

CONTRIBUTION TO THE FLORA AND HABITATS OF THE ESTIL WETLAND (ASTARA) AND ITS SURROUNDINGS, NORTHWEST IRAN*

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Abstract

The present study involves the flora of the Estil wetland and its surroundings in Astara, northwest Iran. During 2006-07, we examined the plant specimens collected in this area and determined that there are 247 vascular plant taxa (229 species, 11 subspecies, and seven varieties) in 170 genera and 60 families. The largest families are Poaceae (27 taxa), Asteraceae (26), and Brassicaceae (21). Genera represented by the greatest number of species are *Ranunculus* (7), *Cyperus* (7) and *Polygonum* (6). From the chronological point of view, the largest proportion of the flora belongs to the pluriregional elements. The number of endemic taxa within the study area is 11 (4.5%). Using all references used, eight species and nine species are reported for the first time for the flora of northern Iran and Guilan Province, respectively. Classification based on life form indicates that the therophytes comprise the largest proportion of the plants in the study area. The main

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habitats in the area include aquatic, sand dune, forest, plain and ruderal. Along with a full checklist of all plants collected in the area, ecological characteristics of all habitats are also discussed. Moreover, a comparison between the data collected here and of other northern Iranian wetlands is presented.

Key words: Life form, Chorology, Estil wetland, Endemic species, Aquatic plants, Iran

Introduction

Wetlands are one of the most important and vital ecosystems which support a wide array of unique plants adapted to wet conditions (CRONK & FENNESSY 2001). They are among the highly productive ecosystems in the world (MITSCH & GOSSELINK 2000) and their ability to adapt to rapidly changing conditions appears to be rather high (KOYUNCU *et al.* 2008). There is an increasing number of studies on wetlands and their functions across the world (see MITSCH & GOSSELINK 2000). Among them, especially important are studies of sensitive coastal ecosystems. Many sensitive wetlands are found along the southern Caspian sea and are protected by the Department of Environment, Iran. Moreover, most of these wetlands are internationally important, as catalogued in the Ramsar convention (ANONYMOUS 2002). The Estil wetland is one of the important coastal wetlands in northwest Iran. Study of this wetland is very important because (1) it serves as an important resting, nesting and wintering place for a wide variety of waterfowl, (2) of the occurrence of pure stands of Euxino-Hyrcanian black alder (*Alnus glutinosa* subsp. *barbata*, which are in decline due to cultivation, human settlement and industry in the southern Caspian lowlands (GHAHREMAN *et al.* 2006, HAMZEH'EE *et al.* 2008), (3) of habitat loss in much of the surrounding region, and (4) the area is characterized as a corridor for flora and fauna between the Republic of Azerbaijan, Turkey and Iran. Nevertheless, despite the many general floristic and vegetation studies of the wetland habitats in Iran are mostly concentrated along the southern Caspian shore (RIAZI 1996, ASRI & EFTEKHARI 2002, KARAMI *et al.* 2001, NAQINEZHAD & GHAHREMAN 2004, GHAHREMAN & ATTAR 2003, EJTEHADI *et al.* 2003, ASRI & MORADI 2004,

GHAHREMAN *et al.* 2004, SHOKRI *et al.* 2004, AKHANI 2005, ASRI & MORADI 2006, NAQINEZHAD *et al.* 2006, ASRI *et al.* 2007, SHARIFNIA *et al.* 2007), detailed habitat studies and floristic accounts are lacking for northwest Iran, particularly for the wetland site in Estil, Astara. The objective of this study was to provide urgently needed scientific information for biodiversity conservation. To this end, a research program was instituted to characterize the floristic composition in the Estil wetland and its surroundings. We provide insights into (1) the conservation value of these wetland habitats, (2) plants species diversity in the area, and (3) how important wetlands in northern Iran differ one from another.

Materials and Methods

Study area

The Estil wetland is located in Guilan Province, northwest Iran, at 38° 22' N and 48° 51' E (Fig. 1). The area is generally flat except in the west. Using the De Martonne method, the study area is characterized as a moist and temperate climate (SABETI 1969). The maximum and minimum mean temperatures are 29.6° C, and 2.7° C, respectively. The mean annual precipitation and mean annual temperature are 1380.8 mm and 15.2° C, respectively. The ombrothermic diagram of the study area (using Walter method) was prepared according to climate data obtained from the Astara meteorological station (Fig. 2).

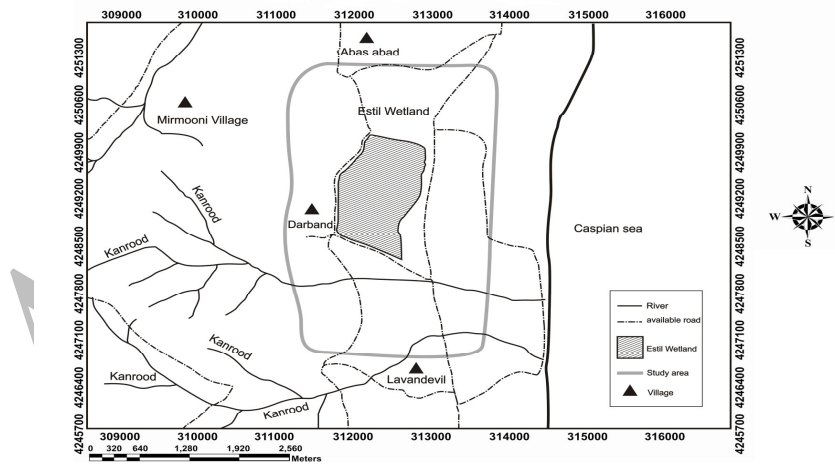


Fig. 1. Location map of Estil wetland and its surrounding areas.

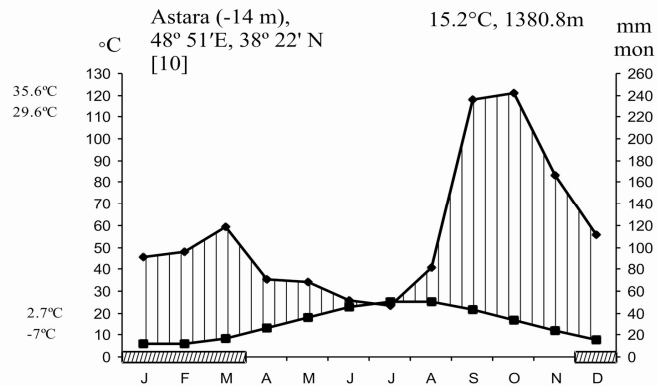


Fig. 2. Climatic diagram of Astara, northwestern Iran (using Walter method).

Data collection

Vascular plant collections were made throughout the area during 2006-07. All species were determined using KOMAROV (1934-1954), RECHINGER (1963-1998), TUTIN *et al.* (1964-1980), DAVIS (1965-1988), and ASSADI *et al.* (1988-2007). The herbaria of IRAN, TUH and Guilan University Herbarium were used to check the determinations (herbarium abbreviations follow HOLMGREN *et al.* 1990). The specimens are deposited at the Guilan University Herbarium. The plant taxa found in the Estil wetland and its surroundings are listed in Appendix 1. The list provides habitat type, life form, chorotype, and herbarium number. Based on the position of the plant's growth-point (perennating bud) in relation to the soil and water surface, the following RAUNKIAER (1934) life-forms were differentiated: chamaephyte, geophyte, helophyte, hemicryptophyte, hydrophyte, phanerophyte and therophyte. The geographical distribution of each species was determined from reviews of monographs and Floras, particularly Flora Iranica (RECHINGER 1963-1998). The terminology and delimitation of major phytogeographic areas (i.e. Euro-Siberian, Irano-Turanian, and Mediterranean) follow standard references, particularly ZOHARY (1973) and TAKHTAJAN (1986). Information regarding collection sites, habitat preferences and ecological status based on our field

observation which is given for each taxon. In addition, delimitation of the habitats was performed using a physiognomical approach and based on field observations.

Abbreviations

Abbreviations used in the paper include, in alphabetical order: aquatic habitat (Aq), chamaephyte (Cha), emergent plants (Em), Euro-Siberian element (ES), floating plants (Fl), forest habitat (FO), geophyte (Geo), helophyte (Hel), hemicryptophyte (Hem), hydrophyte (Hyd), Hyrcanian elements (Hyr), Irano-Turanian element (IT), Mediterranean element (M), parasite (P), phanerophyte (Pha), plain habitat (PN), pluriregional (PL), ruderal habitat (DH), submerged plants (Su), therophyte (Thr), wet place habitat (WP), sand dune (SD).

Results and Discussion

Floristic richness and taxonomic diversity

The vascular flora of the Estil wetland contains a total of 247 taxa (229 species, 11 subspecies and seven varieties) in 60 families (48 dicotyledones, eight monocotyledones and four pteridophytes) and 170 genera (Appendix 1). Moreover, two moss species (*Funaria hygrometrica* Hedw. and *Pleurochaete squarrosa* (Brid.) Lindb.), are also added to this account. The richest families in terms of number of taxa are Poaceae (27), Asteraceae (26), Brassicaceae (21), Fabaceae (17), Cyperaceae (11), Rosaceae (11) and Scrophulariaceae (11). A comparison of families in terms of the number of species found in this study compared with studies of nearby regions with similar habitats (EJTEHADI *et al.* 2003, GHAHREMAN & ATTAR 2003, GHAHREMAN *et al.* 2004, NAQINEZHAD *et al.* 2006) was done. Poaceae was the largest family in all studies except for Asteraceae in the Myankaleh wetland (EJTEHADI *et al.* 2003). Differences among the two latter studied sites might be related to rather different surface areas. The largest families in terms of number of genera are Asteraceae (22), Poaceae (21), and Brassicaceae (18). The genera with the larger member of species are *Cyperus* L. and *Ranunculus* L., each with seven taxa.

Floristic similarity and distribution pattern of species

The ratios of species/genera and genera/families for the Estil wetland and neighboring areas (Table 1) indicate a higher taxonomic diversity as compared to other wetland areas except for the Boujagh wetland (NAQINEZHAD *et al.* 2006) with respect to genera/families. This could be due to occurrence of more diverse habitats and different surface area in the Boujagh wetland. The floristic resemblance varies between 35.5 (with the Myankaleh wetland, easternmost) and 70.7 (with the Anzali wetland, westernmost) using SØRENSEN's (1948) similarity index. It can be shown that the floristic similarity is related to distance between Estil and the other wetlands, so that the nearest wetland to Estil (Anzali) has the highest similarity. Likewise, the Myankaleh wetland, containing many halophytic plant communities, has the lowest similarities with neighboring wetlands, consistent with ASRI *et al.* (2007).

Table 1. Comparative floristic richness and taxonomic diversity. Myankaleh (EJTEHADI *et al.* 2003); Anzali (GHAHREMAN & ATTAR 2003); Amirkelayeh (GHAHREMAN *et al.* 2004); Boujagh (NAQINEZHAD *et al.* 2006)

	Present study	Myankaleh	Anzali	Amirkelayeh	Boujagh
Total number of taxa (T)	248	242	291	320	248
Total number of genera (G)	170	169	194	213	164
Total number of families (F)	60	48	68	76	62
T/G	1.4	1.4	1.8	1.5	1.5
G/F	2.8	3.5	2.9	2.8	2.6

Table 2. Comparison of the flora of the study area with other studies using SØRENSEN's (1948) coefficient (references are as Table 1)

	Myankaleh	Anzali	Amirkelayeh	Boujagh
Present study	35.5	70.7	47.5	47.1
Myankaleh		38.3	37	40
Anzali			55.6	77.9
Amirkelayeh				61.6

Endemism (including both exclusive endemic and subendemic species) in the Estil wetland is 4.5% and includes 11 taxa (Appendix 1). The occurrence of these endemic taxa indicates the special ecological and biogeographic importance of the area. In addition to the endemics, five plant taxa (*Echium amoenum*, *Myosotis anomala*, *Parrotia persica*, *Polygonum hyrcanicum*, *Pterocarya fraxinifolia*) in the study area are characterized as low risk plants (LR) based on the threatened

categories proposed by IUCN (2001) and JALILI & JAMZAD (1999). Eight species found in the study area (*Amaranthus spinosus*, *Cyperus dives*, *C. imbricatus*, *C. michelianus*, *C. pygmaeus*, *Euphorbia maculata*, *Soliva pterosperma* and *Tagetes minuta*) were recently reported as new records for the flora of Iran (AMMINI RAD 2002, AMMINI RAD & NAQINEZHAD 2003, NAQINEZHAD & GHAHREMAN 2004, MOHAMADZADEH *et al.* 2005, NASSEH *et al.* 2006, NAQINEZHAD *et al.* 2007, NAQINEZHAD & SAEIDI MEHRVARZ 2007). Using all current references, eight species (*Brassica nigra*, *Bromus commutatus*, *Bromus intermedius*, *Centaureum tenuiflorum*, *Coronopus didymus*, *Kochia scoparia*, *Lepidium persicum* subsp. *Persicum* and *Myosotis stricta*) are reported as new records for the northern Iran. Moreover, nine other species (*Amaranthus retroflexus*, *Anthemis cotula*, *Cerastium dichotomum*, *Crataegus meyeri*, *Eremopoa persica*, *Geranium collinum*, *Hornungia procumbens*, *Juncus turkestanicus* and *Papaver dubium*) are reported as new records for Guilan Province.

Life forms

The dominant life forms are therophytes, which constitute 53.6% of the taxa, followed by hemicryptophytes (20.2), phanerophytes (10%), geophytes (9.3%), helophytes (3.2%), hydrophytes (2%) and chamaephytes (0.8%), and parasites (0.4%) (Fig. 3).

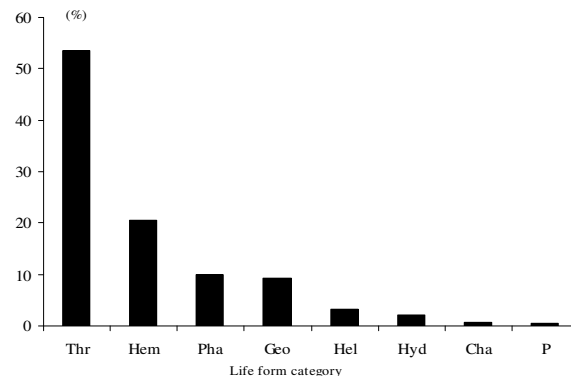


Fig. 3. Life form spectrum of the vascular flora of Estil wetland (Explanation of abbreviations in Materials and Methods).

A comparison between the life forms in the Estil wetland and those in other wetlands in northern Iran that have been studied indicates that therophytes make up the largest proportion of the taxa in all these areas (EJTEHADI *et al.* 2003, GHAHREMAN & ATTAR 2003, GHAHREMAN *et al.* 2004, NAQINEZHAD *et al.* 2006, SHARIFNIA *et al.* 2007). Although therophytes occur abundantly in desert areas (ARCHIBOLD 1995), a high percentage of them is attributed to human activities and extensive grazing (cf. GRIME 2001). PRASAD (1995) studied the effects of grazing on plant species and life form composition and found that grazed areas possess more grassland species than protected areas and that the percentage of therophytes was higher in grazed areas than in protected areas.

Phytogeographical affinities

The flora of the study area is much affected by pluriregional elements due to two reasons. First, the humid and wet habitats dominating the area harbor the bulk of the pluriregional plants adapted to wet places. Second, human activities are responsible for the establishment of widespread weeds. Phytogeographical elements include PL (52.2%), ES (6.9%), ES, IT (13.5%), ES, IT, M (11.8%), IT (4.9%), ES, M (3.3%), IT, M (2.4%) and M (0.4%). The following taxa are found exclusively in the Hyrcanian area: *Alcea hyrcana*, *Campanula rapunculus* var. *lambertiana*, *Gleditschia caspica*, *Myosotis anomala*, *Parrotia persica*, *Polygonum hyrcanicum*, *Ruscus hyrcanus*, *Scutellaria tournefortii*, *Teucrium hyrcanicum* and *Thlaspi umbellatum*. Moreover in flora of Iran, *Albizia julibrissin* is found only in the Hyrcanian area. Likewise *Alnus glutinosa* subsp. *barbata* and *Pterocarya fraxinifolia* are found exclusively in the Euxino-Hyrcanian area (ZOHARY 1973). Phytogeographical comparisons between our study area and other wetlands of northern Iran are presented in Table 3. Pluriregional elements are comparably better represented in the Estil wetland than other phytogeographic region elements. Moreover, endemism is higher compared with other areas.

Table 3. A comparison of the phytogeographical elements and endemism (%) (Explanation of abbreviations in Materials and Methods, references are as Table 1)

Phytogeographical Element	Present Study	Myankaleh	Anzali	Amirkelayeh	Boujagh
ES	6.9	3.7	5	9.3	7
ES, IT	13.5	7.4	7.9	5.5	9
ES, IT, M	11.8	14.4	28.5	11.9	14
IT	4.9	7.4	3	3.5	2
ES, M	3.3	2.8	5.8	5.1	5
IT, M	2.4	8.6	9.6	2.6	1
M	0.4	1.6	3	1.3	1
Pluriregional	52.2	21	29.5	59.4	61
Endemism	4.5	3.5	1	2.1	2.4

Habitat and Ecology

Habitat diversity within the Estil wetland and the surrounding area corresponds to relatively high plant diversity. Five habitat types occur in the area:

(1) Aquatic and wet habitats:

(1-1) Open water: these areas are characterized by floating and submerged plants such as *Azolla filiculoides*, *Ceratophyllum demersum* and *Lemna minor* [Aq (su), Aq (fl) in Appendix 1].

(1-2) Marginal areas: these are the margins of open water and are characterized by an emergent helophytic flora, e.g. *Cyperus dives*, *Juncus acutus*, *Lythrum salicaria*, *Nasturtium officinale*, *Phragmites australis*, *Ranunculus ophioglossifolius*, *R. sceleratus*, *Solanum persicum* subsp. *persicum* and *Veronica anagallis-aquatica* [Aq (Em) in Appendix 1].

(1-3) Wet places: species adapted to drier sites near wetlands, rivers, streams etc.: *Alternanthera sessilis*, *Catabrosa aquatica*, *Cardamine hirsuta*, *Cyperus difformis*, *C. fuscus*, *Echinochloa crus-galli* var. *crus-galli*, *Eclipta prostrata*, *Hydrocotyle vulgaris*, *Polygonum persicaria*, *Ranunculus marginatus* and *R. muricatus* [WP in Appendix 1].

(2) Sand dune or wet sand dune habitat: southern part of the wetland is more influenced by the Caspian sea. The following species were frequently encountered: *Amaranthus spinosus*, *Arenaria leptocladus*, *Cerastium glomeratum*, *Conyza canadensis*, *Lythrum hyssopifolium*, *Medicago lupulina*, *M. polymorpha*, *Silene dichotoma*, *Solanum nigrum* and *Tribulus terrestris* [SD in Appendix 1].

(3) Forest and woodlands: some occur in the study area. This habitat can be considered as remnant patches of Hyrcanian lowland forests which once occurred

continuously along the southern Caspian shores (ZOHARY 1973, GHAREMAN *et al.* 2006). Some important species are *Calystegia silvestris*, *Campanula rapunculus* var. *lambertiana*, *Cornus australis*, *Euphorbia amygdaloides*, *Ficus carica*, *Galium odoratum*, *Gleditschia caspica*, *Hypericum androsaemum*, *Mespilus germanica*, *Morus alba*, *Ranunculus costantinopolitanus*, *Periploca graeca*, *Rosa boissieri*, *Smilax excelsa*, *Tamus communis* and *Viola alba* [FO in Appendix 1].

(4) Plain habitat: between the Caspian sea and the wetland. It also includes some parts around the Estil wetland and surrounding villages. *Geranium purpureum*, *Juncus turkestanicus*, *Melia azedarach*, *Paspalum paspaloides* and *Vicia tetrasperma* are among the most important plant species found in this habitat [PN in Appendix 1].

(4) Disturbed habitats: anthropogenic places, roadsides, cultivated parts and grazed grounds. *Amaranthus chlorostachys*, *Centaurea iberica*, *Chondrilla juncea*, *Euphorbia helioscopia*, *Fimbristylis bisumbellata*, *Portulaca oleracea*, *Ranunculus arvensis*, *Verbascum punalense*, *Verbena officinalis*, *Xanthium spinosum* and *X. strumarium* [DH in Appendix 1].

Threats

All species and habitats were assigned to one or more of the following threats: agricultural activities, road building, livestock grazing, human settlements and invasion of exotic species. The occurrence of exotic plants such as *Azolla filiculoides* is a major concern on open water because they may form a large carpet of vegetation on the water surface. As noted above, the occurrence of *A. glutinosa* subsp. *barbata*, an Euxino-Hyrcanian species, is of high importance for the wetland (GHAREMAN *et al.* 2006, HAMZEH'EE *et al.* 2008). Only small patches of this species occur along the southern Caspian shores. High plant diversity in the wetland and the surrounding area is the main reason for increasing the conservational policies in the area.

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Appendix 1. Vascular plants in the Estil wetland (explanation of abbreviations in Materials and Methods)

Species	Habitat	Life Form	Chorology	Herbarium No.
Pteridophyta				
Aspleniaceae				
<i>Asplenium adiantum-nigrum</i> L.	FO	Geo	PL	13257
<i>Asplenium trichomanes</i> L.	FO	Geo	PL	13258
<i>Phyllitis scolopendrium</i> (L.) Newm.	FO	Geo	PL	13259
Azollaceae				
<i>Azolla filiculoides</i> Lam.	Aq (Fl)	Hyd	PL	13286
Equisetaceae				
<i>Equisetum ramosissimum</i> Desf.	SD, DH	Geo	PL	13346
Hypolepidaceae				
<i>Pteridium aquilinum</i> (L.) Kuhn	DH	Geo	PL	13379
Spermatophyta				
Angiospermae				
Dicotyledones				
Amaranthaceae				
<i>Alternanthera sessilis</i> (L.) R. Br.	WP	Thr	PL	13245
<i>Amaranthus chlorostachys</i> Willd.	DH	Thr	PL	13246
<i>Amaranthus lividus</i> L.	SD	Thr	PL	13247
<i>Amaranthus retroflexus</i> L.	SD	Thr	PL	13248
<i>Amaranthus spinosus</i> L.	SD	Thr	PL	13249
Apiaceae/ Umbelliferae				
<i>Eryngium caucasicum</i> Trautv.	DH	Hem	ES, IT, M	13250
<i>Hydrocotyle ranunculoides</i> L. fil.	Aq (Em)	Hel	PL	13251
<i>Hydrocotyle vulgaris</i> L.	WP	Hel	ES	13252
<i>Pimpinella affinis</i> Ledeb.	DH	Hem	PL	13253
<i>Trinia leiogona</i> (C.A. Mey) B. Fedtsch.	DH	Hem	ES	13254
Asclepiadaceae				
<i>Cynanchum acutum</i> L.	FO	Pha	ES, IT, M	13255
<i>Periploca graeca</i> L.	FO	Pha	ES, IT, M	13256
Asteraceae/ Compositae				
<i>Amblyocarpum inuloides</i> Fisch. & C.A. Mey.	SD	Thr	ES	13260
<i>Anthemis hyalina</i> DC.	DH	Thr	IT	13261
<i>Anthemis cotula</i> L.	DH	Thr	PL	13262
<i>Artemisia annua</i> L.	DH	Thr	ES, IT, M	13263
<i>Carduus seminudus</i> M.B.	DH, SD	Hem	ES, IT, M	13264
<i>Centaurea iberica</i> Spreng.	DH, SD	Thr	PL	13265
<i>Chondrilla juncea</i> L.	DH, SD	Hem	ES, IT, M	13266
<i>Cichorium intybus</i> L.	DH, SD	Hem	PL	13267
<i>Cirsium vulgare</i> (Savi) Ten.	DH, SD	Hem	PL	13268
<i>Conyza bonariensis</i> (L.) Cronq.	DH	Thr	PL	13269
<i>Conyza canadensis</i> (L.) Cronq.	DH	Thr	PL	13270
<i>Conyzanthus squamatus</i> (Spreng.) Tamamsch.	SD	Hem	PL	13271
<i>Crepis pulchra</i> L.	DH, SD	Thr	ES, IT, M	13272
<i>Crepis sancta</i> (L.) Babcock	DH, SD	Thr	PL	13273
<i>Eclipta prostrata</i> (L.) L.	WP	Thr	PL	13274
<i>Filago</i> sp.	DH	Thr		13275
<i>Lactuca serriola</i> L.	SD	Hem	PL	13276
<i>Senecio vernalis</i> Waldst. & Kit.	DH, SD	Thr	ES, IT	13277
<i>Siegesbeckia orientalis</i> L.	WP	Thr	ES, IT	13278
<i>Soliva petrosperma</i> (Juss.) Less.	DH	Thr	PL	13279
<i>Sonchus oleraceus</i> L.	DH	Thr	PL	13280
<i>Tagetes minuta</i> L.	DH	Thr	PL	13281

Species	Habitat	Life Form	Chorology	Herbarium No.
<i>Tanacetum parthenium</i> (L.) Sch.-Bip.	FO	Hem	PL	13282
<i>Taraxacum</i> sp.	DH, WSD	Hem		13283
<i>Xanthium spinosum</i> L.	DH	Thr	PL	13284
<i>Xanthium strumarium</i> L.	DH	Thr	PL	13285
Betulaceae				
<i>Alnus glutinosa</i> (L.) Gaertn. subsp. <i>barbata</i> (C.A. Mey) Yaltirik	WP	Pha	ES (Eux-Hyr)	13287
Boraginaceae				
<i>Cynoglossum creticum</i> Miller.	PN, FO	Hem	ES, IT	13288
<i>Echium amoenum</i> Fisch. et C.A. Mey.	FO	Hem	ES	13289
<i>Heliotropium europaeum</i> L.	DH, SD	Thr	ES, IT	13290
<i>Myosotis anomala</i> H. Riedl	PN, FO	Hem	ES (Hyr)	13292
<i>Myosotis stricta</i> Link	PN, FO	Thr	ES, IT	13293
<i>Nonnea lutea</i> (Desr.) DC.	DH	Thr	ES	13294
Brassicaceae/ Cruciferae				
<i>Alliaria petiolata</i> (M.B.) Cavara & Grande	DH	Thr	ES, IT	13295
<i>Arabidopsis thaliana</i> (L.) Heynh.	DH	Thr	PL	13296
<i>Arabis sagittata</i> (Bertol.) DC	FO	Thr	ES, IT	13297
<i>Brassica arvensis</i> (L.) Rabenh.	DH	Thr	PL	13312
<i>Brassica deflexa</i> Boiss.	DH	Thr	IT	13299
<i>Brassica nigra</i> (L.) W.D.J. Koch	DH	Thr	PL	13300
<i>Brassica tournefortii</i> Gouan	DH	Thr	PL	13298
<i>Capsella bursa-pastoris</i> (L.) Medicus	DH	Hem	PL	13301
<i>Cardamine hirsuta</i> L.	WP	Thr	PL	13302
<i>Descurainia sophia</i> (L.) Schur	DH	Hem	PL	13304
<i>Eruca sativa</i> Lam.	DH	Thr	ES, IT, M	13305
<i>Hornungia procumbens</i> (L.) Hayek	DH	Thr	PL	13306
<i>Lepidium didymum</i> L.	WP	Thr	PL	13303
<i>Lepidium perfoliatum</i> L.	DH	Thr	ES, IT	13307
<i>Lepidium persicum</i> Boiss. subsp. <i>persicum</i>	DH	Hem	IT	13308
<i>Microthlaspi umbellata</i> (DC.) F.K. Mey.	DH	Thr	ES (Hyr)	13314
<i>Nasturtium officinale</i> (L.) R. Br.	Aq (Em-Hel)	Hel	PL	13309
<i>Raphanus raphanistrum</i> L. subsp. <i>raphanistrum</i>	SD	Thr	PL	13310
<i>Rapistrum rugosum</i> (L.) All.	DH	Thr	PL	13311
<i>Sisymbrium officinale</i> (L.) Scop.	DH	Thr	PL	13313
<i>Turritis glabra</i> L.	DH	Thr	ES, IT, M	13315
Campanulaceae				
<i>Campanula rapunculus</i> L. var. <i>lambertiana</i> (A. DC.) Boiss.	FO	Hem	ES (Hyr)	13316
Capparaceae				
<i>Cleome iberica</i> DC.	DH	Thr	ES, IT, M	13317
Caprifoliaceae				
<i>Sambucus ebulus</i> L.	PN, FO	Geo	PL	13318
Caryophyllaceae				
<i>Arenaria leptoclados</i> (Rchb.) Guss.	DH, SD	Thr	ES, IT, M	13319
<i>Cerastium dichotomum</i> L.	DH, SD	Thr	PL	13320
<i>Cerastium glomeratum</i> Thuill.	DH, SD	Thr	PL	13321
<i>Polycarpon tetraphyllum</i> (L.) L.	DH	Thr	PL	13322
<i>Saponaria cerastioides</i> Fisch. ex C.A. Mey.	DH, SD	Thr	ES (Eux-Hyr)	13323
<i>Silene dichotoma</i> Ehrh.	DH, SD	Thr	ES, M	13324
<i>Stellaria media</i> (L.) Vil.	DH, SD	Thr	PL	13325
Ceratophyllaceae				
<i>Ceratophyllum demersum</i> L.	Aq (Su)	Hyd	PL	13326
Chenopodiaceae				
<i>Chenopodium album</i> L. subsp. <i>album</i>	DH, SD	Thr	PL	13327
<i>Chenopodium ambrosioides</i> L.	SD	Hem	PL	13328
<i>Chenopodium botrys</i> L.	SD	Hem	PL	13329

Species	Habitat	Life Form	Chorology	Herbarium No.
<i>Kochia scoparia</i> (L.) Schrad.	DH, SD	Hem	PL	13330
Convolvulaceae				
<i>Calystegia silvestris</i> (Willd.) Roem.	FO	Geo	PL	13331
Cornaceae				
<i>Cornus australis</i> C.A. Mey.	FO	Pha	ES, IT	13332
Crassulaceae				
<i>Sedum hispanicum</i> L.	DH, FO	Hem	ES, M	13333
Euphorbiaceae				
<i>Crozophora tinctoria</i> (L.) Jus.	DH	Thr	ES, IT, M	13347
<i>Euphorbia amygdaloides</i> L.	FO	Cha	ES	13348
<i>Euphorbia helioscopia</i> L.	DH	Thr	ES, IT, M	13349
<i>Euphorbia maculata</i> L.	DH, SD	Thr	PL	13350
<i>Euphorbia peplus</i> L.	DH, FO	Thr	ES, IT, M	13351
Fabaceae				
<i>Albizia julibrissin</i> Durazz.	FO	Pha	ES (Eux-Hyr) China, Japan	13352
<i>Coronilla varia</i> L.	DH, FO	Hem	IT	13353
<i>Lathyrus aphaca</i> L.	WP	Thr	ES, IT, M	13354
<i>Lotus corniculatus</i> L. subsp. <i>corniculatus</i> var. <i>corniculatus</i>	SD	Hem	PL	13355
<i>Gleditschia caspica</i> Desf.	FO	Pha	ES (Hyr)	13356
<i>Medicago lupulina</i> L.	DH, SD, FO	Hem	PL	13357
<i>Medicago minima</i> (L.) L.	DH, SD	Thr	PL	13358
<i>Medicago polymorpha</i> L.	DH	Thr	IT, M	13359
<i>Melilotus officinalis</i> (L.) Desr.	DH, FO	Hem	PL	13360
<i>Pisum sativum</i> L.	DH	Thr	IT	13361
<i>Trifolium arvense</i> L.	DH	Thr	ES, M	13362
<i>Trifolium campestre</i> Schreb.	DH, SD	Thr	ES, IT, M	13363
<i>Trifolium repens</i> L.	PN, FO	Geo	ES, IT, M	13364
<i>Trifolium resupinatum</i> L.	PN, SD	Thr	ES, IT, M	13365
<i>Trifolium scabrum</i> L.	DH	Thr	ES, M	13366
<i>Vicia sativa</i> L.	DH, SD	Thr	ES, IT, M	13367
<i>Vicia tetrasperma</i> (L.) Schreb.	PN	Thr	ES, IT, M	13368
Gentianaceae				
<i>Centaurium tenuiflorum</i> (Hoffm. & Link) Fritsch	PN, SD	Thr	ES, IT	13369
Geraniaceae				
<i>Erodium cicutarium</i> (L.) L'Her.	DH	Hem	ES, IT, M	13370
<i>Geranium collinum</i> Steph. ex Willd.	FO	Thr	IT	13371
<i>Geranium dissectum</i> L.	PN, FO	Thr	PL	13372
<i>Geranium lucidum</i> L.	PN	Thr	PL	13373
<i>Geranium purpureum</i> Vill.	PN	Thr	ES, M	13374
<i>Geranium pyrenaicum</i> Burm. f.	PN, FO	Hem	PL	13375
Hammamelidaceae				
<i>Parrotia persica</i> (DC.) C.A. Mey.	FO	Pha	ES (Hyr)	13376
Hypericaceae				
<i>Hypericum androsaemum</i> L.	FO	Cha	ES (Eux-Hyr, IT)	13377
<i>Hypericum perforatum</i> L.	DH	Hem	PL	13378
Juglandaceae				
<i>Pterocarya fraxinifolia</i> (Lam.) Spach	PN, FO	Pha	ES (Eux-Hyr)	13380
Lamiaceae				
<i>Calamintha grandiflora</i> (L.) Moench	PN	Hem	ES	13384
<i>Mentha pulegium</i> L.	PN	Hem	ES	13385
<i>Origanum viridae</i> (Boiss.) Halacsy	FO	Hem	PL	13386
<i>Prunella vulgaris</i> L.	PN, SD	Geo	PL	13387
<i>Scutellaria tournefortii</i> Benth.	FO	Geo	ES (Hyr)	13388
<i>Teucrium hyrcanicum</i> L.	PN	Geo	ES (Hyr)	13389

Species	Habitat	Life Form	Chorology	Herbarium No.
Lythraceae				
<i>Lythrum hyssopifolia</i> L.	PN	Thr	PL	13392
<i>Lythrum salicaria</i> L.	Aq (Em-Hel)	Hel	PL	13393
Malvaceae				
<i>Abutilon theophrasti</i> Medicus	DH	Thr	PL	13394
<i>Alcea hyrcana</i> (Grossh.) Grossh.	FO	Thr	ES (Hyr)	13395
<i>Malva neglecta</i> Wallr.	DH	Thr	PL	13396
Meliaceae				
<i>Melia azedarach</i> L.	PN	Pha	ES, IT	13397
Moraceae				
<i>Ficus carica</i> L.	FO	Pha	IT, M	13398
<i>Morus alba</i> L.	FO	Pha	IT	13399
Onagraceae				
<i>Epilobium hirsutum</i> L.	SD, PN	Geo	PL	13400
Oxalidaceae				
<i>Oxalis corniculata</i> L.	WP	Thr	PL	13401
Orobanchaceae				
<i>Orobanche nana</i> Noë	PN	P	PL	13402
Papaveraceae				
<i>Papaver arenarium</i> M.B.	FO	Thr	ES, IT	13403
<i>Papaver dubium</i> L.	FO	Thr	ES, IT	13404
Phytolaccaceae				
<i>Phytolacca americana</i> L.	DH	Hem	PL	13405
Plantaginaceae				
<i>Plantago lanceolata</i> L.	DH, SD	Hem	ES, IT, M	13406
<i>Plantago major</i> L.	DH, SD	Hem	PL	13407
Polygonaceae				
<i>Polygonum aviculare</i> L.	DH, SD	Thr	PL	13435
<i>Polygonum convolvulus</i> L.	DH	Thr	PL	13436
<i>Polygonum hydropiper</i> L.	WP	Thr	ES, IT	13437
<i>Polygonum hyrcanicum</i> Rech. f.	PN, SD	Hem	ES	13438
<i>Polygonum lapathifolium</i> subsp. <i>lapathifolium</i>	WP	Thr	ES, IT	13439
<i>Polygonum persicaria</i> L.	WP	Thr	PL	13440
<i>Rumex sanguineus</i> L.	SD, PN	Hem	ES	13441
Portulacaceae				
<i>Portulaca oleracea</i> L.	DH	Thr	ES, IT, M	13442
Primulaceae				
<i>Anagallis arvensis</i> L.	PN, FO	Thr	PL	13445
Punicaceae				
<i>Punica granatum</i> L.	PN, FO	Pha	ES, IT	13446
Ranunculaceae				
<i>Batrachium trichophyllum</i> (Chaix) Bosch	Aq (Su)	Hyd	PL	13447
<i>Ranunculus arvensis</i> L.	DH	Thr	PL	13448
<i>Ranunculus cicutarius</i> Schlechtend.	PN	Geo	ES, IT	13449
<i>Ranunculus constantinopolitanus</i> (DC.) d'Urv.	FO	Hem	ES, IT	13450
<i>Ranunculus marginatus</i> d'Urv.	WP	Thr	PL	13451
<i>Ranunculus muricatus</i> L.	WP	Thr	IT, M	13452
<i>Ranunculus ophioglossifolius</i> Vill.	Aq (Em-Hel)	Thr	ES, IT, M	13453
<i>Ranunculus sceleratus</i> L.	Aq (Em- Hel)	Thr	PL	13454
Rhamnaceae				
<i>Paliurus spina-christi</i> Miller	FO	Pha	ES, IT, M	13455
Rosaceae				
<i>Crataegus meyeri</i> A. Pojark.	FO	Pha	ES, IT	13456
<i>Crataegus microphylla</i> C. Koch	FO	Pha	ES (Eux-Hyr, IT)	13457
<i>Geum urbanum</i> L.	PN	Hem	ES	13458
<i>Mespilus germanica</i> L.	FO	Pha	ES	13459

Species	Habitat	Life Form	Chorology	Herbarium No.
<i>Potentilla reptans</i> L.	PN, FO	Hem	ES, IT	13460
<i>Rosa boissieri</i> Crepin	FO	Pha	ES, IT	13461
<i>Rubus caesius</i> L.	PN, FO	Pha	ES, IT	13462
<i>Rubus dolichocarpus</i> Juz.	DH	Pha	ES, IT	13463
<i>Rubus grantii</i> Gilli	PN	Pha	ES (Hyr)	13464
<i>Rubus karakalensis</i> Freyn	PN	Pha	ES, IT	13465
<i>Rubus sanctus</i> Schreber	DH, FO	Pha	ES, IT	13466
Rubiaceae				
<i>Galium ghilanicum</i> Stapf	WP	Thr	IT	13467
<i>Galium odoratum</i> (L.) Scop.	PN, FO	Hem	PL	13468
<i>Galium tricoratum</i> Dandy	WP	Thr	IT, M	13469
<i>Oldenlandia hedyotoides</i> F. et M.	WP	Thr	M	13470
Scrophulariaceae				
<i>Kickxia commutata</i> (Rchb.) Fritsch subsp. <i>graeca</i> (Bory & Chaub) R. Fernandes	DH	Thr	PL	13471
<i>Parentucellia latifolia</i> (L.) Caruel subsp. <i>flaviflora</i> (Boiss) Hand.-Mtz.	PN	Thr	PL	13472
<i>Parentucellia viscosa</i> (L.) Caruel	PN	Thr	ES, IT	13473
<i>Rhynchosorys elephas</i> (L.) Griseb.	FO	Hem	ES	13474
<i>Verbascum punalense</i> Boiss. & Buhse	DH	Hem	ES, IT	13475
<i>Verbascum thapsus</i> L.	DH	Hem	ES	13476
<i>Verbascum</i> sp.	DH	Hem		13477
<i>Veronica anagallis-aquatica</i> L.	WP	Hem	PL	13478
<i>Veronica arvensis</i> L.	SD, WP	Thr	PL	13479
<i>Veronica persica</i> Poir.	DH, SD	Thr	PL	13480
<i>Veronica polita</i> Fries	DH, SD	Thr	PL	13481
Solanaceae				
<i>Datura innoxia</i> Miller	DH	Thr	PL	13483
<i>Datura stramonium</i> L.	DH	Thr	PL	13484
<i>Physalis alkekengi</i> L.	SD, PN	Geo	ES, IT	13485
<i>Solanum nigrum</i> L.	SD, DH	Thr	PL	13486
<i>Solanum persicum</i> Roemer & Schultes subsp. <i>persicum</i>	PN	Pha	ES, IT	13487
Urticaceae				
<i>Urtica dioica</i> L. subsp. <i>dioica</i>	DH	Hem	PL	13488
Verbenaceae				
<i>Phyla nodiflora</i> (L.) Greene	SD, PN, WP	Hem	PL	13489
<i>Verbena officinalis</i> L.	SD, DH	Hem	PL	13490
Violaceae				
<i>Viola alba</i> Bess. subsp. <i>sintenisii</i> (W. Becker) W. Becker	FO	Hem	ES (Hyr), IT	13491
Zygophyllaceae				
<i>Tribulus terrestris</i> L.	SD, DH	Thr	PL	13492
Monocotyledones				
Cyperaceae				
<i>Carex divulsa</i> Stokes subsp. <i>divulsa</i>	PN	Geo	PL	13334
<i>Cyperus difformis</i> L.	SD	Thr	PL	13335
<i>Cyperus dives</i> Del.	Aq (Em-Hel)	Hel	PL	13336
<i>Cyperus fuscus</i> L.	WP	Thr	PL	13337
<i>Cyperus imbricatus</i> Retz.	WP	Hel	ES, IT, M	13338
<i>Cyperus michelianus</i> L.	SD	Thr	PL	13339
<i>Cyperus pygmaeus</i> Rottb.	WP	Thr	PL	13340
<i>Cyperus rotundus</i> L.	DH	Geo	PL	13341
<i>Fimbristylis bisumbellata</i> (Forssk.) Bubani	WP	Thr	PL	13342
<i>Fimbristylis squarrosa</i> Vahl	SD	Thr	PL	13343
<i>Pycneus flavesense</i> (L.) R	SD, DH, WP	Geo	PL	13344

Species	Habitat	Life Form	Chorology	Herbarium No.
Dioscoraceae				
<i>Tamus communis</i> L.	FO	Geo	ES, M	13345
Juncaceae				
<i>Juncus acutus</i> L.	SD	Geo	PL	13381
<i>Juncus articulatus</i> L.	PN	Geo	PL	13382
<i>Juncus turkestanicus</i> V. Krecz. & Gontsch.	PN	Thr	IT	13383
Lemnaceae				
<i>Lemna minor</i> L.	Aq (Fl)	Hyd	PL	13390
Liliaceae				
<i>Ruscus hyrcanus</i> Woron.	FO	Pha	ES (Hyr)	13391
Poaceae				
<i>Alopecurus myosuroides</i> Huds. subsp. <i>myosuroides</i>	DH	Thr	PL	13408
<i>Avena sativa</i> L.	DH	Thr	PL	13409
<i>Briza minor</i> L.	DH	Thr	ES, M	13410
<i>Bromus commutatus</i> Schrad.	PN	Thr	ES, IT	13411
<i>Bromus japonicus</i> Thunb. var. <i>japonicus</i>	DH	Thr	PL	13412
<i>Bromus intermedius</i> Guss.	DH	Thr	IT	13413
<i>Bromus scoparius</i> var. <i>scoparius</i>	PN	Thr	ES, IT, M	13414
<i>Bromus tectorum</i> var. <i>tectorum</i>	DH	Thr	PL	13415
<i>Catabrosa aquatica</i> (L.) P. Beauv.	Aq (Em- Hel)	Hel	PL	13416
<i>Catapodium rigidum</i> (L.) C.E. Hubb.	SD	Thr	ES, IT, M	13417
<i>Cynodon dactylon</i> (L.) Pers.	DH, FO	Geo	PL	13418
<i>Dactylis glomerata</i> L.	FO	Hem	PL	13419
<i>Echinochloa crus-galli</i> (L.) P. Beauv. var. <i>crus-galli</i>	WP	Thr	PL	13420
<i>Eremopoa persica</i> (Trin.) Roshev.	PN	Thr	IT, M	13421
<i>Eleusine indica</i> (L.) Gaertn.	DH	Thr	PL	13422
<i>Hordeum spontaneum</i> C. Koch	DH	Thr	PL	13423
<i>Lolium rigidum</i> Gaudin	DH, SD	Thr	ES, IT, M	13424
<i>Lophochloa phleoides</i> (Vil.) Rchb.	PN	Thr	PL	13425
<i>Paspalum paspaloides</i> (Michx.) Scribner	PN	Geo	PL	13426
<i>Phleum paniculatum</i> Hudson var. <i>ciliatum</i> (Boiss.) Bor	PN	Thr	ES	13427
<i>Phragmites australis</i> (Cav.) Steud.	Aq (Em- Hel)	Hel	PL	13428
<i>Poa annua</i> L.	DH	Thr	PL	13429
<i>Poa trivialis</i> L.	PN, SD	Geo	PL	13430
<i>Polypogon fugax</i> Nees	WP, SD	Thr	PL	13431
<i>Polypogon monspeliensis</i> (L.) Desf.	DH	Thr	PL	13432
<i>Setaria glauca</i> (L.) P. Beauv.	WP, SD	Thr	PL	13433
<i>Vulpia myuros</i> (L.) C.C. Gmelin	DH, SD	Thr	IT, M	13434
Potamogetonaceae				
<i>Potamogeton crispus</i> L.	Aq (Su)	Hyd	PL	13443
<i>Potamogeton pectinatus</i> L.	Aq (Su)	Hyd	PL	13444
Smilacaceae				
<i>Smilax excelsa</i> L.	FO	Pha	ES, M	13482

Symbols and abbreviations used in the table:

1. Life form: Cha (chamaephyte), Geo (geophyte), Hel (helophyte), Hem (hemicryptophyte), Hyd (Hydrophyte), P (parasite), Pha (phanerophyte), Thr (therophyte); 2. Chorotype: ES (Euro-Siberian), Hyr (Hyrceanian elements), IT (Irano-Turanian elements), M (Mediterranean), PL (pluriregional); 3. Habitat and Ecology: Aq (aquatic habitats), Em (emergent plant), Fl (floating plant), FO (forest habitat), PN (plain habitat), DH (disturbed habitats), SD (sand dune), Su (submerged plant), WP (wet place habitat).

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