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Research Article

NEW CONTRIBUTIONS TO VEGETATION KNOWLEDGE OF THE DANUBE DELTA, ROMANIA (I)

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Abstract: New investigations on the flora, vegetation, and natural habitats of the Danube Delta (Romania) were recently carried out. Thus, more than 1,200 vascular plant species were inventoried, phytocoenoses of 253 plant communities, and 32 Natura 2000 habitats were recorded, all mapped on a large scale.
As part of the reviewing process of the Standard Form of the Natura 2000 site ROSCI0065 Danube Delta - Romania, the natural habitats included within it were also revised. Thus, it was found that black alder forests were omitted, which was one the purposes of this work, namely to fill this gap.
Following the recordings of all black alder forests in the Danube Delta, a phytocoenotaxon is proposed as new for science, namely Ass. *Periploco graecae-Alnetum glutinosae* ass. nov.
The Natura 2000 habitat in the Danube Delta that include this newly proposed plant community is: 91E0* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*).

Key words: *Alnus glutinosa*, Natura 2000 habitats, new coenotaxon, *Periploca graeca*, Romania.

Introduction

As a result of the many surveys on the flora and vegetation of the Danube Delta, Romania, more than 1,200 vascular plant species [DIHORU & NEGREAN, 1976a; CIOCÂRLAN, 1994, 2011; DOROFTEI & al. 2011] and 157 plant communities [SIMON, 1960; DIHORU & NEGREAN, 1975, 1976b; POPESCU & al. 1997; SÂRBU, 2002] have been inventoried so far.

However, new phyto- and coenotaxa are still being identified, or new plant communities are being proposed for science.

Thus, in addition to those already inventoried plant communities so far, phytocenoses of another 96 plant communities were identified [Revision of the Management Plan ..., 2014-2021]. Those 253 plant communities identified so far are assigned to 32 natural habitats (it should be noted that a complete inventory of the existing natural habitats in the Danube Delta, with the allocation of plant community's characteristic of each natural habitat, has not been yet published).

Under provisions of the Article 17 of the Habitats Directive 92/43/EEC, each Member State must report each six years to the European Commission "on the measures taken under this Directive..." and the conservation status of both plant species and natural habitats on their territories [European Commission, Council Directive 92/43/EEC, 1992]. Thus, by analyzing the

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respective plant species, as well as the habitats within the Standard Form of ROSCI0065 Danube Delta, it was found that the black alder forests were completely omitted [Formularul Standard al ROSCI0065 Delta Dunării, 2008].

Alnus glutinosa (L.) Gaertn. (Syn. *Betula alnus* L. var. *glutinosa* L.), black alder or common alder, is a tree (Ph as life form) to 20 m high, flowering in March-April in Romania. It is frequently distributed across the country, from the pedunculate oak zone to the sessile oak zone, along the rivers, as isolated trees or in stands, sometimes growing in eutrophic swamps. It could be defined as a mesotrophic, hygrophyllous, and heliosciophyle species. The black alder prefers humid places, with groundwater on the surface, rich in humus and mineral substances, characterized by short-term floods and with as little amplitude as possible of the water level during floods [DRAGOMIR & BĂRBAT, 1961; LEANDRU, 1971]. It belongs to the alliances *Alnion glutinosae* or *Alno-Padion*, and class *Alnetea* [SANDA & al. 1980] or to alliance/suballiance *Alnion glutinosae/Alnenion glutinoso-incanae* [CHIFU & al. 2006; CHIFU & IRIMIA, 2014].

Distribution in Romania: *A. glutinosa* is natural distributed in historical provinces of Transylvania, Sătmar-Maramureş, Crişana, Banat, Oltenia, Muntenia, Moldavia, Bukovina, and Dobrogea [COLDEA & URSU, 2016] - from 1-2 m a.s.l. as minimum altitude to 1,250 m a.s.l. as maximum altitude in Southern Carpathians [GEORGESCU, in: SĂVULESCU, 1952].

The presence of the black alder in the Danube Delta, Romania, must be related to the smaller variations in the water level. The trees grow there on the high mounds, where the water is maintained for a large part of the year, their growth being quite vigorous [LEANDRU, 1970, 1971].

It should be mentioned that the marshes with black alder in the Danube Delta are part of a group of periodically flooded phytocoenoses [POPESCU & al. 1997].

According to MUNTEANU & CURELARIU (1996), surface deposits of *Alnus glutinosa* sites in the Danube Delta, are as follows:

- inside of the Nature Reserve "Arinişul Erenciuc" and along the right side of the Sf. Gheorghe arm: clay-loamy, loamy-clay (32-60% clay content), weakly carbonate, of fluvial and fluvial-lakes deposits; organic stratifications (sometimes marly) are frequently present in the low areas; the presence of peat deposits between 20 and 50 cm thick is indicated in several places;

- inside of the "Gârla Turcească" area: clayey, fluvial carbonate, and fluvial-lacustrine deposits, sometimes with thin sandy or organic stratifications (<10 cm thick).

It has been found that black alder trees within the Danube delta prefers poor freshwater habitats, settling on mollic/histic sandy soils, and constant high-water tables [HANGANU & al. 1994].

To mention, the Danube Delta itself, on the territory of Romania, covers an area smaller than the entire Danube Delta Biosphere Reserve [GÂŞTESCU & al. 2006]. The distribution area of black alder within the Danube Delta includes only the maritime delta, east of the Periprava-Crişan-Crasnicol line.

Study area

The study area is the Danube Delta (Romania), which is entirely made up of the Danube River, one of the most important European waterways. The Danube River flows into the Black Sea through a delta, situated in the north-western part of the Black Sea, between 44º25' and 45º30' northern latitude and 28º45' and 29º46' eastern longitude, being bordered by the Bugeac Plateau to the north and by the Dobrogea orogenic area to the south. The Danube Delta is one

of the main elements of the Danube River - Danube Delta - Black Sea Geosystem. This delta can be divided into three major depositional systems, as they are: delta plain, delta front, and prodelta [PANIN, 1989; PANIN & RĂDAN, 2011].

The delta plain is separated into 2 large parts by an old chain of littoral cordons (today the large sandy islets of Letea, Caraorman, etc., which mark a former coastline – Periprava-Crişan-Crasnicol), in: 1) fluvial delta (upstream) and 2) maritime delta (downstream). The fluvial delta is more developed and older (among other reasons, it has well-developed reed swamps), while the maritime delta is younger, sandier, having a higher saline potential [HANGANU & al. 2002].

Climate

The climate of the Danube Delta (according to the meteo station of Sulina town) is excessively continental-temperate [PAŞCOVSCHI & DONIŢĂ, 1967] or of the so-called "dry steppe" [DONIŢĂ & IVAN, 1992].

The meteorological station of Sulina is placed at an altitude of 3 m a.s.l. (above sea level); thus, the average annual temperature is 11.1 °C, while the quantity of precipitations is of 359 mm/year, respectively. The number of recorded years is 61 for temperatures and 55 for precipitations [PAŞCOVSCHI & DONIŢĂ, 1967; PAŞCOVSCHI, 1976-1977].

Materials and methods

Data collection

The aquatic and terrestrial vegetation research was performed in several points of the Danube Delta during the summers of 2020 to 2024. They consisted in field trips, on which occasion there were made relevés within varied phytocoenoses. Also, all the peculiarities of the vegetation encountered on the field were recorded. Phytosociological relevés were made in the field following the methodology of Central European Zürich-Montpellier School; the field data were processed in the laboratory, according to the principles of the same Central-European floristic-sociological criteria to characterize the floristic composition of plant communities [BRAUN-BLANQUET, 1964].

The similar phytocoenoses were grouped in synthetic tables based on which were achieved the description of the vegetation considering several features, as: chorology, floristic composition and synmorphology, synecology, syndynamics, coenotaxonomy, importance, conservative value, and so on. The hierarchical syntaxonomy and syntaxon nomenclature is according to COLDEA & al. (2012, 2015, 2017).

The nomenclature of plant species follows the opera *Flora Europaea* [TUTIN & al. 1964-1980, 1993], Euro+Med Plant bases [https://ww2.bgbm.org/EuroPlusMed/PtaxonDetail …; europlusmed.org/cdm_dataportal/taxon …], and a field identification book [SÂRBU & al. 2013].

The authors' abbreviation of the Latin names of vascular plants in paper followed, in this work, BRUMMITT & al. (1992).

The new syntaxon was named taking into account the provisions of the International Code of Phytosociological Nomenclature [WEBER & al. 2000].

The maps were designed on a raster downloaded for free from the internet [https://www.geamap.com/en/ ...]. Some of the geographical maps were made with the help of the unmanned aerial vehicles (UAV)/aerial drones, which flew at low altitudes (between 50 m and 100 m).

Indices of soil moisture (humidity=U), air temperature (T), and soil reaction (*p*h, R) were given following certain works dealing with the indices of ecological characteristics of the wild vascular plant species of Romania [SANDA & al. 1983; SÂRBU & al. 2013].

Aim of the study

The purposes of this study are as follow: i) to demonstrate, once again, that *Alnus glutinosa* is present in the Danube Delta, Romania, and this species has been forming well-structured forests for decades in the lower part of the maritime delta, ii) to inform scientists, authorities responsible for biodiversity management and conservation, as well as the public or interested tourists, about the entire distribution of black alder (*Alnus glutinosa*) within the Danube Delta, and iii) to propose a new phytocoenotaxon for science, which includes black alder (*Alnus glutinosa*) plant communities, constantly accompanied by the silkvine (*Periploca graeca*), communities distributed exclusively on the territory of the Danube Delta.

Results and discussion

Black alder (*Alnus glutinosa*) is a native species to almost all continental Europe (except for the extreme North and South), the United Kingdom, and Ireland [https://europlusmed.org/cdm_dataportal/taxon/…]. Its range in Asia includes Turkey, Iran, and Kazakhstan; in North Africa, it is found in Tunisia, Algeria, and Morocco [GEORGESCU, in: SĂVULESCU, 1952].

Black alder is pretty common spread in the hilly and submontane-montane areas of Romania [GEORGESCU, 1952]. But, the plant communities dominated by black alder are frequently distributed in valleys along rivers and streams in hilly and submontane areas, being grouped in Ass. *Stellario nemorum-Alnetum glutinosae* Lohmeyer 1957 [COLDEA & URSU, 2016].

Although black alder is a common species in the vegetation belts mentioned above, in the plain area of Romania it is a fairly rare species, being cited as such in:

- fragmentary in the Muntenia Plain - in Chitila forest, Ilfov County, along the numerous meanders that the Colentina River makes there [SANDA & POPESCU, 1972; POPESCU & al. 1984], being considered as a scientific curiosity over there, with the trees growing on high mounds, around which the water never dries up [PAȘCOVSCHI & LEANDRU, 1958];
- in the forests of Frasinu and Spătaru, Buzău County [SANDA, 1970];
- small patches of black alder (grouped in Ass. *Alnetum glutinosae* Meijer-Drees 1936, in orig.) are found scattered in the Tecuciului Plain, as part of the northeastern Romanian Plain, along the banks of the Siret River, close to Cosmeşti-Vale and Cosmeşti-Deal villages, Galaţi county [MITITELU & al. 1993];
- along the lower part of the Siret River, in Galaţi and Vrancea Counties [MONAH, 2001].

Although *Alnus glutinosa* has also been cited in other areas of the Steppic Bioregion, sensu Habitat Directive EUR 27 of the European Union [INTERPRETATION MANUAL …, 2007], such as they are along the Colentina River, on the banks of the Siret River, or the forests of Frasinu and Spătaru and so on, black alder forms true groves, so characteristic on the embankments of the Danube River, in fluvial-maritime section of the Danube Delta, which presents a series of particularities as will be seen below.

A. On the fluvial-maritime sand islets

On the fluvial-maritime sand islet of Letea, in the northern part of it, towards the Chilia arm, between the villages of C. A. Rosetti (former Satu Nou), Letea, and Periprava, *A. glutinosa* enters the composition of the stands with naturally established species, which together form the "Hasmacul Mare" forest body. The low percentage of black alder existing today in the composition of that forest is explained by the gradual extraction of many trees by the inhabitants of the neighboring settlements, the bark being highly sought after for dyeing fabrics, and the wood for the construction of small boats, houses, and furniture [DRAGOMIR & BĂRBAT, 1961]. Another reason for the rarity of black alder on the fluvial-maritime sand islets is the presence of so-called "wild horses", who eats the bark especially in the winter season, so the trees dry out over time.

B. On the fluvial sand islets

The black alder has also settled naturally on the fluvial sand islets formed on both banks of the Sf. Gheorghe arm, in the downstream area, towards its discharge into the Black Sea, over a length of about 20 Km, where the amplitude of the water level during floods registers the minor variations. The first natural grove of black alder appeared on the low fluvial, left bank, of the Sf. Gheorghe arm, at Km 20, in the southeastern part of the Erenciuc Lake. At this point, the black alder forms pure stands as a floodplain, riparian forests. Thus, a nature reserve was designated, called "the Forestry reserve Arinișul Erenciuc", with an area of 50 ha [LAW No. 5 …, 2000], the trees being about 110 years old and average diameters between 28 and 50 cm, and average heights between 10 and 20 m; the consistency of the stand is between 0.7 and 0.9, with an average increase of about 8 m^3/year/ha; it is mentioned that current trees derive from shoots due to the exploitation of the initial trees, all of which originated from seeds [INCEF, 1960].

It is worth noting that due to the very low terrain in front of the Erenciuc Lake (2.5 hydro-degrees), the specimens of black alder developed adventive roots (as pneumatophores, more or less), which caught the annually deposited sediments, fixing themselves in the soil like giant stools placed on the ground. It was mentioned that downstream from the Erenciuc stand, there are isolated specimens or small clumps of black alder, aged up to 80 years, scattered among the specimens of white willow (*Salix alba* subsp. *alba*), grey willow (*Salix cinerea*), crack willow (*Salix fragilis*), almond willow (*Salix triandra*), the narrow-leaved ash (*Fraxinus angustifolia* subsp. *oxycarpa*), downy ash (*Fraxinus pallisae*), alder buckthorn (*Frangula alnus*), etc., located on the very low sand islets, of more recent formation, on both banks of the Sf. Gheorghe arm, until close to its discharge into the Black Sea [DRAGOMIR & BĂRBAT, 1961].

The locations already mentioned with *Alnus glutinosa* from the Danube Delta are: Letea forest [KANITZ, 1879-1881; BRÂNDZĂ, 1898]; Caraorman forest [PRODAN, 1923]; along the Danube River [PRODAN, 1935]; Erenciuc [PAȘCOVSCHI & LEANDRU, 1958; LEANDRU & al. 1960; DONIȚĂ & IVAN, 1992; MITITELU & al. 1997]; Sf. Gheorghe [MITITELU & al. 1968]; North of Cardon [ȘTEFUREAC & MOHAN, 1969]; "Hasmacul Mare" forest on Letea Sand Islet [IANCULESCU, 1970; DONIȚĂ & IVAN, 1992]; Sulina (without an exact distribution inhere) [DIHORU & NEGREAN, 1976a] (Figure 1 - black dots). In the last years there were identified new locations with black alder within the Danube Delta (Figure 1 - red rhombic signs), as they are: around Erenciuc lake (Figure 2), nearby and inside of "Cotu Ivancea" - on the right side of Sf. Gheorghe arm, along Sf. Gheorghe arm toward Sf. Gheorghe village (Figure 3), South of Sf. Gheorghe village (within the "Gârla Turcească" area)

(Figure 4), and Periprava - at the "tail" of Nebunu (also called Durnoi by the locals) lake. The geographical maps (Figures 2-4) were made with the help of aerial drones, which flew at low altitudes (between 50 and 100 m).

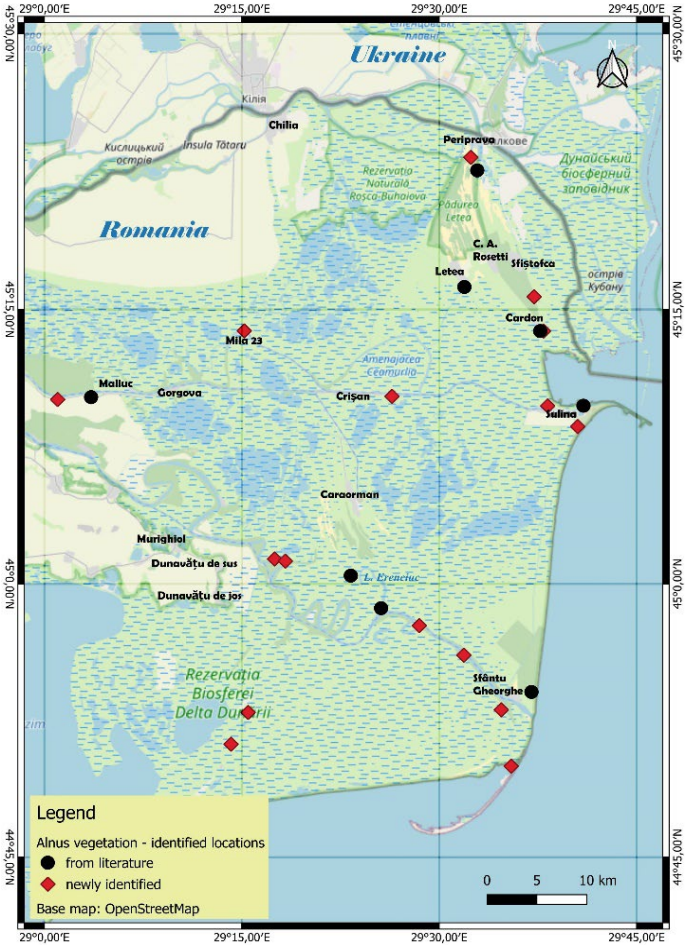

Figure 1. Distribution map of the black alder (*Alnus glutinosa*) in the Danube Delta (legend: ● old locations; ♦ newly identified locations; explanations above in the text)

Figure 2. Locations of black alder with silkvine communities - the area of Erenciuc lake

Figure 3. Locations of black alder with silkvine communities - along Sf. Gheorghe arm toward Sf. Gheorghe village

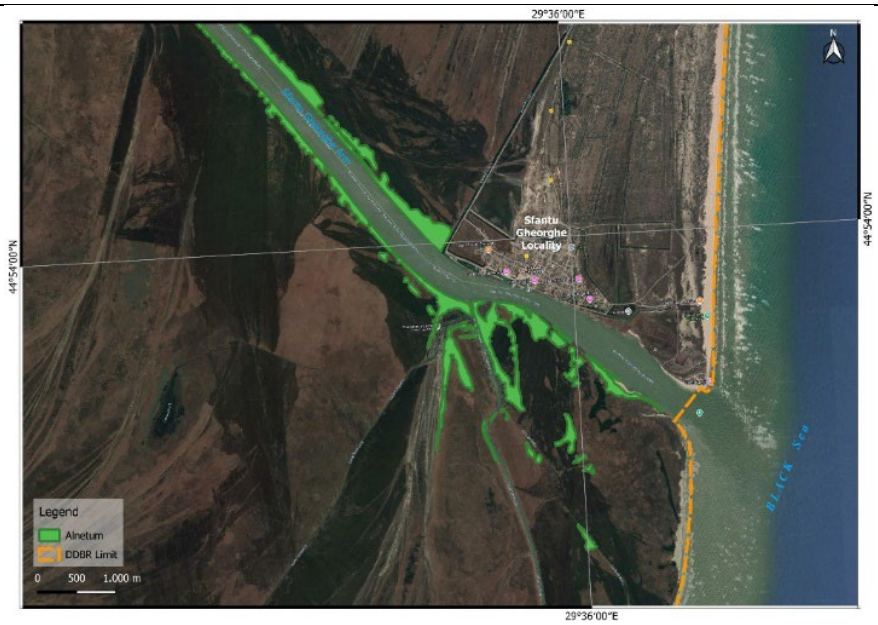

Figure 4. Locations of black alder with silkvine communities - south of Sf. Gheorghe village toward "Gârla Turcească" area

In some places of the Danube Delta, the black alder forms pure natural stands (locally called "aninişuri" or "arinişuri") while in other places it enters into association with other species, such as pedunculate oak (*Quercus robur* L.), grayish oak (*Quercus pedunculiflora* K. Koch), downy ash (*Fraxinus pallisae* Willm.), white poplar (*Populus alba* L.), quaking poplar (*Populus tremula* L.), and so forth [DRAGOMIR & BĂRBAT, 1961; DONIŢĂ & IVAN, 1992]. It is added that the black alder does not tolerate large variations in the amplitude of the flood level, from annual or periodic floods [RĂDULESCU & al. 1960]. Thus, the black alder could only settle close to the Danube River branches flowing into the Black Sea, on the fluvial-maritime beds of older formations, or, sometimes, on the fluvial beds of more recent formations [DRAGOMIR & BĂRBAT, 1961].

In recent years of our scientific trips, a lot of observations have been made on the companion plant species of black alder. Thus, one of them is the Balkan-east Mediterranean species *Periploca graeca* (silkvine, as its English vernacular name), which constantly accompanies the black alder in the Danube Delta. Thus, a new plant community/plant association is proposed here for science, to better characterize these plant communities from the Danube Delta (Romania), that is classified from a syntaxonomic point of view as follows:

Cl. ALNETEA GLUTINOSAE Braun-Blanq. & Tüxen ex V. Westh., J. Dijk, Passchier & G. Sissingh 1946

Ord. Alnetalia glutinosae Tüxen 1937

All. Alnion glutinosae Malcuit 1929

Ass. *Periploco graecae-Alnetum glutinosae* ass. nov. (syn. pro parte Ass. *Carici acutiformis-Alnetum* (Soó 1957) Dostal 1933 subass. *periplocaetosum graecae* Mititelu & al. 1997) (Table 2)

Relevé no. 1 is the type relevé for this newly proposed plant community (Table 2 includes 15 phytosociological relevés with the occurrence of *Alnus glutinosa* as the dominant species, in different points of the Danube Delta, Romania).

Why was it necessary to propose a new plant community for science?

Considering the plant structure of this newly proposed plant community (Table 2), we only partially agree with the point of view of MITITELU & al. (1997). According to the provisions of the International Code of Phytosociological Nomenclature, this syntaxon was not validly published, because it is neither accompanied by a vegetation table with relevés, nor is a type relevé previously identified in any described valid taxon indicated before 1.1.1979 (Art. 7, Rec. 7A) [WEBER & al. 2000]. Here's why it was proposed a new phytocoenotaxon for science, with relevés made in various points on both sides of the Sf. Gheorghe arm, Danube Delta, including those from the Nature Reserve "Arinişul Erenciuc", under the name: Ass. *Periploco graecae-Alnetum glutinosae* ass. nov.

The diagnostic species for this newly proposed syntaxon are the silkvine (*Periploca graeca*) and the black alder (*Alnus glutinosa*).

It is mentioned that on river levees in the maritime part of the Danube Delta, where the Sf. Gheorghe arm cuts through extensive peaty landscapes, black alder trees mix into the white willows (*Salix alba*) on the narrow clayey river levees. Often, they grow together with narrow leaved ash (*Fraxinus angustifolia* subsp. *oxycarpa*) and downy ash (*F. pallisae*). In such cases, the ashes grows in the highest part of the levees, accompanied by bushes of guelder rose (*Viburnum opulus*). It has been found that the silkvine (*Periploca graeca*), a Balkan-east Mediterranean plant species, constantly accompanies the river levee forests where the black alder is present in Danube Delta. The plant communities of black alder and silkvine prefers base-poor freshwater habitats with mollic/histic sandy soils, and constant high-water tables. Due to the precipitation (rain and snow) deficit recorded in the Danube Delta, the black alder habitat is normally too salinized to be suitable for this species. This is reflected in the isolated character and small to medium size of the tree stands with *Alnus glutinosa* in the Danube Delta, as well as the apparently weak vitality of black alder trees in some stands, such as those found along the Sf. Gheorghe arm. Nevertheless, this position at the margin of the distribution area makes the black alder stands of the Danube Delta important sites, both from geobotanic and conservation points of view [HANGANU & al. 1994].

It is worth noting that there have been several attempts to describe, or just cite, by various authors, the presence of black alder plant communities located in the Danube Delta, under the same name, more or less, as:

1. Ass. *Carici acutiformis-Alnetum* (Dostál 1933) Soó 1957 - a plant community cited without an exact locations in the Danube Delta; in fact, the cited work intended to present only an inventory list of all the plant communities in the vegetation of Romania, with scattered locations by historical provinces, mountain ranges, etc., but nothing else; the work did not include any vegetation table to argue the presence of the above indicated phytocoenotaxon in the Danube Delta vegetation [SANDA & al. 1980];

2. Ass. *Carici acutiformis-Alnetum* Soó 1963 - the authors cited the presence of this phytocoenotaxon only in a few locations in the Danube Delta, such as "Hasmacul Mare" forest at Letea and Erenciuc point, being characterized by the edifying species *Alnus glutinosa* and other hygrophilous species; the work did not include any vegetation table that would argue the presence of the indicated phytocoenotaxon in the Danube Delta, either [DONIŢĂ & IVAN, 1992];

3. Ass. *Carici* (*acutiformis*)-*Alnetum* (Soó 1957) Dostal 1933 subass. *periplocaetosum graecae* Mititelu, Baisan, Dumitrașcu & Parincu 1997 - the authors said that the black alder phytocoenoses from Erenciuc point were taken over in a conservation area under the name "the Forestry Reserve Arinișul Erenciuc", with an area of 11.6 ha at those times, where the substrate (soil) is permanently wet and represents an eutrophic peat, in a layer up to 1 m deep; the authors present only a synthetic vegetation relevé (no analytical table of vegetation is included in the original work), where *Alnus glutinosa* and *Carex acutiformis* only have AD indices (AD=4); the other species in the list do not have attached AD indices [MITITELU & al. 1997];

4. Ass. *Thelypteridi-Alnetum* Klika 1940 - this plant community was mentioned in the following areas: 1) Erenciuc point [POPESCU & al. 1997; SANDA & ARCUȘ, 1999]; 2) along St. Gheorghe arm to near its mouth into the Black Sea [POPESCU & al. 1997]; 3) Letea - at "Hasmacul Mare" [POPESCU & al. 1997]. There is no vegetation table included in the two works cited above.

MITITELU & al. (1997) observing that the black alder forests of the Danube Delta (Romania), being constantly accompanied by the Balkan-east Mediterranean liana *Periploca graeca*, are clearly different from other types of black alder forests (such as those included in Ass. *Carici acutiformis-Alnetum* and/or Ass. *Thelypteridi-Alnetum*); that why, the authors gave those forest communities a new name - "*Carici* (*acutiformis*) *alnetum* (Soó 57) Dostal 33 subass. *periplocaetosum graecae*" (in original).

According to the most recent synthesis on the woody vegetation of Romania, Ass. *Carici acutiformis-Alnetum* (Dostál 1933) Soó 1957, Ass. *Carici acutiformis-Alnetum* Soó 1963, and Ass. *Carici* (*acutiformis*)-*Alnetum* (Soó 1957) Dostal 1933, are all synonyms for Ass. *Thelypterido palustris-Alnetum glutinosae* Klika 1940 [COLDEA & al. 2015].

Comparing the presence of those species with the highest K (constancy classes K=III-V) within the given association (Ass. *Thelypterido palustris-Alnetum glutinosae* Klika 1940) in the other provinces of Romania [COLDEA & al. 2015] and the plant communities of *A. glutinosa* in the Danube Delta (Table 1) it can be easily observed that:

1) Ass. *Periploco graecae-Alnetum glutinosae* ass. nov. has as characteristic species *Periploca graeca*, with a maximum constancy (K=V) and the dominat species *Alnus glutinosa*, also with a maximum constancy (K=V); this combination of plant species is completely absent in the other regions, according to current knowledge regarding the vegetation cover of Romania; it is not excluded that this newly proposed plant community will be identified in the future in other areas, perhaps along the Danube River, where the silkvine (*Periploca graeca*) has been identified over time [ȚOPA, 1961]; we assume that the silkvine is widespread at its northernmost limit, in Romania, along the Danube River (see the species distribution map in Euro+Med PlantBase [https://europlusmed.org/cdm_dataportal …].

2) *Carex acutiformis* (cited within the Ass. *Carici acutiformis-Alnetum* (Dostál 1933) Soó 1957) has a low constancy (K=I) and a quite random presence, nowadays, in black alder phytocoenoses in the Danube Delta, while achieving the greatest constancy (K=V) in the other provinces, as well as in other plant communities in Romania.

One can observe some similarities of those plant communities with *Alnus glutinosa* and *Thelypteris palustris* recorded in different regions of Romania, as well as in central and eastern European area, excluding the Danube Delta [COLDEA & al. 2015] with the new plant community proposed here (see the analytical Table 2), namely:

1. a series of taxa, identified in the black alder communities of the Danube Delta, such as *Periploca graeca*, *Iris pseudacorus*, *Stachys palustris*, *Phalaroides arundinacea* subsp.

arundinacea, *Fraxinus pallisae*, *Rumex hydrolapathum*, *Jacobaea paludosa* subsp. *angustifolia*, could be considered as diagnostic taxa for this new plant community.

2. the characteristic taxa for the Ass. *Thelypterido palustris-Alnetum glutinosae* Klika 1940 seems to be the next ones: *Thelypteris palustris*, *Carex acutiformis*, *Galium palustre*, *Eupatorium cannabinum*, *Lemna minor* [COLDEA & al. 2015] (Table 1).

3. there is no black alder plot in the Danube Delta where the fern *Thelypteris palustris* is present nowadays, though it has been reported in the past works [MITITELU & al. 1997; POPESCU & al. 1997].

Table 1. Synoptic table reflecting the difference between the Ass. *Periploco grecae-Alnetum glutinosae* ass. nov. and Ass. *Thelypterido palustris-Alnetum glutinosae* Klika 1940; only species with a constancy of at least III (presence of at least 41%) in each association were recorded

Species	P-A	T-A
Periploca graeca	**V**	-
Rubus caesius var. arvalis	V	II
Salix alba subsp. alba	V	-
Carex riparia	V	II
Iris pseudacorus	**V**	I
Stachys palustris	**IV**	-
Amorpha fruticosa	IV	-
Phalaroides arundinacea subsp. arundinacea	**IV**	I
Humulus lupulus	III	I
Fraxinus angustifolia subsp. oxycarpa	III	I
Viburnum opulus	III	II
Fraxinus pallisae	**III**	-
Rumex hydrolapathum	**III**	-
Jacobaea paludosa subsp. angustifolia	**III**	-
Phragmites australis subsp. australis	III	-
Ranunculus repens	V	II
Calystegia sepium	IV	I
Symphytum officinale subsp. uliginosum	III	I
Urtica dioica subsp. pubescens	**II**	-
Alnus glutinosa	V	V
Solanum dulcamara	IV	IV
Lycopus europaeus	IV	III
Salix cinerea	III	III
Thelypteris palustris	-	V
Carex acutiformis	I	V
Galium palustre	II	IV
Eupatorium cannabinum	II	IV
Lemna minor	II	III
Poa palustris	I	III
Urtica dioica subsp. dioica	-	III

Legend. **P-A**: Ass. *Periploco grecae-Alnetum glutinosae* ass. nov. (15 relevés, the Danube Delta, personal data - see Table 2); **T-A**: Ass. *Thelypterido palustris-Alnetum glutinosae* Klika 1940 (34 relevés, in different regions/provinces of Romania, excluding the Danube Delta, according to COLDEA & al. 2015)

The tree layer, with a coverage of (50-) 75 (-90)%, is dominated by *Alnus glutinosa*. *Salix alba* subsp. *alba* is also a constant species in the tree layer, but with rather reduced coverage (up to 20%). Other tree species relatively frequent (K=III) are *Fraxinus angustifolia* subsp. *oxycarpa* and *F. pallisae*.

The shrub layer, with a coverage of up to 20%, is mainly composed by *Rubus caesius* var. *arvalis*, *Salix cinerea*, *Viburnum opulus*, and *Amorpha fruticosa*, the latter one being an invasive alien species [ANASTASIU & NEGREAN, 2007; SÎRBU & OPREA, 2011; ANASTASIU & al. 2019].

In the herbaceous layer, with a variable coverage between 15% and 80%, the species *Carex riparia* is mainly noticeable, with values of abundance-dominance (AD) between 1 and 4. *Solanum dulcamara*, *Stachys palustris*, *Iris pseudacorus*, *Phalaroides arundinacea* subsp. *arundinacea*, *Lycopus europaeus*, *Ranunculus repens*, *Calystegia sepium* are also constant species.

Periploca graeca grows abundantly both in the herbaceous layer (as many juvenile individuals) and in those of the shrub and the tree layers, giving, through its twisted stems, the most characteristic aspect of the physiognomy of these forests (Figure 9).

It can be observed that within this newly proposed plant community, i.e. Ass. *Periploco grecae-Alnetum glutinosae* ass. nov., there are some species with high constancy (Table 1 and 2), such as: *Carex riparia* (K=V), *Rubus caesius* var. *arvalis* (K=V), *Salix alba* subsp. *alba* (K=V), *Ranunculus repens* (K=V), etc. One might think that the species above mentioned could better characterize this plant community than *Periploca graeca*. Of course, the silkvine is indeed present in other plant communities in the Danube Delta, such as the forests located on Letea and Caraorman sand islets, for instance. But, this is not about the dominant species within the association; the species chosen now, namely *Periploca graeca*, as a characteristic species, characterizes best the black alder forests, accompanying the latter species throughout its distribution area in Danube Delta, reflecting the habitats/soil type (base-poor freshwater habitats, with constant high-water tables, mollic/histic sandy soils, and periodically flooded phytocoenoses) and local/particular climatic conditions (permanent deficit of precipitation, rain and snowfall) in the easternmost part of Romania, a climate called as an excessively continental-temperate or of "dry steppe". The other species having high constancy indices in Table no. 2 (e.g. *Carex riparia*, *Rubus caesius* var. *arvalis*, *Salix alba* subsp. *alba*, *Ranunculus repens*, etc.) are interesting, but these have too large distribution areas and large ecological preferences, so they cannot be considered as characteristic taxa.

Analysing the life forms spectrum of this newly plant community one can remark: out of a total of 82 species, hemicriptophytes (H) represents 42.68%; phanerophytes (Ph)=15.85%; terophytes (T)=14.63%; geophytes (G)=6.09%; geophytes-helohydatopyhtes (G-HH)=6.09%; hemitherophytes (Ht)=3.65%; epiphytes (Ep)=2.43%; chamaephytes (Ch)=1.21%; hydrophytes (Hd)=2.43%; geophytes-hemicriptophytes (G-H)=1.22%; hemicriptophytes-chamaephytes (H-Ch)=1.22%; hemicriptophytes-helohydatopyhtes (H-HH)=1.22%; helohydatopyhtes (HH)=1.22% (Figure 5).

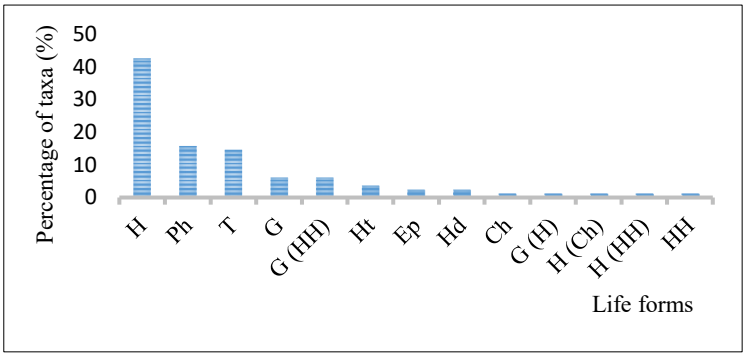

Figure 5. Life forms spectrum of the ass. *Periploco graecae-Alnetum glutinosae* ass. nov.

Concerning the floristics elements (geoelements), the Eurasian species represent 46.34%, circumpolar 19.51%, adventitious 9.75%, European 7.31%, cosmopolites 4.87%, atlanto-mediterranean 1.22%, balkano-danubian-pontics 1.22%, central-east European 1.22%, central European 1.22%, central European-Sub-Mediterranean 1.22%, Eurasian (Sub-Mediterranean) 1.22%, Eurasian-Africa 1.22%, Eurasian-north American 1.22%, Mediterranean 1.22%, pontic-pannonian-Mediterranean 1.22% (Figure 6).

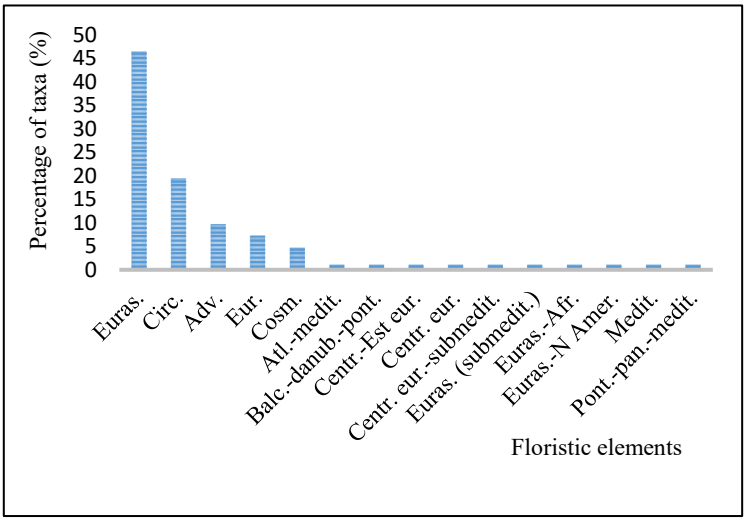

Figure 6. The floristics elements/geoelements spectrum of the ass. *Periploco graecae-Alnetum glutinosae* ass. nov.

The ecological factors were compiled accordind to SÂRBU & al. (2013); they are like the next:

- soil humidity (**U**) - U_{10} (plants of flooded soils)**=22.2%**; U_8=19.8%; U_9=16%; U_6=12.3%; U_5=12.3%; U_7=7.4%; U_{11}=4.9%; U_3=2.5%; U_4=1.2%; U_x=1.2%;
- air temperatures - $\mathbf{T_6}$ (moderately thermophilic plants)=**49.4%**; T_x=40.7%; T_7=7.4%; T_5=2.5%; T_x=40.7%);
- soil *p*H - $\mathbf{R_x}$ (euryonic plants)**=50.0%**; R_7=46.3%; R_6=3.7% (Figure 7).

The soil type is a gleysoil - it has the water table close to the earth's surface, being a "permanently wet soil"... [MARIAN MIERLĂ, 2023, pers. comm.]. Within the Forest Reserve "Arinişul Erenciuc" there are also soils with histic characters, i. e. they present a peaty horizon on the surface, of approximately 40 cm thickness (0-40 cm depth) [MUNTEANU & CURELARIU, 1995].

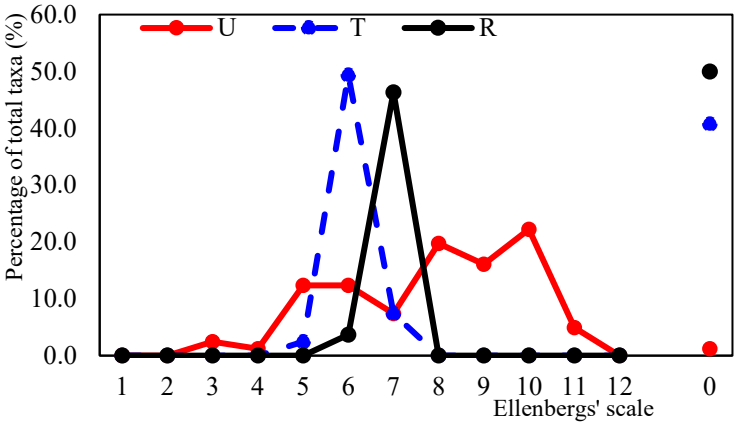

Figure 7. The ecological factors (soil humidity – U, air temperature – T, soil *p*H – R) chart of the ass. *Periploco graecae-Alnetum glutinosae* ass. nov.

As for the sozological categories, within the phytocoenoses of this newly proposed syntaxon, the following plant species on the national and international red lists, were registered: VU/R *Hottonia palustris*, R *Periploca graeca* (Figure 9), R *Cyperus serotinus*, R *Petasites spurius* [OLTEAN & al. 1994; IUCN CRITERIA..., 2024].

Aslo, the following alien plant species were recorded: *Amorpha fruticosa*, *Bidens connatus*, *B. frondosus*, *Eclipta prostrata*, *Sicyos angulatus*, *Fraxinus pennsylvanica*, *Prunus cerasifera*, *Aster lanceolatus* [SÎRBU & OPREA, 2011].

Forestry typology

According to the forestry typology, black alder communities in the Danube Delta were classified according to various works/authors as follows:

i) the great unit - **Elm, ash, and alder tree stands**; type 218. Alder trees stands of ponds and lakes - a scarce type of swamp forest, reported so far in two places in the Danube Delta and fragmentarily in the Muntenia Plain (e.g. along Colentina river valley), as a scientific curiosity, with the trees growing on high mounds, around which the water never dries up [PAŞCOVSCHI & LEANDRU, 1958]

ii) unit **L_{12a} Danubian-Pontic psammophilic steppes** (with *Stipa borysthenica*, *Carex colchica*, *Scabiosa ucranica*), in complex with oak, ash, and poplar forests (*Quercus robur*, *Q. pedunculiflora*, *Fraxinus angustifolia*, *F. pallisae*, *Populus alba*, *P. tremula*, *P. canescens*), subunit **Low Depressions**, represented by Ass. *Carici acutiformi-Alnetum* Soó 1963. It is stated: "the *Carici acutiformi-Alnetum* association is found only in a few places ("Hasmacu Mare" forest, Erenciuc point), being characterized by the edifying species *Alnus glutinosa* and other hygrophilous species. It is found at the bottom of larger depressions where the water stagnates until summer, and the soil has a peaty character" [DONIȚĂ & IVAN, 1992].

Figure 8. Black alder stands at Erenciuc

Figure 9. *Periploca graeca* in black alder stands

Concerning the Natura 2000 habitats (under the typology of *Habitat Directive*, *European Communities Council*, 1992), the black alder communities in the Danube Delta can be attributed to a single and singular type of natural habitat, namely: **91E0*** Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) (* means a priority habitat for conservation by Annex I of the Habitat Directive [EUROPEAN COMMISSION…, 1992; FORMULARUL STANDARD…, 2008; GAFTA & MOUNTFORD, 2008] (Figures 8-9).

From consulting the Natura 2000 Standard Form for the ROSCI0065 Danube Delta site [FORMULARUL STANDARD …, 2008], it was found that this habitat type was omitted from the inventory; through this work and through this proposal of a new phytocoenotaxon, a contribution is made to the correct identification of this Natura 2000 habitat type within the Danube Delta, on valid and pertinent scientific bases.

It is worth noting that riparian forests are under-researched in southeastern Europe. [DOUDA & al. 2016], and many of these forests have already been destroyed, for example, in Albania [KÁRPÁTI & KÁRPÁTI, 1961].

Conclusions

- the entire distribution of black alder (*Alnus glutinosa*) in the Danube Delta (Romania) is presented based on the geographical maps, including some made with the help of unmanned aerial vehicles (UAV)/aerial drones, within this work;
- the marshes with black alder in the Danube Delta are part of a group of periodically flooded phytocoenoses and the presence of this species within the Danube Delta is related to the smaller variations in the water level; the trees grow there on the high mounds, where the water is maintained for a large part of the year;
- a new phytocoenotaxon for science was proposed here, namely Ass. *Periploco graecae-Alnetum glutinosae* ass. nov., for the description of the vegetation built by the black alder in the Danube Delta and characterized by the presence of the Balkan-east Mediterranean species, *Periploca graeca*;
- the new phytocoenotaxon characterize the best those black alder communities in the Danube Delta, having the silkvine (*Periploca graeca*) as its characteristic species;
- the black alder communities in Danube Delta can be assigned to the Natura 2000 habitat 91E0* Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*), under the provisions of Annex I to the Habitats Directive of the European Union no. 92/43/EEC;
- there are some threatened plant species identified within black alder phytocoenoses, such as: *Hottonia palustris*, *Periploca graeca*, *Cyperus serotinus*, and *Petasites spurius*, which are included on national/international red lists, under different sozological categories (VU or R);
- some of the species identified within black alder forests are aliens, such as: *Amorpha fruticosa*, *Bidens connatus*, *B. frondosus*, *Eclipta prostrata*, *Sicyos angulatus*, *Fraxinus pennsylvanica*, *Prunus cerasifera*, *Aster lanceolatus*.

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Our respect to all the researchers, foreign or Romanian, who through their research contributed to the know the flora, vegetation and natural habitats of the Danube Delta. We thank our colleague Marian Mierlă for the information provided on the substrate of the investigated areas. Our gratitude also goes to the anonymous reviewers of this paper.

Conflict of interest

There is no actual or potential conflict of interest in relation to this paper.

Table 2. Ass. *Periploco graecae-Alnetum glutinosae* ass. nov.

Relevé area (sq. m)	400	400	400	400	400	400	400	400	400	400	400	400	400	400	400	
Canopy	0.9	0.7	0.7	0.7	0.65	0.7	0.5	0.7	0.7	0.65	0.65	0.5	0.65	0.8	0.45	
Tree layer height (m)	16-17	18-20	18-20	10 -12	8-10	8-10	8-9	10 -12	8-10	10-11	10-11	10 -12	8-10	10-11	10 -12	K
Tree diameter (cm)	22-50	20-45	25-45	15-50	20-30	15-35	15-25	15-40	20-30	20-40	20-45	20-45	15-40	20 -45	10-30	
Shrub layer cover + regeneration (%)	30	15	20	15	15	5	15	7	25	25	7	10	10	30	10	
Herbaceous layer cover (%)	70	70	70	70	90	50	75	75	55	30	10	50	50	45	50	
Relevé no.	1*	2	3	4	5	6	7	8	9	10	11	12	13	14	15	V
Charact. ass.																
Alnus glutinosa	5	4	4	4	4	4	4	4	4	4	4	3	4	4	3	V
Alnus glutinosa juv.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	V
Periploca graeca	1	1	1 (-2)	.	+	+	1	+	+	1	+	+	+	1	1	V
Alnion glutinosae, Alnetalia glutinosae et Alnetea glutinosae																
Rubus caesius var. *arvalis*	2	1 (-2)	1	1 (-2)	1	+	1	1	1	.	1	1	+	2	+	V
Solanum dulcamara	+	+	+	+	+	+	+	+	.	+	+	.	+	.	.	IV
Stachys palustris	+	+	+	+	.	+	+	+	+	.	+	+	+	.	+	IV
Humulus lupulus	.	.	.	.	1	+	+	.	+	.	+	+	+	.	+	III
Salix cinerea	1	+	+	1	+	+	.	.	.	.	.	.	.	1	+	III
Fraxinus angustifolia subsp. *oxycarpa*	.	.	.	.	+	+	+	.	+	+	+	1	.	.	+	III
Glechoma hederacea	.	.	.	.	.	.	+	+	+	.	+	+	.	.	+	II
Eupatorium cannabinum	.	.	.	.	+	+	+	.	.	.	.	.	+	+	+	II
Lysimachia vulgaris	+	.	.	.	+	.	.	+	+	.	.	+	+	.	.	II
Salix cinerea juv.	.	.	.	1	.	.	.	.	.	.	.	.	.	+	+	I
Frangula alnus	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Fraxinus angustifolia subsp. *oxycarpa* juv.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	I
Carpino-Fagetea																
Viburnum opulus	.	.	.	.	.	+	.	+	+	+	.	+	+	+	+	III
Viburnum opulus juv.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	III
Fraxinus pallisae	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III

Salicetea purpureae																
Salix alba subsp. *alba*	+	1	1	1	+	1	+	1	1	+	.	1	1	2	1	V
Amorpha fruticosa	.	.	+	1	+	+	1	+	2	2	+	+	.	+	+	IV
Salix triandra subsp. *triandra*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I
Salix triandra juv.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I
Salix fragilis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I
Phragmito-Magnocaricetea																
Carex riparia	4	4	4	4	4	3	4	4	3	2	1	3	2	3	3	V
Iris pseudacorus	+	+	+	+	+	+	+	+	.	+	+	+	+	.	+	V
Phalaroides arundinacea subsp. *arundinacea*	+	.	+	.	+	+	+	.	+	+	+	+	+	+	+	IV
Lycopus europaeus	+	+	+	.	+	+	+	1	+	+	+	+	+	.	.	IV
Rumex hydrolapathum	.	.	.	.	+	.	+	+	.	+	+	+	.	+	+	III
Jacobaea paludosa subsp. *angustifolia*	+	+	+	.	.	.	+	.	.	+	.	+	.	.	+	III
Phragmites australis subsp. *australis*	+	+	+	+	+	+	+	.	.	.	+	.	.	.	+	III
Galium palustre subsp. *palustre*	.	.	.	.	+	.	+	.	.	.	+	.	+	.	+	II
Mentha aquatica subsp. *aquatica*	.	.	.	.	.	.	+	+	.	.	.	.	+	+	+	II
Rorippa amphibia	.	.	.	.	.	.	.	.	+	+	+	+	.	+	+	II
Sium latifolium	+	+	+	.	+	.	.	.	.	.	.	.	.	.	+	II
Sium sisarum var. *lancifolium*	.	.	.	.	.	+	+	.	.	+	+	+	.	+	.	II
Sparganium erectum subsp. *erectum*	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	I
Stellaria palustris	.	.	.	+	.	.	.	.	.	+	.	.	+	.	.	I
Leersia oryzoides	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	I
Lythrum salicaria	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	I
Scrophularia umbrosa subsp. *umbrosa*	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	I
Oenanthe aquatica	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	I
Alisma plantago-aquatica	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	I
Carex acutiformis	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Poa palustris	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	I

Sagittaria sagittifolia	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	I
Molinio-Arrhenatheretea																
Ranunculus repens	+	+	.	+	1	+	+	+	+	+	+	+	+	+	+	V
Calystegia sepium	+	+	.	.	+	+	+	.	+	+	+	.	+	.	+	IV
Symphytum officinale subsp. *uliginosum*	.	.	.	.	+	+	+	+	+	+	+	+	.	.	.	III
Equisetum arvense	.	.	.	.	.	.	.	.	+	.	+	+	.	.	+	II
Symphytum officinale subsp. *officinale*	+	+	+	+	.	.	.	.	.	.	.	.	.	.	+	II
Myosotis scorpioides subsp. *scorpioides*	.	.	.	.	+	.	+	.	.	+	+	+	.	+	.	II
Glyceria maxima	.	.	.	.	+	.	.	+	.	+	+	.	.	.	+	II
Alopecurus pratensis subsp. *pratensis*	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	I
Agrostis stolonifera	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Berula erecta	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	I
Cardamine pratensis subsp. *pratensis*	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	I
Potentilla reptans	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	I
Scutellaria galericulata	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	I
Veronica beccabunga	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	I
Rorippa sylvestris subsp. *sylvestris*	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	I
Carex hirta	.	.	.	.	.	.	+	.	.	.	.	.	2	+	.	I
Apium graveolens	.	.	.	.	+	.	.	.	.	.	.	.	+	+	.	I
Bidentetea																
Bidens frondosus	.	.	.	.	.	.	+	.	+	+	.	.	+	.	+	II
Persicaria dubia	.	.	.	.	+	+	.	+	.	+	.	+	+	.	.	II
Bidens tripartitus	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	I
Echinochloa crus-galli	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	I
Eclipta prostrata	.	.	.	.	.	.	.	+	+	.	.	.	+	.	.	I
Persicaria hydropiper	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	I
Bidens connatus	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	I
Ranunculus sceleratus	.	.	.	.	+	.	.	+	.	.	+	.	.	.	.	I

Isoëto-Nanojuncetea																
Cyperus michelianus	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Cyperus serotinus	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	I
Plantago major subsp. *major*	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	I
Potametea																
Persicaria amphibia var. *aquaticum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I
Hottonia palustris	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	I
Stellarietea mediae																
Chenopodium polyspermum	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Artemisietea																
Arctium lappa	.	.	.	.	.	.	+	.	+	.	+	.	+	.	.	II
Cirsium vulgare	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	I
Tanacetum vulgare	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	I
Galio-Urticetea																
Urtica dioica subsp. *pubescens*	.	.	.	+	+	+	.	.	+	.	+	.	.	.	.	II
Sicyos angulatus	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.	II
Myosoton aquaticum	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	I
Aliae																
Petasites spurius	.	.	.	.	.	+	+	.	.	+	.	.	.	+	.	II
Fraxinus pennsylvanica	.	.	.	.	.	.	+	.	+	+	.	+	.	.	.	II
Prunus cerasifera juv.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	i
Aster lanceolatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I
Loranthus europaeus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I

Place and date of relevés: Rel. no. 1 - Nature Reserve "Arinişul Erenciuc" - left bank of Erenciuc Canal, N44.97672/E29.42572, August 1, 2023; Rel. no. 2 - Nature Reserve "Arinişul Erenciuc" - right bank of Erenciuc Canal, N44.97648/E29.42553, August 1, 2023; Rel. no. 3-4 - Nature Reserve "Arinişul Erenciuc" - right bank of Erenciuc Canal, N44.97546/E29.42616, August 1, 2023; Rel. no. 5 - right bank of Sf. Gheorghe arm - N44.89254/E29.58388, August 2, 2023; Rel. no. 6 - right bank of Sf. Gheorghe arm, N44.89299/E29.58480, August 2, 2023; Rel. no. 7 - right bank of Sf. Gheorghe arm, N44.89462/E29.57823, August 2, 2023; Rel. no. 8 - right bank of Sf. Gheorghe arm, N44.89429/E29.57844, August 2, 2023; Rel. no. 9 - right bank of Sf. Gheorghe arm, N44.89469/E29.57760, August 2, 2023; Rel. no. 10 - right bank of Sf. Gheorghe arm, N44.89622/E29.57538, August 2, 2023; Rel. no. 11 - right bank of Sf. Gheorghe arm, N44.89954/E29.57095, August 2, 2023; Rel. no. 12 - right bank of Sf. Gheorghe arm, N44.90058/E29.56935, August 2, 2023; Rel. no. 13 - South of Sf. Gheorghe arm in "Gârla Turcească" area, N44.88921/E29.57936, August 2, 2023; Rel. no. 14 - South of Sf. Gheorghe arm - "Gârla Turcească" area, N44.88843/E29.57857, August 2, 2023; Rel. no. 15 - left bank of Sf. Gheorghe arm, N44.92436/E29.55073, August 4, 2023.

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