Buletinul Grădinii Botanice Iaşi
Tomul 14, 2007

THE FLORA OF "HERGHELIE MARSH" NATURAL RESERVE (CONSTANȚA COUNTY)

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Abstract: The paper's aim is to present the floristic inventory and the main vegetation types of Herghelie Marsh, a less-known Natural Reserve placed near Mangalia city, in the proximity of the Black Sea shore area. Some considerations about the life forms, phytogeographical elements, ecological categories and rare or threatened taxa within this eutrophic marsh are also presented.

Key words: flora, Herghelie marsh, Natural Reserve, vegetation types, rare and threatened taxa.

Introduction

Herghelie Marsh is situated in the south of the Dobrudja plateau, near Mangalia city, between Venus and Saturn resorts [13] (**Fig. 1**), in the proximity of the Black Sea shore. It is a former maritime gulf, turned into lagoon and subsequently separated from the sea through maritime sands. The actual marsh surface is 98 hectares [13]. This marsh has a Natural Reserve status (botanic and ornithological) beginning with December 8th, 2005.

The specific of this eutrophic marsh flora and vegetation, the diversity of habitats and plant communities have called botanists' attention since ancient times. In spite of this, the floristic and phytocoenological researches are very few. The last detailed study regarding this area is more than thirty years old. In 1977, Pop & Hodisan [8] mentioned 63 vascular plant taxa and 9 plant associations in the marsh area.

In the last thirty years, the flora and vegetation of this area have undergone many changes, as a result of the anthropogenic impact, but also a natural succession of vegetation. That is why, we have proposed to update the floristical knowledge of this recent Natural Reserve.

Material and Methods

The plant species nomenclature follows the "Flora Europaea" [11, 12], "Flora ilustrată a României" [1] and "Flora României" [9]. Field studies have been done in the period 2005-2006, during the entire vegetation season, in order to capture all the phenology stages.

The establish of the life forms, phytogeographic elements and ecological categories - in dependence of moisture (U), temperature (T) and soil reactivity (R), has been made on the basis of "Flora ilustrată a României" [1] and "Conspectul florei cormofitelor spontane din România"[9].

The studied area included the water surface, the marsh banks and the neighboring higher surfaces.

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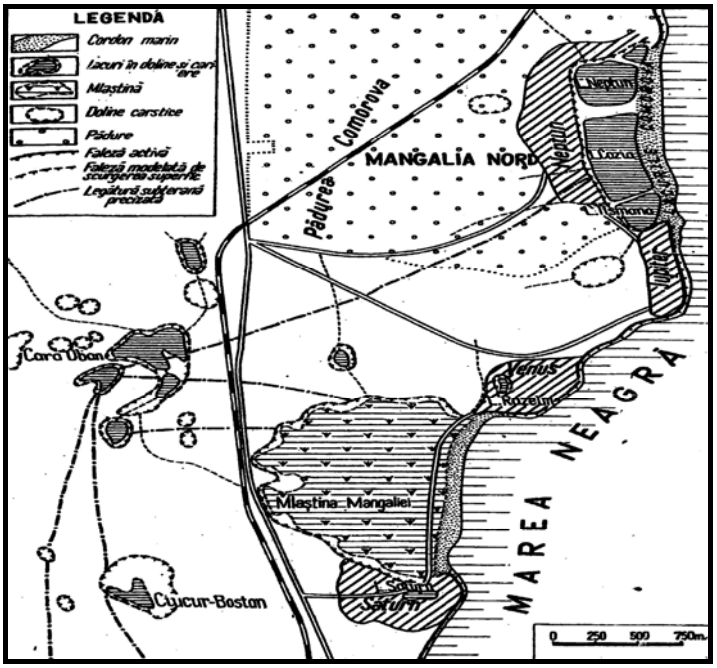

Fig. 1 The detailed map of Herghelie marsh Natural Reserve

Results and discussions

The following vegetation types have been observed within Herghelie Marsh Natural Reserve:

- fixed or floating hydrophylous plant communities;
- paludous vegetation, composed of hygrophilous plants, with a large distribution around the marsh banks or within the islands;
- meso-halophylous plant communities, placed on the lightly salty and moderately wet soils;
- xero-mesophylous vegetation, on the higher surfaces from the marsh proximity, composed especially of xerophylous weeds;

In the studied area we have identified 134 taxa, from which, 132 vascular plants and two macrophytic algae. However, the floristic conspectus contains other 16 plant taxa mentioned by Pop & Hodișan [8], but not recovered by us. These taxa have not been takes into consideration in the drafting of life forms, floristic elements and ecological categories spectrums.

The identified vascular taxa are the follows: *Aegilops cylindrica* Host.– Th, Eua (Cont), U1,5 T3 R0; *Alisma plantago-aquatica* L. – HH (Hd), Circ, U6 T0 R0; *Althaea officinalis* L. ssp. *officinalis* – H, Eua (Cont), U3 T4 R4; *Anagallis arvensis* L. – Th, Cosm, U3 T3,5 R0; *Anthriscus caucalis* Bieb. – Th, Pont-Med, U2 T4 R0; *Anthriscus cerefolium* (L.) Hoffm. – Th, Pont-Med, U2,5 T4 R4; *Apium graveolens* L. – TH, Atl-Med; U1,5 T4 R4,5; *Arctium lappa* L. – TH, Eua (Med), U3,5 T3 R4; *Artemisia absinthium* L. – Ch-H,

Eua (med); U2 T3 R4; *Artemisia vulgaris* L. – H, Circ, U2,5 T3 R4; *Aster tripolium* L. ssp. *pannonicus* (Jacq.) Soo – H, Pont-Pan, U5 T0 R5; *Atriplex prostrata* Boucher ex DC. – Th, Circ, U3,5 T0 R0, 2n = 18; *Avena fatua* L. – Th, Eua (Cont), U2,5 T0 R4; *Avena sativa* L. – Th, Eua; *Ballota nigra* L. – H, Med-Euc, U2 T3,5 R4; *Berula erecta* (Huds.) Coville [8] – H (HH), Circ, U6 T3 R0; *Bidens tripartita* L. – Th, Eua, U4,5 T3 R0; 2n = 48; *Scirpus maritimus* L. – G (HH), Cosm, U4,5 T3 R5; *Bromus squarrosus* L. – Th, Eua (Cont), U1,5 T4 R4; *Bromus sterilis* L. – Th, Eua (Med), U2 T4 R4; *Calamagrostis epigeios* (L.) Roth – G, Eua (Med), U2 T3 R0; *Carduus nutans* L. – TH, Eua (Med), U1,5 T3 R3; *Carex acuta* L. [8] – G (HH), Circ, U5 T3 R0; *Carex distans* L. – H, Eua (Med), U4 T3 R4; *Carex extensa* Good. – H, Atl-Med, U4 T3 R4,5; R [2, 5]; *Carex riparia* Curtis [8] – G (HH), Eua, U5 T4 R4; *Carthamus lanatus* L. – Th, Pont-Med; U2,5 T4 R0; *Centaurea solstitialis* L. – TH, Med, U2 T4 R0; *Ceratophyllum demersum* L. – HH (Hd), Cosm, U6 T3 R0; *Ceratophyllum submersum* L – HH, Eua (med); U6 T3,5 R0; *Epilobium angustifolium* L. – H, Circ; U4 T1,5 R0; *Cichorium intybus* L. – H, Eua, U3 T0 R3; *Cicuta virosa* L. – HH, Eua; U5 T0 R3; *Cirsium arvense* (L.) Scop. – G, Eua (Med), U2,5 T3 R0; *Cladium mariscus* (L.) Pohl – HH, Cosm, U6 T0 R5; *Conium maculatum* L. – Th-TH, Eua, U3 T3 R3; *Convolvulus arvensis* L. – H (G), Cosm, U2,5 T3,5 R3,5; *Conyza canadensis* (L.) Cronq. – Th, Adv (Am. N.), U2,5 T0 R0; *Coronilla varia* L. – H, Euc (Med), U2 T3 R4; *Crepis foetida* L. ssp. *rhoeadifolia* (Bieb.) Celak. – Th, Pont-Med, U2,5 T3,5 R3; *Cuscuta campestris* Yuncker ssp. *campestris* – Th, Adv (Am N.), U3 T3 R0; *Cynodon dactylon* (L.) Pers. – G (H), Cosm, U2 T3,5 R0; *Daucus carota* L. ssp. *carota* – TH, Eua (Med), U2,5 T3 R0; *Descurainia sophia* (L.) Webb ex Prantl – Th, Eua, U2,5 T4 R4; *Diplotaxis muralis* (L.) DC. – Th, Med, U2,5 T4,5 R4,5; *Echinochloa crus-galli* (L.) Beauv. – Th, Cosm, U4 T0 R3; *Echinochloa crus-galli* f. *oryzoides* – Th, Cosm, U4 T0 R3; *Elaeagnus angustifolia* L. – Ph (arbore), As. temp; *Elymus elongatus* (Host.) Runemark ssp. *elongatus* – H, Pont-Med, U3 T4 R4,5; *Elymus hispidus* (Opiz) Melderis ssp. *hispidus* – G, Eua (Cont), U2 T4,5 R4; *Elymus repens* (L.) Gould – G, Circ, U0 T0 R0; *Epilobium hirsutum* L. [8]– H, Eua (Med), U4 T3 R3; *Epilobium parviflorum* Schreber – H, Eua, U5 T3 R4,5; *Epilobium tetragonum* L. ssp. *tetragonum* – H, Eua (Med), U4,5 T3 R0; *Erodium cicutarium* (L.) L Her. – Th, Cosm, U2,5 T0 R0; *Eupatorium cannabinum* L. – H, Eua, U4 T3 R3; *Festuca arundinacea* Schreber ssp. *arundinacea* – H, Euc, U4 T3 R4; *Galega officinalis* L. – H, Pont-Med, U4,5 T3 R4; *Galium palustre* L. – H, Circ, U5 T3 R0; *Glyceria maxima* (Hartman) Holmberg – H (HH), Circ, U5 T3 R4; *Gypsophyla perfoliata* L. [8] – Ch, Pont, U1,5 T4 R5; *Heraclerum sphondylium* L. [8] - H, Eua; U3 T2,5 R5; *Hordeum murinum* L. ssp. *murinum* – Th, Eua (Med), U2,5 T4 R0; *Hypericum perforatum* L. – H, Eua, U3 T3 R0; *Iris pseudacorus* L. [8] – G, Eur; U5,5 T0 R0; *Juncus gerardi* Loisel – G, Circ, U4,5 T3 R5; *Lactuca aurea* (Sch.) Stebbins [8] – H, Balc; U2 T4 R4,5; *Lactuca tatarica* (L.) C.A.Mey – H, Eua (Cont), U0 T4 R4,5; *Lathyrus pratensis* L. – H, Eua; U3 T0 R4; *Lathyrus tuberosus* L. – H, Eua (Med), U2 T4 R4; *Lemna minor* L. – HH (Hd), Cosm, U6 T3 R0; *Lemna trisulca* L. – HH (Hd), Cosm, U6 T3 R4; *Linaria genistifolia* (L.) Miller ssp. *genistifolia* – H, Eua (Cont), U1 T3,5 R5; *Lolium perenne* L. – H, Cosm, U3 T3 R0; 2n = 14; *Lotus corniculatus* L. – H, Eua, U2,5 T0 R0; *L. glaber* Miller – H, Eua (Med), U3,5 T3 R4; *Lycopus europaeus* L. – H (HH), Eua, U5 T3 R0; *Lycopus exaltatus* L. fil. [8] – H (HH), Eua (Cont), U5 T3 R0; *Lysimachia vulgaris* L. [8] – H (HH), Eua, U5 T2 R0; *Lythrum salicaria* L. – H, Circ; U4 T2,5 R0; *Lythrum virgatum* L. – H, Eua (Cont), U4,5 T3,5 R4; *Malva sylvestris* L. ssp. *sylvestris* – TH (H), Eua (Cosm), U3 T3 R0; *Matricaria chamomilla* L. – Th, Eua (Med), U2,5 T3,5 R5; *Medicago lupulina* L. – TH(H), Eua, U2,5 T3 R4; *Medicago minima* (L.) L. – Th, Eua (Med), U1,5 T4 R4; *Medicago sativa* L. – Ch-H, Eua (cont); U2 T3 R5; *Melilotus alba* Medik. – Th, Eua, U2,5 T3 R0; *Melilotus*

officinalis Lam. – Th, Eua, U2,5 T3,5 R0; *Mentha aquatica* L..– H (HH), Eur, U5 T3 R0; *Miosoton aquaticum* (L.) Moench. [8] – Th (TH), Eua (Med), U4 T3 R0; *Myosotis scorpioides* L. – H, Eua, U5 T3 R0; *Myriophyllum spicatum* L. – HH (Hd), Circ, U6 T0 R4,5; *Najas marina* L. – HH, Cosm; U6 T4,5 R4,5; *Oenanthe aquatica* (L.) Poiret – HH (Hd), Eua, U6 T3 R0; *Oenothera biennis* L. – TH, Adv (Am N.), U2 T4 R0; *Onopordum acanthium* L. – TH, Eua (Med), U2,5 T4 R4; *Papaver rhoeas* L. - Th, Cosm, U3 T3,5 R4; *Pastinaca sativa* L. [8] – TH-H, Eua; U3 T4 R4; *Phragmites australis* (Cav.) Steudel ssp. *australis* var. *australis* – HH, Cosm, U6 T0 R4; *Plantago lanceolata* L. – H, Eua, U3 T0 R0; *Plantago major* L. ssp. *major* – H, Eua, U3 T0 R0; *Plantago media* L. – H, Eua, U2,5 T0 R4,5; *Poa palustris* L. – H, Circ, U5 T4 R2; *Polygonum amphibium* L. - HH, Cosm, U6 T3 R0; *Polygonum aviculare* L. – Th, Cosm, U2,5 T0 R3; *Polygonum hydropiper* L. – Th, Circ, U5 T3 R4; *Polygonum lapathifolium* L. ssp. *lapathifolium* - Th, Cosm, U4 T0 R3; *Polygonum maritimum* L. [8] – H, Med, U2 T4,5 R5; *Polygonum mit*e Schrank – Th, Eur (Med), U5 T3 R4; *Polypogon monspeliensis* (L.) Desf. – Th, Med, U4 T4 R5; R [2, 6]; *Populus x canadensis* Moench s.l. (*P. deltoides* x *P. nigra*) – Ph, Canada; *Populus nigra* L. – Ph, Eua; U4 T3 R4; *Potamogeton pectinatus* L. – HH, Cosm; U6 T3 R4,5; *Puccinellia distans* (L.) Parl. ssp. *distans* – H, Eua (Cont), U0 T0 R4; *Puccinellia gigantea* Grossh. – H, Pont-Med, U0 T4 R5; *Pulicaria dysenterica* (L.) Bernh. – H, Euc, U3,5 T3 R4; *Ranunculus aquatilis* L. ssp. *aquatilis* [8] - HH (Hd), Cosm, U6 T4 R0; *Rorippa amphibia* (L.) Besser [8] – HH, Eua (Med); *Rubus caesius* L. – Ph, Eur, U4,5 T3 R4; *Rumex conglomeratus* Murray [8] – H, Eua (med); U4 T4 R4; *Rumex crispus* L. – H, Eua, U4 T3 R0, 2n = 60; U4 T3 R0; *Rumex obtusifolius* L. ssp. *obtusifolius* – H, Eur.; U4 T0 R3; *Rumex palustris* Sm. – Th -TH, Eua, U5 T3 R4; *Ruppia maritima* L. – HH (Hd), Cosm, U6 T3 R4,5; V/R [6]; *Salix fragilis* L. – Ph, Eua; U5 T3 R4; *Scabiosa ochroleuca* L. – H, Eua (Cont), U2 T4 R4; 2n = 16; *Scirpus lacustris* L. – HH, Cosm, U6 T3 R4; *Scirpus tabernaemontani* C. Gmel. – G (HH), Eua, U5 T3 R4; *Senecio vernalis* Waldst. et Kit. – Th, Eua (Cont), U2,5 T4 R0; *Sium latifolium* L. – HH, Eua, U6 T0 R4; *Solanum dulcamara* L. – Ch, Eua (Med), U4,5 T3 R4; *Sonchus arvensis* L. ssp. *arvensis* – G, Cosm, U3 T0 R0; *Stachys palustris* L. – H, Circ, U4 T3 R4; *Stellaria media* (L.) Vill. – Th, Cosm, U3 T0 R0; *Tamarix tetrandra* Pallas ex Bieb. – Ph, Eur SE şi As SV; *Taraxacum officinale* Weber et Wiggers – H, Eua (Cosm), U3 T0 R0; *Torilis arvensis* ssp. *arvensis* (Huds.) Link. – Th, Euc (Med), U2,5 T3,5 R4; *Trifolium angustifolium* L. – Th, Med; U1,5 4,5 R4; R [5], I/E [2]; *Trifolium fragiferum* L. ssp. *fragiferum* – H, Eua, U3 T3 R5; *Trifolium hybridum* L. ssp. *hybridum* – H, Eur; U3,5 T3 R4; *Trifolium pratense* L. ssp. *pratense* – H, Eua, U3 T0 R0; *Trifolium repens* L. ssp. *repens* – H, Eua, U3,5 T0 R0; *Tripleurospermum inodorum* (L.) Sch. Bip. – Th-TH, Eua; U0 T0 R3,5; *Typha angustifolia* L. – G (HH), Cosm, U6 T4 R0; 2n = 30; *Typha latifolia* L. – G (HH), Cosm, U6 T3,5 R0; *Typha laxmanni* Lepechin – G (HH), Eua (Cont), U5 T4 R0; *Vicia cracca* L. – H, Eua, U3 T0 R3; *Xanthium strumarium* ssp. *italicum* (Moretti) D.Love – Th, Adv, U3,5 T4 R0; *Zannichellia palustris* L. ssp. *palustris* – HH, Cosm; U6 T0 R4. The following macrophytic algae species have been found : *Cladophora glomerata* and *Spyrogyra communis.*

The life forms spectrum (**Fig. 2**) shows the high percentages of hemicryptophytes (33,33%), hydro-helophytes (19,04%) and geophytes (8,16%), biological forms which confer the general aspect of the marsh vegetation. The terophytes (26,53%) and hemitherophytes (6,80%) which totalize 33,33%, fill in the gapped spaces between the perennial plant communities. The phanerophytes (4,08%) and chamaephytes (2,04%) are represented by some tree and bush species, planted in the eastern part of the marsh, within the recreational area.

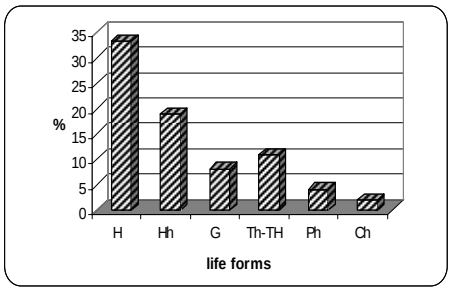

Fig. 2 The life forms spectrum

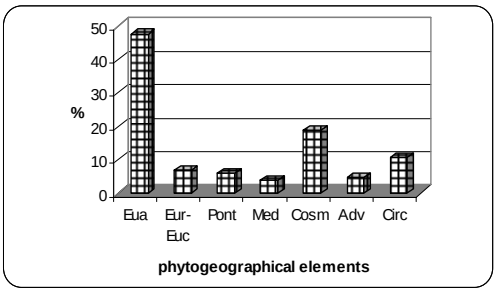

Fig. 3 The phytogeographical elements spectrum

Among the phytogeographical elements, the Eurasian species (47,71%), Cosmopolite ones (18,93%) and Circumpolar elements (10,60%) are prevalent. Other categories (Pontic – 6,06%, Adventive – 4,54%, European – 3,78%, Central-European – 3,03%, Mediteranean – 3,78% and Atlantic-Mediteranean – 1,51%) have lower percentages (**Fig. 3**). The numerous Cosmopolite, Circumpolar and Adventive species are due to the homogenous microclimate of the hygrophilous and hydrophilous plant communities and to the human influences within the marsh area as well.

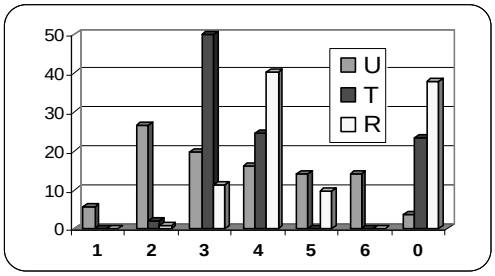

Fig. 4 The ecological categories spectrum

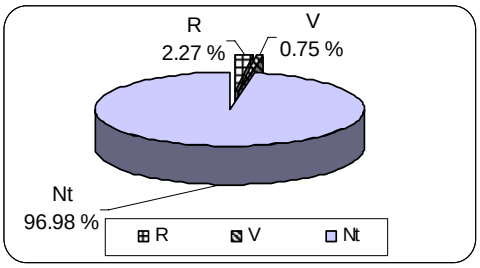

Fig. 5 The rate of rare and threatened taxa

The ecological categories spectrum (**Fig. 4**) show the high total percentages of mesophylous (19,71%), hygrophilous (14,08%) and hydrophilous plants (14,08%), higher than the xero-mesophylous (26,76%) and xerophylous plants (5,63%), spreading especially on the dry surfaces from marsh purlieus. Remarkable are also the mesotherme (50%) and light acid-neutrophile species (**Fig. 4**).

Herghelie marsh flora is remarkable especially through its high diversity and not so much through conservation value of flora. In the studied area we have identified only four rare or vulnerable taxa, in accordance with the Romanian Red lists [2, 5, 6]*: Carex extensa* (R), *Polypogon monspeliensis* (R) , *Trifolium angustifolium* (R) and *Ruppia maritima* (V/R); the rate of these taxa (3,03%) is presented in **Fig. 5**. The rest of plant species (96,98 %) are not threatened (Nt).

Conclusions

- As a result of the field studies, we have identified 132 vascular taxa and two macrophytic algae within Herghelie Marsh area. Compared to the floristic inventory made by Pop & Hodişan, we described 69 more plant taxa from the studied area.
- Among the biological forms, the hemicryptophytes, hydro-helophytes and geophytes are prevalent (60,53%), in comparison with yearly species (therophytes and hemitherophytes) and tree or bush species (phanerophytes and chamaephytes).
- The numerous Cosmopolite, Circumpolar and Adventive plants, may be explained through the specific microclimate of marsh biotopes and also through pregnant anthropogenic influences within the marsh area, placed in the proximity of the sea, between two well-known resorts.
- In comparison with older bibliographical data, we have observed a pronounced ruderalization process of the vegetation, most likely due to the anthropogenic influences from this touristic zone. These negative influences will probably be diminished in the future, because of the new Natural Reserve status of this swampy area.

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