Ma	Thr	PL	BW	13757
Polygonum barbatum L.	Ma	Geo	PL	BW	13708
Polygonum hydropiper L	Ma	Thr	ES, IT	MW	13776
Polygonum hyrcanicum Rech. f.	Ma	Hem	ES	BW, LW	13759
Polygonum lapathifolium L. subsp. *lapathifolium*	Ma	Thr	ES, IT	MW, BW	13745
Polygonum patulum M. Bieb.	Ma	Thr	ES, IT	LW	13607
Polygonum persicaria L.	Ma	Thr	PL	RW, AW	13579
Rumex pulcher L.	Ma	Hem	ES, IT, M	RW	13569
Rumex sanguineus L.	Ma	Hem	ES	RW	13790
Portulacaceae					
Portulaca oleracea L.	Ma	Thr	ES, IT, M	MW	13791
Primulaceae					
Anagalis arvensis L.	Ma	Thr	PL	MW, LW	13550
Samolus valerandi L.	Em	Hem	PL	LW, MW	13554
Punicaceae					
Punica granatum L.	Ma	Pha	ES, IT	LW	13556
Ranunculaceae					
Batrachium trichophyllum (Chaix) Bosch	Su	Hyd	PL	AW, LW, MW	13537
Ranunculus ophioglossifolius Vill.	Em	Thr	ES, IT, M	RW	13589
Ranunculus marginatus d'Urv.	Ma	Thr	PL	MW	13651
Ranunculus scleratus L.	Em	Thr	PL	AW	13532
Rosaceae					
Potentilla reptans L.	Ma	Hem	ES, IT	LW, RW	13792
Rubus caesius L.	Ma	Pha	ES, IT	LW, RW	13618
Rubus hyrcanus Juz.	Ma	Pha	ES	LW	13716
Rubus sanctus Schreb.	Ma	Pha	ES, IT	LW, RW	13617
Rubiaceae					
Galium elongatum C. Presl	Em	Hyd	ES	BW	13593
Galium ghilanicum Stapf	Ma	Thr	ES, IT, M	RW, LW	13582
Salicaceae					
Populus nigra L.	Ma	Pha	ES, IT, M	RW, MW	13793
Salix alba L.	Ma	Pha	ES, IT	AW, LW	13796
Scrophulariaceae					
Kickxia elatine (L.) Dumort.	Ma	Thr	M	MW.LW	13662
Verbascum punalense Boiss. & Buhse	Ma	Hem	ES, IT	LW	13684

Taxa	Habitat	Life form	Chorotype	Locality	Hb. No. (FAR)
Veronica anagallis-aquatica L.	Em	Hem	PL	AW, LW	13551
Veronica persica Poir.	Ma	Thr	PL	BW	13598
Veronica polita Fr.	Ma	Thr	PL	BW	13599
Solanaceae					
Datura innoxia Mill.	Ma	Thr	PL	MW	13771
Datura stramonium L.	Ma	Thr	PL	MW	13773
Solanum persicum Willd. ex Roem. & Schult. subsp. *persicum*	Ma	Pha	ES, IT	AW, MW	13743
Solanum nigrum L.	Ma	Thr	PL	BW, MW	13703
Tamaricacaeea					
Tamarix ramosissima Ledeb.	Ma	Pha	PL	LW	13614
Urticaceae					
Parietaria officinalis L.	Ma	Hem	ES	MW	13511
Urtica dioica L.	Ma	Hem	PL	MW	13798
Urtica urens L.	Ma	Thr	PL	MW	13799
Verbenaceae					
Phyla nodiflora (L.) Greene	Ma	Hem	PL	BW, MW	13760
Verbena officinalis L.	Ma	Hem	PL	RW, MW	13577
Monocotyledones					
Alismataceae					
Alisma plantago-aquatica L.	Em	Hyd	COSM	LW, BW	13549
Sagittaria sagittifolia L.	Em	Hyd	ES-IT-M	LW	13686
Butomaceae					
Butomus umbellatus L.	Em	Hyd	ES-IT-M	RW, LW, BW, MW	13610
Cyperaceae					
Bolboschoenus affinis Drobow	Em	Hyd	PL	RW, MW, LW	13581
Carex divulsa Stokes subsp. *divulsa*	Ma	Geo	ES-IT-M	RW	13584
Carex riparia (R. Br.) Poir.	Em	Hyd	ES	MW, RW	13525
Carex sylvatica Huds.	Em	Geo	ES-M	AW	13721
Carex songorica Kar. & Kir.	Em	Geo	IT, ES	MW, RW, AW	13517
Cyperus alternifolius L.	Ma	Geo	PL	MW	13656
Cyperus difformis L.	Ma	Thr	PL	MW	13630
Cyperus fuscus L.	Em	Thr	PL	LW, MW	13687
Cyperus longus L.	Ma	Geo	ES-IT-M	MW	13772
Cyperus odoratus L. subsp. *Transcaucasicus* (Kuk.) Kukkonen	Ma	Geo	ES, IT	BW, MW	13643
Cyperus pygmaeus Rottb.	Ma	Thr	PL	MW	13632
Cyperus rotundus L.	Ma	Hem	COSM	RW, BW, MW	13564
Cyperus serotinus Rottb.	Em	Hyd	PL	AW	13736
Fimbristylis bisumbellata Bubani	Ma	Thr	PL	BW, MW	13709
Pycreus flavesence (L.) Reichenb.	Em	Geo	PL	MW	13680
Pycreus flavidus (Retz.) T.Koyama	Em	Thr	PL	LW	13720
Schoenoplectus lacustris (L.) Palla	Em	Hyd	ES, IT	MW, LW, RW	13545
Schoenoplectus litoralis (Schrad.) Palla	Em	Hyd	ES, IT, M	AW	13526
Schoenoplectus mucronatus (L.) Palla	Em	Hyd	PL	BW, AW	13696
Iridaceae					
Iris pseudacorus L.	Em	Hyd	ES	MW, LW, AW	13515
Juncaceae					
Juncus articulatus L.	Ma	Geo	PL	BW, AW	13700
Juncus inflexus L.	Ma	Hel	PL	AW	13740
Juncus littoralis C.A.Mey.	Ma	Geo	IT-M	LW, MW	13616
Juncus acutus L.	Ma	Geo	PL	LW	13625
Lemnaceae					
Lemna minor L.	Fl	Hyd	PL	MW, LW, AW	13658
Hydrocharitaceae					
Najas graminea Delile	Su	Thr	PL	MW	13731

Taxa	Habitat	Life form	Chorotype	Locality	Hb. No. (FAR)
Poaceae					
Aegilops tauschii Coss.	Ma	Thr	ES, IT, M	AW	13535
Agrostis stolonifera L.	Ma	Geo	ES , IT, M	BW	13605
Alopecurus arundinaceus Poir. var. *arundinaceus*	Ma	Geo	PL	AW	13534
Arundo donax L.	Ma	Geo	ES-IT-M	MW, BW	13794
Bromus japanicus Thunb.var. *japonicus*	Ma	Thr	PL	BW	13596
Briza minor L.	Ma	Thr	ES, M	BW	13723
Calamagrostis epigejos (L.) Roth	Ma	Geo	PL	MW	13726
Catabrosa aquatica P. Beauv.	Em	Hyd	PL	MW, LW	13500
Cynodon dactylon (L.) Pers.	Ma	Geo	PL	MW	13795
Dactylis glomerata L.	Ma	Hem	PL	RW	13722
Digitaria sanguinalis (L.) Scop.	Ma	Thr	PL	MW, AW	13667
Echinochloa crus-galli (L.) P. Beauv.	Em	Thr	PL	RW	13585
Eleusine indica (L.) Gaertn.	Ma	Thr	PL	MW	13635
Lolium perenne L.	Ma	Hem	COSM	RW	13567
Lophochloa phleoides (Vill.) Richb.	Ma	Thr	PL	RW	13588
Paspalum dilatatum Poir.	Ma	Geo	PL	BW, MW	13604
Paspalum distichum L.	Em	Geo	COSM	RW, MW, LW	13587
Phalaris arundinacea L.	Ma	Geo	PL	MW	13724
Phleum paniculatum Huds. var. *ciliatum* (Boiss.) Bor	Ma	Thr	ES	MW	13725
Phragmites australis (Cav.) Steud.	Em	Hyd	COSM	MW, RW, BW	13732
Polypogon monspeliensis (L.) Desf.	Ma	Thr	PL	MW, LW	13502
Polypogon semiverticillatus (Forssk.) H. Hyl.	Ma	Thr	PL	MW	13664
Setaria glauca (L.) P. Beauv.	Ma	Thr	PL	LW, BW	13621
Sorghum halepense (L.) Pers.	Ma	Geo	PL	MW	13659
Potamogetonaceae					
Potamogeton crispus L.	Su	Hyd	PL	MW, LW	13560
Potamogeton lucens L.	Su	Hyd	PL	RW, LW, MW	13575
Potamogeton nodosus Poir.	Su	Hyd	PL	MW	13647
Potamogeton pectinatus L.	Su	Hyd	COSM	LW, MW	13558
Sparganiaceae					
Sparganium erectum L. subsp.*neglectum* (Beeby) K. Richter	Em	Geo	ES	AW, LW, MW	13536
Typhaceae					
Typha angustifolia L.	Em	Hyd	PL	RW	13713
Typha caspica Pobed.	Em	Hyd	ES (Eux-Hyr)	AW	13738
Typha domingensis Pers.	Em	Hyd	PL	LW	13608
Typha latifolia L.	Em	Hyd	COSM	RW, MW	13797

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تنوع زیستی گیاهی پنج مانداب مهم شهرستان بابل، استان مازندران

فرخ قهرمانی‌نژاد [۱]*، علیرضا نقی‌نژاد [۲] و وحید امیرقلی‌پور کاسمانی [۱]

[۱] گروه علوم گیاهی، دانشکده علوم، دانشگاه خوارزمی، تهران، ایران

[۲] گروه زیست‌شناسی، دانشکده علوم پایه، دانشگاه مازندران، بابلسر، ایران

چکیده

این پژوهش، شامل مطالعه فلور و بررسی تنوع زیستی پنج مانداب مهم مرزون آباد، لنگور، بصراء، رمنت و آغوزبن در شهرستان بابل در شمال ایران است. برای تحقق مطالعات فلوریستیکی در این مانداب‌ها، همه گیاهان آوندی در طی دو فصل رویشی (۱۳۸۹-۱۳۹۰) جمع‌آوری گردید. تعداد کل ۱۹۶ گونه متعلق به ۱۳۸ جنس و ۵۸ خانواده گیاهی شناسایی شد. تیره‌های Poaceae (۲۴ گونه)، Cyperaceae (۱۹ گونه)، Asteraceae (۱۶ گونه)، Fabaceae (۱۳ گونه) و Polygonaceae (۹ گونه) دارای بیشترین غنای گونه در منطقه مورد مطالعه بودند. جنس‌هایی که بیشترین تعداد گونه را در بردارند عبارتند از: *Cyperus* (۸ گونه)، *Polygonum* (۷ گونه) و *Potamogeton* (۴ گونه). در بین گیاهان منطقه، تروفیت‌ها با ۳۷ درصد فراوان‌ترین شکل زیستی منطقه را تشکیل می‌دهند. از لحاظ پراکنش جغرافیایی، بیشترین گونه‌ها متعلق به عناصر چند ناحیه‌ای با ۵۴/۵ درصد هستند. زیستگاه‌های مختلف این مانداب‌ها ارزیابی شد. از میان پنج مانداب شهرستان بابل، مانداب مرزون‌آباد بیشترین تعداد گونه‌ها (۱۱۱) را به خود اختصاص داده است و مانداب لنگور با ۶۳ گونه در رتبه دوم قرار دارد. به علاوه، مقایسه‌ای بین اطلاعات به دست آمده از این مانداب‌ها با سایر مانداب‌های شمال ایران نیز انجام گردید که نشان‌دهنده برخی شباهت‌ها و اختلافات بین مناطق مختلف مورد بررسی است. طبق ضریب تشابه سورنسون مشخص شد که شباهت اندکی بین گونه‌های گیاهی این پنج مانداب با یکدیگر وجود دارد که دلیل آن مساحت متفاوت و فاصله نسبتاً زیاد میان آنهاست.

واژه‌های کلیدی: استان مازندران، پراکنش جغرافیایی، شکل زیستی، فلور، گیاهان آبزی، مانداب‌های بابل

* ghahremaninejad@khu.ac.ir