PIONEER VEGETATION ON WATER SHORES (*BIDENTI-POLYGONETUM HYDROPIPERI* LOHMEYER IN R. TÜXEN 1950 AND *ECHINOCHLOO-POLYGONETUM LAPATHIFOLII* SOÓ ET CSŰRÖS 1974) IN THE ROMANIAN BANAT

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Abstract. *The class Bidentetea tripartiti R. Tüxen et al. ex von Rochow 1951 encompasses nitrophilic vegetation found in humid areas (swamps, water shores, humid microdepressions) and slightly humid arable land. These associations present a pioneer character, frequently occur in stripe or patches and are mainly made up of annual hygrophytes. In the Romanian Banat, two associations are frequent: Bidenti-Polygonetum hydropiperi Lohmeyer in R. Tüxen 1950 and Echinochloo-Polygonetum lapathifolii Soó et Csűrös 1974. These weed formations appear alongside rivers and lakes banks or in periodically flooded depressions, on soils rich in nutrients, described, among others, by GRIGORE, 1971 (the Timiș-Bega interfluve), COSTE, 1974 (Locva Mountains), OPREA et al., 1974, OPREA, 1976 (Satchinez, Sînnicolaul Mare Plain), LOVASZ, 1995 (Buziaș Plain), DRĂGULESCU, 2013 (Timiș river basin). Our previous research (NEACȘU, 2008) refers to the association Bidenti-Polygonetum hydropiperi Lohmeyer in R. Tüxen 1950 which we studied in two locations: Pișchia (at 123 m altitude) and Surduc (at 196 - 198 m altitudes). The total species number in this composition is of 57. The species average / relevé is of 10.1, the minimum number species / relevé of 5, and the maximum species number / relevé, of 20. Of the species characteristic to the association, cited in the specialty literature and occuring in the flora composition of our phytocenoses, we mention the following: Bidens tripartita L., Polygonum hydropiper L., Echinochloa crus-galli (L.) Beauv., Polygonum mite Schrank, Potentilla reptans L., Alisma plantago-aquatica L., Lycopus europaeus L., Lysimachia vulgaris L., Xanthium strumarium L. Under a synecological aspect, the association is meso-hygrophilic. The ecologic indices analysis shows that the phytocenoses we analysed encompass a higher percentage of mesophilic species, 28.07 %. Their presence is due to the drier aspect of the stations (land in the process of draining) and the community transitory character. The mesophilic species are followed by meso-hygrophilic ones, with 21.52 %, the other categories not being so well represented. The Echinochloo-Polygonetum lapathifolii Soó et Csűrös 1974 phytocenoses, which we studied, can be found at altitudes ranging from 116 m (Pișchia) to 196 m (Surduc). The total number of species identified there is of 24. The average species / relevé is of 9.66, the minimum species number / relevé of 7, and the maximum species number / relevé, of 10. The dominant characteristic species, Echinochloa crus-galli (L.) Beauv., accompanied by Polygonum lapathifolium L. occurs alongside other species characteristic for the association, such as: Rorippa austriaca (L.) Besser., Bidens tripartita L., Pulicaria vulgaris Gaertner, Mentha pulegium L. The last two species indicate a slightly soil salinization tendency. Under the flora composition, life forms and phytogeographic categories aspect, our phytocenoses mostly resemble to those described in the Timiș-Bega interfluve (Timiș county), by GRIGORE (1971), varying to a certain degree from those analysed by COSTE (1974), at Zăvoi and Pojejena (Caraș county), which encompass, aside from characteristic species, a significant number of transgressive species from Isoëto-Nanojuncetea Br.-Bl. et Tx. 1943 and Chenopodietea Oberd. 1957 em. Lohm. et Tx. 1961. This fact is due to the difference in altitude and biotope described by this author (fallows, gardens and humid depressions). The studied communities constitute the pioneer vegetation installed on free lands, bordering humid areas and which transitions is to other associations of shore weed formations, mesophilic or xero-mesophilic. They vary largely under the aspect of flora composition, physiognomy and ecology, are unstable and difficult to outline, because of the anthropic pressure they are exposed to and we consider them important because of their specific character.*

Key words: *pioneer vegetation, water shores, Romanian Banat*

INTRODUCTION

Research on the water and palustrine plants in Banat highlighted the existence of a remarkable number of plant associations, most of them common, characteristic for humid habitats, and others remarkable, because of the species they preserve (e.g. *Marsilea quadrifolia* L., *Lindernia procumbens* (Krocker) Philcox, *Nuphar lutea* (L.) Sm., *Nymphaea alba* L.).

The *Bidentetea* class encompasses quasi-natural anthropized phytocenoses (COLDEA *et al*., 2012). It represents nitrophilous weed vegetation growing on water, pond, channel or river shores, or growing on arable land with humidity excess, largely spread in Romania. The vegetal carpet reach their maximum development, during the second half of August, when the station soils dry out (MUCINA *et al.*, 1993, *in* COLDEA *et al.*, 2012).

With R. SOÓ (1964, *in* COSTE, 1974), the class is considered as an order inside the *Chenopodietea* Br.-Bl. 1951 class, but only for a short time, since in 1968, the author again accepts it as a distinct class. I. MORARIU (1967, *in* COSTE, 1974) considerably extends the class limits and ecologic specification, considering alongside with largely accepted alliances *Bidention tripartitae* Nordh. 1940 and *Chenopodion fluviatilis* Tx. 1960) and alliances *Oryzion sativae* W. Koch 1926, *Chenopodion muralis* Br.-Bl. 1951, 1936, *Panico-Setarion* Sissingh 1946 and *Polygono-Chenopodion polyspermi* W. Koch 1926, Sissingh 1946.

As class recognition and characteristic species, SANDA *et al.* (1998, 2008) mention: *Bidens tripartita* L., *Bidens frondosus* L., *Barbarea vulgaris* R. Br., *Chenopodium polyspermum* L., *Echinochloa crus-galli* (L.) Beauv., *Mentha arvensis* L., *Polygonum hydropiper* L., *Polygonum lapathifolium* L., *Polygonum persicaria* L., *Polygonum minus* Huds., *Polygonum mite* Schrank, *Ranunculus sceleratus* L., *Rorippa austriaca* (Crantz) Spach, *Rorippa sylvestris* (L.) Besser, *Rumex limosus* Thuill., *Rumex conglomeratus* Murray, *Xanthium italicum* Moretti, *Alopecurus aequalis* Sobol, *Galega officinalis* L., *Sonchus asper* (L.) Hill, *Symphytum officinale* L., *Cyperus alopecuroides* Rottb., *Chlorocyperus glomeratus* (L.) Palla, *Chenopodium botrys* L., *Rumex palustris* Sm. COLDEA *et al*. (2012) present as diagnostic species (from those given by JAROLINEK & ŠIBIK, 2008, for *Bidentetea tripartitae* in Slovakia): *Bidens tripartita* L., *Polygonum lapathifolium* L., *Echinochloa crus-galli* (L.) Beauv., *Polygonum hydropiper* L., *Matricaria perforata* Merat. and *Potentilla supina* L. ŠUMBEROVÁ (2011) considers a diagnostic species of the class in Czech Republic: *Alopecurus aequalis* Sobol., *Atriplex prostrata* subsp. *latifolia* (Wahlenb.) Rauschert, *Bidens cernua* L., *B. radiata* Thuill., *B. tripartita* L., *Carex bohemica* Schreb., *Chenopodium ficifolium* Sm., *C. glaucum* L., *C. rubrum* L., *Oenanthe aquatica* (L.) Poiret, *Persicaria lapathifolia* (L.) Gray., *Ranunculus sceleratus* L., *Rorippa palustris* (L.) Besser and *Rumex maritimus* L. Under European Vegetation Survey group[1], the class and subordinated units are described trough a consistent group of diagnostic species: *Abutilon theophrasti* Medik., *Alopecurus aequalis* Sobol., *Arenaria gothica* Fr., *Atriplex prostrata* Boucher ex DC., *Bidens aurea* (Aiton) Sherff., *B. cernua* L., *B. connata* Muhl. ex Willd., *B. frondosa* L., *B. radiata* Thuill., *B. tripartita subsp. bullata* (L.) Rouy, *B. tripartita subsp. tripartita* L., *Chenopodium acerifolium* Andrz., *C. ficifolium* Sm., *Cochlearia officinalis* L., *Corrigiola litoralis subsp. litoralis* L., *C. litoralis subsp. perez-larae* Chaudhri, Muñoz Garm. & Pedrol, *Cyperus strigosus* L., *Echinochloa crus-galli subsp. crus-galli, E. muricata* (P.Beauv.) Fernald., *Eragrostis albensis* H. Scholz, *Lipandra polysperma* (L.) S. Fuentes, Uotila & Borsch, *Mollugo verticillata* L., *Oxybasis chenopodioides* (L.) S. Fuentes, Uotila & Borsch, *O. glauca* (L.) S. Fuentes, Uotila &

[1] https://www.synbiosys.alterra.nl/evc/…

Borsch, *O. rubra* (L.) S. Fuentes, Uotila & Borsch, *Panicum riparium* H. Scholz, *Persicaria amphibia var. amphibia* L., *P. foliosa* (H.Lindb.) Kitag., *P. hydropiper* (L.) Delarbre *P. lapathifolia subsp. brittingeri* (Opiz) Soják, *P. lapathifolia subsp. lapathifolia* (L.) Delarbre, *P. maculosa* Gray., *P. minor* (Huds.) Opiz., *P. mitis* (Schrank) Holub, *Polypogon monspeliensis* (L.) Desf., *Potentilla supina* L., *Pulicaria vulgaris* Gaertner, *Ranunculus sardous* Crantz., *R. sceleratus* L., *Rorippa anceps* (Wahlenb.) Rchb., *Rorippa islandica* (Oeder) Borbás, *R. palustris* (L.) Besser., *R. sylvestris* (L.) Besser., *Rumex maritimus* L., *R. marschallianus* L., *R. palustris* Sm., *R. stenophyllus* Ledeb., *R. ucranicus* Fisch., *Schenkia spicata* (L.) G.Mans., *Solanum lycopersicum* L., *Tephroseris palustris (*L.) Fourr., *Veronica peregrine* L., *Xanthium albinum subsp. albinum* Widder, *X. albinum subsp. riparium* Widder, *X. orientale subsp. italicum* (Moretti) Greuter, *X. strumarium subsp. brasilicum* Vell., *X. strumarium subsp. strumarium* L.. CHIFU (2014) considers as characteristic species for *Bidentetea tripartiti* in Romania a group formed by: *Barbarea vulgaris* R. Br., *Bidens vulgate* Greene, *Bolboschoenus maritimus* (L.) Palla, *Polygonum mite* Schrank, *Ranunculus sceleratus* L., *Rorippa palustris* (L.) Besser, *Xanthium saccharatum* Wallr. & Widder.

In the Romanian Banat, pertaining to this class, the following associations were described: *Polygono hydropiperi-Bidentetum* Lohm. 1950 (syn. *Bidenteto-Polygonetum hydropiperis* (W. Koch 1926) Lohm. 1950), *Echinochloo-Polygonetum lapathifolii* (Ujvárosi 1940) Soó et Csűrös (1944) 1947, *Rumicetum limosae* Grigore 1971, *Xanthietum italici* I. Mor. 1943, *Panico-Chenopodietum polyspermi* (Br.-Bl. 1921) Tx. 1937 (GRIGORE, 1971). Among these, the first two (also studied by us) are the most frequent.

Communities from the class *Bidentetea* were described in Europe and around the world, among others by: ELLENBERG (1978), in Central Europe, KAZMIERCZAK (1997) (in Central Poland), MARKOVIC (1975, 1980), from Croatia, BRANDES (1999), on river banks in the middle course of the river Elbe, Germany, ZALIBEROVA (1995), as synantropic vegetation in Biosphere Reserve East Carpathians (Poland, Slovakia and Ukraine), ZALIBEROVÁ & JOROLÍMEK, (1995), in north-eastern Slovakia, DEKLERK (1997), in the Dutch fluvial area, SADLO & KOLBEK (1997), as terrestrial ruderal and segetal vegetation of North Korea, KIESSLICH *et al.* (2003), in Mecklenburg-Vorpommern (northern Germany), BISSELS *et al.* (2005), along the northern Upper Rhine as ephemeral wetland vegetation etc.

Our associations can be found among plant associations corresponding to the Natura 2000 habitats: *3270 – Muddy shore rivers with Chenopodion rubri and Bidention vegetation (habitat characteristic for muddy shores in the plain area up to the submontane level, with annual nitrophilous pioneer vegetation, from the Chenopodion rubri p.p. and Bidention p.p. alliances),* and to Palearctic type 24.52. - *Euro-Siberian annual river mud communities* (GAFTA & MOUNTFORD, 2008; DEVILLERS *et al*., 2001). Under the Romanian habitat classification, its correspondence is the habitat *R5312 - Ponto-Danubian Communities with Bidens tripartita, Echinochloa crus-galli and Polygonum hydropiper* (Doniță *et al*., 2005). Other associations correspondent to the habitat 3270 are (GAFTA & MOUNTFORD, 2008):

Romanian cenotaxa associated with the habitat:

Bidenti - Polygonetum hydropiperis Lohm. in Tuxen 1950;
Polygono lapathifolii - Bidentetum Klika 1935;
Echinochloo-Polygonetum lapathifolii Soo et Csuros 1974 (including subas. *chlorocyperetosum glomerati* Burescu 1999);
Xanthio strumarii - Bidentetum tripartitae Timar 1947;
Bidentetum cernui (Kobenza 1948) Slavnic 1951.

MATERIAL AND METHODS

The discussed associations are described trough habitat particularities: the protected areas of Surduc (nature reserve) and Pișchia (SPA – Special Protection Area). The presentation schema takes into account the cenotaxonomy, the chorology of described units in Romania, with reference to Banat, the floristic composition and synmorphology, synecology, syndinamic aspects, importance and conservation value. Our data are related to those of others authors which published data about the same units in the Romanian Banat: GRIGORE, 1971 (the Timiș-Bega interfluve), COSTE, 1974 (Locva Mountains, southern Romanian Banat), OPREA *et al*., 1974, OPREA, 1976 (Satchinez, Timiș county, and Sînnicolaul Mare plain), PEIA, 1978 (Almaj's Depression), LOVASZ, 1995 (Buziaș plain), DRĂGULESCU, 2013 (Timiș river basin). The association cenotaxonomy is in accordance with CHIFU (2014), and for the biologic, geographic and ecologic cormophytes identified in the phytocenoses, we applied SANDA *et al*., 2003. The chorological data, taken over from CHIFU (2014), mainly. Species nomenclature follows The Euro+Med PlantBase system.

RESULTS AND DISCUSSIONS

The two vegetal communities, *Bidenti-Polygonetum hydropiperi* Lohmeyer in R. Tüxen 1950 and *Echinochloo-Polygonetum lapathifolii* Soó et Csűrös 1974, are discussed in the following, according to the presentation schema indicated in the method.

1. *Bidenti-Polygonetum hydropiperi* Lohmeyer in R. Tüxen 1950 cenotaxonomy (after CHIFU, 2014):

Syntaxon syn.: *Polygonetum hydropiperi* Passarge 1965
Syn: *Bidentetum tripartiti* W. Koch 1926 (Art. 8)
Cls. *BIDENTETEA TRIPARTITI* R. Tüxen et al. ex von Rochow 1951
Syn. *BIDENTETEA TRIPARTITI* R. Tüxen et al. 1950 (Art. 8)
Ord. *Bidentetalia tripartiti* Br.-Bl. et R. Tüxen ex Klika et Hadač 1944
Syn. *Bidentetalia tripartiti* Br.-Bl. et R. Tüxen 1943 (Art. 8)
Al. *Bidention tripartiti* Nordhagen 1940 em. R. Tüxen in Poli et J. Tüxen 1960

This plant association is common, widely spread with numerous occurrences around the country. The chorology presented in the following is in accordance with CHIFU (2014): a) *bidenti-polygonetosum hydropiperi* sass. typ.: Muntenia, Transylvania (MORARIU, 1943), Cluj county (SOÓ, 1949), Sebeșului Valley (BORZA, 1959), Forest Soca, Banat (BORZA, 1962), Caransebeșului Valley (BUJOREAN *et al*., 1969), Dudu, Mogoșoaia (NEDELCU, 1969), Blaj (PĂUN, 1969), Beregsău (BUJOREAN & COSTE, 1970), Cara, Pop's Spring (NYARADY, 1970), Bistriței Aurii Valley (PASCAL & MITITELU D., 1971), Trotușului Valley, surroundings of Bacău (MITITELU D. & BARABAȘ, 1972), Jiu-Desnățui interfluve (CÂRȚU, 1972), Căldărușani lake (NEDELCU, 1972), Hanu Conachi (MITITELU D. *et al*., 1973), Gorge of the Danube (DIHORU *et al*., 1973), Lozna-Dersca (MITITELU D. *et al*., 1974), Tazlau basin (BARABAȘ, 1974), Valea Lungă (MITITELU L., 1974), Prut's meadow (MITITELU D. & BARABAȘ, 1975), Siriu Mountains (DIHORU, 1975), Snagov (NEDELCU, 1976), surroundings of Roman (MITITELU D. *et al*., 1977), Gurguiata-Plopi Valley (MITITELU D., 1982), Berezeni (MITITELU D. & BARABAȘ, 1987), Moldova (LUPAȘCU, 1999), Milcovului basin (COROI, 2001), northwest of Romania (BURESCU, 2003), Gurghiului Valley (SĂMĂRGHIȚAN, 2005), Orșova (SANDA *et al*., 2006), Bistriței basin (AONCIOAIE, 2008); b) *xanthietosum riparii* (Morariu 1943) SANDA *et al*., 2001: surroundings of București (MORARIU, 1943), surroundings of Bacău (MITITELU D. & BARABAȘ, 1972), Tazlăului basin (BARABAȘ, 1974), Berezeni (MITITELU D. & BARABAȘ,

1987), Siretului Valley (MONAH, 2001). In Banat, it was described also by GRIGORE, 1971 (interfluve Timiș-Bega), PEIA, 1978 (Almaj's Depression), COSTE *et al*., 1998 (Timișoara).

We found 10 phytocenoses which we subsumed to this association, at Surduc and Pișchia, localized at altitudes of 123 m (the only phytocenoses described at Pișchia), respectively 196 - 198 m (the 9 phytocenoses analysed at Surduc). The total identified species number is of 57, species average / relevé is of 10.1, the minimum species / relevé of 5, and the maximal species number / relevé is 20 (table 1).

The maximal vegetation assertion period is during the months of July-September. General coverage for the described phytocenoses was estimated between 80-100 %. The dimension of the surfaces under study was of 3-6 m^2. Within our phytocenoses, the following species displayed high constancy: *Bidens tripartita* L., *Echinochloa crus-galli* (L.) Beauv., *Gnaphalium uliginosum* L., *Lycopus europaeus* L., *Oenanthe aquatica* (L.) Poiret, *Polygonum hydropiper* L. During droughty periods, *Bidens tripartita* L. extends towards the humid depression border, with organic substance rich soil.

Table 1.

Bidenti-Polygonetum hydropiperi Lohmeyer in R. Tüxen 1950 association - identified stations, altitudinal limits, numeric species data

localities	altitudes	number of total species	average number of species per relevé	minimum number of species per relevé	maximum number of species per relevé
Pișchia, Sânandrei	123 – 198 m	57	10,1	5	20

The floristic composition of communities described in our country is quite heterogeneous, with many weed species characteristic for humid soils (meso-hygrophyte), but also hidatophyte and many mesophytes. ARDELEAN & KARÁCSONY (2002) observe that in the floristic composition of the phytocenoses described in the Ierului Valley, there occur representatives of the *Bidentetum tripartite* preceding associations, on the succession scale. Sometimes, these formations have a slightly halophile character, imprinted by the scarce presence of some species, such as: *Juncus gerardii* Loisel, *Aster tripolium* L., *Bolboschoenus maritimus* (L.) Palla, *Chenopodium glaucum* L. (COLDEA *et al*., 2012).

The association physiognomy is determined by the dominant species, *Bidens tripartita* L. Alongside it, alongside the phytocenoses we analysed, the following association characteristic species are present: *Alisma plantago-aquatica* L., *Echinochloa crus-galli* (L.) Beauv., *Lycopus europaeus* L., *Lysimachia vulgaris* L., *Polygonum hydropiper* L., *Polygonum mite* Schrank, *Potentilla reptans* L., *Xanthium strumarium* L.

GRIGORE (1971) indicates these phytocenoses as frequent in the Timiș-Bega interfluve, on the bottom of dried out windings, at pond or mild stream shores, in floodable depressions and channels, in the Timișului Meadow and at the Bega channel, at Ghiroda, Albina, Uliuc, Coștei, Cebza, Otelec, Sînmihaiul Român and Timișoara. Under the aspect of specific diversity, our phytocenoses resemble these: 57 species identified by us and 55 species in the interfluve phytocenoses. We also identified a nucleus of species which occur in the Timiș-Bega interfluve as well: *Bidens tripartita* L., *Polygonum hydropiper* L., *Polygonum hydropiper* L., *Cichorium intybus* L., *Cynodon dactylon* (L.) Pers., *Daucus carota* L., *Echinochloa crus-galli* (L.) Beauv., *Gnaphalium uliginosum* L., *Gypsophilla muralis* L., *Lycopus europaeus* L., *Lythrum salicaria* L., *Plantago lanceolata* L., *Plantago major* L., *Polygonum aviculare* L., *Ranunculus repens* L., *Ranunculus sardous* Crantz., *Xanthium italicum* Moretti. In the interfluve, the author identifies the subassociation *bidentetosum*

tripartiti Tim. Bdrg. 1959 on lighter soils, and in the more humid, cogged up depressions, *polygonetosum hydropiperi* Tx. 1937.

For this plant association, described in Almaj's Depression, PEIA (1978) identifies 29 species in the 4 phytocenoses analysed. Common species to ours are: *Bidens tripartita* L., *Polygonum hydropiper* L., *Echinochloa crus-galli* (L.) Beauv., *Xanthium italicum* Moretti, *Ranunculus repens* L., *Potentilla reptans* L., *Plantago major* L., *Lythrum salicaria* L., *Inula britannica* L.

According to POP (1968), these weeds usually develop alongside shores or depressions which are periodically flooded, distributed in stripes or patchess; sometimes also in demi-salted soils, or on the verge of draining and clogging, favouring sunny biotopes and nitrate rich soils. The soils from our locations are Pellic-gleyic Vertisoles (Pișchia) and Stagnic Luvisols (Surduc) and they have specific chemical properties and fertility capacity (LAȚO *et al*., 2013).

The associations occurs during the second summer half, on intensely dried soils. The optimal development is registered during autumn, when the dominant species fructifies. This association is described as meso-hygrophyte.

In our spectrum, the life forms are well represented by annual hemi-cryptophyte and therophyte, both with a participation of 35.087 %. This high hemicryptophyte participation, indicates a tendency of drying out of the vegetal carpet. These are then followed by helohidatophytes (14.035 %), from land with humidity excess. The spectrum is completed by biannual therophyte and geophytes, with an under 10 % participation.

Of the floristic elements, Eurasian species are the floristic elements with the highest participation (61.403 %), followed by a remarkable percent of cosmopolites (21.052 %), whose presence highlights the transitory station character. The others categories are only slightly represented.

Comparing our phytocenoses to those described by other authors, we observed their resemblance to those described by GRIGORE (1971), in the Timiș-Bega interfluve, under the aspect of life forms as well as of phytogeographic categories. The author, comparing the ones in the interfluve with the ones described in the contemporary specialty literature, underlines their bioform resemblance to those described by BUJOREAN *et al*., (1969, 1970), in the Caransebeș basin and the Beregsău meadows and those described in the Crișurilor Plain by POP (1968), however displaying some phytogeographc differences.

The analysis of the ecologic indices shows that the phytocenoses we analysed encompass mesophilic species, of a 28.1 % percentage. Their slightly increased presence can be explained by the fact that the station undergoes a draining process. The mesophytes are followed by meso-hygrophilic species, with 21.1 %. With regards to temperature, the species are mostly micro-mesothermes (54.385 %), and with regards to soil reaction, they are amphi-tolerant (59.7 %).

This association occurs in succession after high sedges and facilitates the transition to mesophilic pastures (BURESCU, 2002). Sometimes, it occurs as fallow or weed association, on agricultural marshy land (BUJOREAN & GRIGORE, 1967, *in* GRIGORE, 1971). NAGY *et al.* (1998) considers the association as the degradation stage of the association *Typhetum angustifoliae* Pignatti 1953. Although of no economic importance, the association *Bidenti-Polygonetum hydropiperi* Lohmeyer in R. Tüxen 1950 is important from the point of view of vegetation succession. Its conservation value is low (DONIȚĂ *et al*., 2005).

2. *Echinochloo-Polygonetum lapathifolii* Soó et Csűrös 1974 cenotaxonomy (according to CHIFU, 2014):

Cls. *BIDENTETEA TRIPARTITI* R. Tüxen et al. ex von Rochow 1951

Syn. *BIDENTETEA TRIPARTITI* R. Tüxen et al. 1950 (Art. 8)
Ord. *Bidentetalia tripartiti* Br.-Bl. et R. Tüxen ex Klika et Hadač 1944
Al. *Chenopodion fluviatile* (*rubri*) Tx. 1960
syn.: *Echinochloo crus galli – Galinsogetum parviflorae* Burduja et Diaconescu Floriţa 1976, incl. *Malachio – Polygonetum mite* Mititelu 1982 non. Pass. 1964.

The association has the following mentions in our country (CHIFU, 2014): a) *echinochloo-polygonetosum lapathifolii* sass. typ.: Cluj county (SOÓ, 1949), Crișurilor Plain (POP, 1968), surroundings of București (SPIRIDON, 1969), meadow from Mircești (SLONOVSCHI, 1971), Valea Lungă (MITITELU L., 1974), Prutului Valley, surroundings of Bacău (MITITELU D. & BARABAȘ, 1975), Buhluiului basin (BURDUJA & DIACONESCU, 1976), Gurguiata-Plopi Valley (MITITELU D., 1982), surroundings of Baia Mare (MITITELU D. & DORCA, 1987), Berezeni (MITITELU D. & BARABAȘ, 1987), Moldova (HOREANU *et al*., 1987), Râmnicului Sărat basin (ȘTEFAN, 1990), northwest of Romania (BURESCU, 2003), Natural Park Vânători (DARABAN, 2007); b) *crypsidetosum alopecuroidis* Pop 1968: Crișurilor Plain (POP, 1968); c) *chenopodietosum polyspermi* Bujorean et Grigore 1967: Banat (BUJOREAN & GRIGORE 1967); d) *bolboschoenetosum maritimi* Horeanu et Ștefan 1987: Moldova (HOREANU *et al.*, 1987), Milcovului basin (COROI, 2001); e) *cyperetosum glomeratae* Burescu 2003: northwest of Romania (BURESCU, 2003); f) *chenopodietosum albi* Soó 1961: Sebeșului Valley (BORZA, 1959), Caransebeșului basin (BUJOREAN *et al.*, 1969), surroundings of Adjud (MITITELU D. & BARABAȘ, 1970), Trotușului Valley (MITITELU D. & BARABAȘ, 1974), Prutului Valley (MITITELU D. & BARABAȘ, 1975), Buhluiului basin (BURDUJA & DIACONESCU, 1976), Massive Preluca (MITITELU D. *et al.*, 1986), Suceava county (MITITELU D. *et al.*, 1987), Berezeni (MITITELU D. & BARABAȘ, 1987); g) *galinsogetosum parviflorae* (Burduja et Diaconescu 1976) Chifu, Mânzu et Zamfirescu 2006: Buhluiului basin (BURDUJA & DIACONESCU, 1976), Neamț county (ȘTEFAN, 1992), Jijiei basin (HUȚANU, 2004). In Banat it is also described by GRIGORE 1971 (interfluve Timiș-Bega).

We found phytocenoses from this association at Pișchia and Surduc, at the last station, occurring in a flooded area, former corn crop. The altitudes at which the phytocenoses were identified ranged between 116 m (at Pișchia) and 196 m (at Surduc). The total number of identified species is of 24, the species average / relevé is 9.66, the minimum species / relevé is 7, and the maximum species number / relevé is 10 (table 2).

The maximum vegetation assertion period coincides with the period of our findings, respectively July-August. The general coverage for the described phytocenoses was estimated between 70-100 %. The study surfaces had a coverage of 2, respectively 4 m^2. The dominant characteristic species is *Echinochloa crus-galli* (L.) Beauv. Of the association characteristic species, we identified the followingamong our phytocenoses: *Polygonum lapathifolium* L., *Rorippa austriaca* (L.) Besser., *Bidens tripartita* L., *Pulicaria vulgaris* Gaertner, *Mentha pulegium* L. The last of threses species indicates the direction which these formations follow and a slight salinization of the stations they occupy.

Table 2.

Echinochloo-Polygonetum lapathifolii Soó et Csűrös 1974 association - identified stations, altitude limits, numeric species data

localities	altitudes	number of total species	average number of species per relevé	minimum number of species per relevé	maximum number of species per relevé
Pișchia, Sânandrei	116-196 m	24	9.66	7	10

GRIGORE, 1971 describes the association on humid soils in meadows along Timiș and Bega rivers, in floodable areas, on cultivated land and fallows, at Timișoara, Otelec, Moșnița,

Foeni, Giulvăz, Cruceni, Uliuc. The author determines two subassociations: subass. *normale* Soó 1964 and subass. *heleochloëtum alopecuroides* Tim. 1950. The last subassociation occurs after the marsh drainange as a primary vegetation, as a short and dense carpet of *Heleochloa alopecuroides* (Piller et Mitterp.) Host ex Roem. (= *Crypsis alopecuroides* (Piller & Mitterp.) Schrad.).

Analysing the phytocenoses described in Romania under floristic and ecologic aspect, COLDEA *et al*. (2012) determines several distinct subassociations among this association: *typicum* Soó 1964 (grouping most of the phytocenoses described in our area), *xanthietosum italici* h.l. (grouping the phytocenoses from the south-eastern part of the country, with differential thermophile species), *galinsogetum parviflorae* (Burduja et Diaconescu 1976) CHIFU *et al*., 2006 (grouping phytocenoses occurring on corn cultivated land, where precipitate water stagnează), *chenopodietosum polyspermi* Soó 1961 (grouping some phytocenoses from the south-western apart of the country which evolve on the low shores of drainage channels), *heleochloetosum alopecuroides* Timár 1950 (grouping phytocenoses which evolve on the salty dried out bottom of some ponds in the western part of the country, just like in Hungary). See also the corology presented above.

Under the aspect of specific diversity, our phytocenoses are most likely to the ones described by GRIGORE (1971), in the Timiș-Bega interfluve. We also identified a nucleus of common species: *Echinochloa crus-galli* (L.) Beauv., *Polygonum lapathifolium* L., *Alisma plantago-aquatica* L., *Bidens tripartita* L., *Gnaphalium uliginosum* L., *Mentha pulegium* L., *Plantago major* L., *Pulicaria vulgaris* Gaertner, *Trifolium repens* L.

Synecologic aspects. The association occurs on marshy soils, with humidity excess, in areas where the water lingers at the surface in spring and dries out during summer months, when the association can optimally develop. It prefers soils with high fertility (BURESCU, 2002). The association appears quite frequent on cultivated, flooded fields. At Surduc, *Echinochloa crus-gali* grows well on the stone layer of steep shores, where seeds are brought by water, the shores being created under the waves' action.

Annual therophytes predominate in the life form spectrum (58.333 %) and as floristic elements, the Eurasian species are best represented (54.166 %). Under the aspect of life forms and phytogeographic category, our phytocenoses resemble a lot the ones described by GRIGORE (1971) in the Timiș-Bega interfluve (the author highlighting their resemblance with the ones described POP (1968, 1969), from the Crișurilor Valley and Someșului Mic Valley).

The ecologic factor analysis shows that, depending on humidity, the predominant species are the meso-hygrophilic ones (33.3 %), followed by the same percentage of hygrophilic, amphi-tolerant and mesophilic ones (16.7 %). Depending on temperature, the amphi-tolerant and micro-mesothermal species observe the same participation (45.8 %) and regarding soil reaction, most species are amphi-tolerant (54.2 %).

Sindinamically, *Echinochloo-Polygonetum lapathifolii* Soó et Csűrös 1974 constitutes a pioneer vegetation, which occurs on uncultivated fields along water shores and represents the transition to mesophilic weed formations (BURESCU, 2002). In the cases we studied, we noticed that these phytocenoses will be relatively quickly replaced by those edified by *Bidens tripartita* L.

From the point of view of grassland management, these associations constitutes good fodder pastures, grazed especially by sheep. After grazing, the vegetation is restored relatively quickly (BURESCU, 2003). ARDELEAN & KARÁCSONY (2002) draw attention to the fact that that *Echinochloa crus-galli* (L.) Beauv. can be used as fodder only at an early stage, since later on its nutritional qualities diminishes. The association presents low conservation value (DONIȚĂ *et al*., 2005), however, it is important for the vegetation succession process.

Table 3.

Synthetic table including species identified among the phytocenoses of the two described associations ("+" – species present, "-" – species not found)

Life form	Biogeographic element	Indicator value			Species	*Bidenti-Polygonetum hydropiperi* Lohmeyer in R. Tüxen 1950	*Echinochloo-Polygonetum lapathifolii* Soó et Csűrös 1974
		H*	T*	R*			
Th	Eua	4.5	3	0	*Bidens tripartita* L.	+	+
H	Circ (bor)	0	0	0	*Agrostis capillaris* L.	+	-
HH	Cosm	6	0	0	*Alisma plantago-aquatica* L.	+	+
TH	Eua (Med)	3	3	4	*Arctium lappa* L.	+	-
H	Eua	4	3	4	*Calystegia sepium* (L.) R. Br.	+	-
H	Carp-Balc	3	3	0	*Campanula abietina* Griseb.	+	-
G	Eur (Med)	0	3	0	*Carex hirta* L.	-	+
HH	Eua (Med)	5	4	4	*Carex riparia* Curtis	+	-
TH	Cosm	2.5	3	0	*Cerastium glomeratum* Thuill.	+	-
Th	Cosm	3	3	0	*Chenopodium album* L.	-	+
H-TH	Eua	2.5	3.5	4.5	*Cichorium intybus* L.	+	-
H-G	Cosm	0	0	0	*Convolvulus arvensis* L.	-	+
G (H)	Cosm	2	3.5	0	*Cynodon dactylon* (L.) Pers.	+	-
Th	Eua (Med)	6	3	4	*Cyperus fuscus* L.	+	+
TH-H	Eua (Med)	2.5	3	0	*Daucus carota* L.	+	-
Th	Cosm	4	0	3	*Echinochloa crus-galli* (L.) Beauv.	+	+
Th	Circ (bor)	5.5	0	0	*Eleocharis acicularis* (L.) Roemer et Schultes	+	+
G-HH	Cosm	5	0	4	*Eleocharis palustris* (L.) Roemer et Schultes	+	-
G	Eua	0	0	0	*Elymus repens* (L.) Gould	+	-
Th	Adv	4	0	4	*Erigeron annuus* (L.) Pers.	+	-
H	Eua (Med)	4	3	0	*Eupatorium canabinum* L.	+	-
H	Eua	4.5	3	4	*Galium uliginosum* L.	+	-
Th	Eua	5	3	4	*Gnaphalium uliginosum* L.	+	+
Th	Eua (cont)	2	3	2	*Gypsophilla muralis* L.	+	-
H	Eua	3.5	3	0	*Holcus lanatus* L.	+	-
Th	Eua	4	3	4	*Impatiens noli-tangere* L.	+	-
TH-H	Eua (Med)	3	3	0	*Inula britannica* L.	+	-
G-HH	Eur	3.5	0	0	*Iris pseudacorus* L.	+	-
Th	Cosm	4.5	0	3	*Juncus bufonius* L.	+	+
HH	Circ (bor)	6	3	0	*Leersia oryzoides* (L.) Swartz	+	-
H	Eua	3	0	0	*Leontodon autumnalis* L.	+	-
Th	Eua (Med)	4.5	4	0	*Lindernia procumbens* (Krocker) Philcox	+	+
H	Eua	2.5	0	0	*Lotus corniculatus* L.	+	
HH	Eua	5	3	0	*Lycopus europaeus* L.	+	+
H-HH	Eua	5	0	0	*Lysimachia vulgaris* L.	+	+

Life form	Biogeographic element	Indicator value			Species	*Bidenti-Polygonetum hydropiperi* Lohmeyer in R. Tüxen 1950	*Echinochloo-Polygonetum lapathifolii* Soó et Csűrös 1974
		H*	T*	R*			
H-HH	Cosm	4	3	0	*Lythrum salicaria* L.	+	-
Th-TH	Eua	0	3	3.5	*Matricharia perforata* Merat	+	+
TH	Pan-Dac	2.5	3.5	4	*Melampyrum barbatum* Waldst. et Kit.	+	-
H	Eua (Med)	4	3	5	*Mentha pulegium* L.	-	+
H-HH	Eua	5	3	0	*Myosotis scorpioides* L.	+	-
HH	Eua	6	3	0	*Oenanthe aquatica* (L.) Poiret	+	-
Th	Eur (Med)	3.5	0	0	*Oxalis stricta* L.	+	-
H	Adv	3	0	0	*Phytolacca americana* L.	+	-
H	Eua	0	0	0	*Plantago lanceolata* L.	+	+
H	Eua	3	0	0	*Plantago major* L.	+	+
H	Eua	3	3	0	*Poa nemoralis* L.	+	-
Th	Cosm	2.5	0	3	*Polygonum aviculare* L.	+	+
Th	Eua (Med)	4.5	3	4	*Polygonum hydropiper* L.	+	-
Th	Eua	4	0	3	*Polygonum lapathifolium* L.	-	+
Th	Eua	5	3	4	*Polygonum mite* Schrank	+	-
H	Cosm	3.5	0	4	*Potentilla reptans* L.	+	-
Th	Eua (Med)	4	3	3	*Pulicaria vulgaris* Gaertner	-	+
H	Eua (Med)	4	0	0	*Ranunculus repens* L.	+	-
Th-TH,H	Eua	3	3	4	*Ranunculus sardous* Crantz.	+	-
HH	Eua (Med)	6	3	4	*Rorippa amphibia* (L.) Besser	+	-
H-G	Euc	4	3.5	4	*Rorippa austriaca* (L.) Besser	-	+
Th	Cosm	3	4	0	*Solanum nigrum* L.	+	-
Th	Cosm	2.5	4	0	*Setaria pumila* (Poiret) Schultes	+	+
HH	Eua	5.5	3.5	0	*Sparganium erectum* L.	+	-
H	Eua (Med)	2.5	2	3	*Stellaria graminea* L.	+	-
H	Eua	3.5	0	0	*Trifolium repens* L.	+	+
HH	Cosm	6	3.5	0	*Typha latifolia* L.	+	-
Th	Adv	3.5	4	0	*Xanthium italicum* Moretti	+	-
Th	Eua	3.5	3.5	4	*Xanthium strumarium* L.	+	+
					Mumber of species	57	24

(*H – soil humidity, T – temperature, R – soil reaction; Th – annual therophyte, TH – biennal therophyte; H – Helophyte, HH – Hydrophyte, G - Geophytes; Eua – Euro-Asiatic, Cosm. – Cosmopolite / ubiquitous, Med. – Mediterraneean, Circ – Circumpolar, Adv – Adventive, Eur – European, Euc – Central European, Carp.-Balc. - Carpathian-Balkan, Pan.-Dac. – Panonic - Dacic)

Table 3 enumerates the species identified among the phytocenoses of the two described associations, some of these occurring in both associations. E.g.: *Bidens tripartita* L., *Echinochloa crus-galli* (L.) Beauv., *Gnaphalium uliginosum* L., *Juncus bufonius* L., *Lycopus europaeus* L., *Lysimachia vulgaris* L., *Matricharia perforata* Merat, *Plantago lanceolata* L., *Plantago major* L., *Polygonum aviculare* L., *Setaria pumila* (Poiret) Schultes, *Trifolium repens*

L., *Xanthium strumarium* L. For efficiency, the list was organized in an alphabetical order. In the left column we noted for each species bioform, geoelement and ecologic indices value, according to SANDA *et al*., 2003.

CONCLUSIONS

Among the Banat's vegetation units, the associations *Bidenti-Polygonetum hydropiperi* Lohmeyer in R. Tüxen 1950 and *Echinochloo-Polygonetum lapathifolii* Soó et Csűrös 1974 (class *Bidentetea tripartiti* Tx., Lohm. et Prsg. 1950) are frequently encountered.

The associations we described are correspondent to the habitat R5312 - Ponto-Danubian Communities with *Bidens tripartita*, *Echinochloa crus-galli* and *Polygonum hydropiper* and to the habitat 3270 - Rivers with marshy shores with *Chenopodion rubri* and *Bidention vegetation*.

Upon comparing our data to that of other authors, we observed that the phytocenoses we described at Surduc and Pișchia, mostly resemble the ones described by GRIGORE (1971) in the Timiș-Bega interfluve, having a nucleus of common species, the same predominant life forms, as well as the same floristic structure. They present some differences in comparison with those described by COSTE, 1974 (in whose structure more cyperaceae and transgressive chenopodiaceae can be found), in gardens and humid micro-depressions (at Zăvoi and Pojejena, Caraș-Severin county).

These plant communities present particularities under the aspect of floristic composition, of physiognomy and ecology, which are sometimes unstable from an year to another. They are exposed to anthropic pressure, a major successional factor.

BIBLIOGRAPHY

1. ARDELEAN, G., KARÁCSONY, C., 2002 – Flora și fauna Văii Ierului (înainte și după asanare), Editura Bion, Satu Mare.
2. BARBERI, P., BORONA, V., CHODOVA, D., ĐIKIĆ, M., HAOUALA, R., JOVOVIĆ, Z., KAZINCZI, G., MILANOVA, S., NARWAL, S.S., OSTOJIĆ, Z., STEFANOVIĆ, L., ŠARIĆ, T., ŠOLJAN, D., TYR, Š., 2011 – Herbologia. An international journal on weed research and control, Štamparija Garmond Graphic, Sarajevo
3. BISSELS, S., DONATH, T.W., HOLZEN, N., OTTE, A., 2005 – Ephemeral wetland vegetation in irregularly flooded arable fields along the northern Upper Rhine: the importance of persistent seedbanks, Phytocoenologia, 35 (2-3), pp. 469-488.
4. BRANDES, D., 1999 – Bidentetea-Arten an der mittleren Elbe-Dynamik, räumliche Verbreitung und Soziologie (Species of the class Bidentetea on river banks in the middle course of the river Elbe, Germany. Dynamics, spatial distribution and community ecology). Braunschweiger Naturkundliche Schriften, 5 (4), pp. 781-809.
5. BURESCU, P., 2003 – Flora și vegetația zonelor umede din nord-vestul României, Editura Academiei Române, București.
6. CHIFU, T. (ed.), IRIMIA, I., 2014 – Diversitatea fitosociologică a vegetației României, II. Vegetația erbacee antropizată. B. Vegetația pionieră și a buruienișurilor, Institutul European, Iași, p. 971.
7. CHYTRÝ, M. (ed.), ŠUMBEROVÁ, K., HÁJKOVÁ, P., HÁJEK. M., , HROUDOVÁ, Z., NAVRÁTILOVÁ, J., ČTVRTLÍKOVÁ, M., SÁDLO, J., LOSOSOVÁ, Z., HRIVNÁK, R., RYDLO, J., OŤAHEĽOVÁ, H., BAUER, P., HANÁKOVÁ, P., EKRT, L., EKRTOVÁ, E., 2011 – Vegetation of the Czech Republic 3. Aquatic and weatland vegetation, Academia, Praha, 828 p.
8. COLDEA, G., OPREA, A., SARBU, I., SIRBU, C., ȘTEFAN, N., 2012 – Les associations végétales de Roumanie, tome 2. Les associations anthropogènes, Presa Universitară Clujeană, Cluj-Napoca.
9. COSTE, I., 1974 – Flora şi vegetaţia Munţilor Locvei, PhD Thesis, Universitatea „Babeş-Bolyai", Cluj-Napoca.

10. DEKLERK, P., JANSSEN, C.R., JOOSTEN, J.H.R., 1997 – Patterns and processes in natural wetland vegetation in the Dutch fluvial area: A palaeoecological study, Acta Botanica Neerlandica, 46 (2), pp. 147-157.
11. DEVILLERS P., DEVILLERS-TERSCHUREN J., VANDER LINDEN C., 2001 – *PHYSIS* Palaearctic Habitat Classification. Updated to 10 December *2001*. Institut Royal des Sciences Naturelles, Bruxelles. Compléments à la table : SPN-MNHN / INPN, février 2010.
12. DONITA, N., POPESCU, A., PAUCA-COMANESCU, M., MIHAILESCU, S., BIRIS, I.-A., 2005 – Habitatele din România, Editura Tehnică Silvică, Bucureşti
13. DRĂGULESCU, C., 2013 – The hydrophilous flora and vegetation of the Timiș drainage basin (Banat, Romania), Transylvanian Review of Systematical and Ecological Research, 15-special issue, "*The Timiş River Basin*", Sibiu, pp. 61-88
14. ELLENBERG, H., 1978 – Vegetation Mitteleuropasmit den Alpen, Eugen Ulmer, Sttutgart, p. 903.
15. GAFTA, D., MOUNTFORD, O. (cords.), 2008 – Manual de interpretare a habitatelor Natura 2000 din România, Ed. Risoprint, Cluj-Napoca, 101 p.
16. GAMRAT, R., 2006 – Threat of small midfield ponds on Weltyń Plain, Int. Agrophysics, 20, pp. 97-100
17. GLOWACKA, A., 2011 – Dominant weeds in maize (Zea mays L.) cultivation and their competitiveness under conditions of various methods of weed control, Acta Agrobotanica, vol. 64 (2), pp. 119-126
18. GRIGORE, S., 1971 – Flora şi vegetaţia din interfluviul Timiş – Bega, PhD Thesis, Institutul Agronomic „Ion Ionescu de la Brad", Iaşi.
19. HAMAR, J., SÁRKÁNY-KISS (eds.), 1999 – The Upper Tisa Valley. Preparatory proposal for Ramsar site designation and an ecological background Hungarian, Romanian, Slovakian and Ukrainian co-operation, TISCIA monograph series
20. JARIĆ, S., MITROVIĆ, M., VRBNIČANIN, S., KARADŽIĆ, B., DJURDJEVIĆ, L., KOSTIĆ, O., MAČUKANOVIĆ-JOCIĆ, M., GAJIĆ, G., PAVLOVIĆ, P., 2011 – A contribution to studies of the ruderal vegetation of Southern Srem, Serbia, Arch. Biol. Sci, Belgrade, 63 (4), pp. 1181-1197
21. JAROLINEK, J., ŠIBIK, J. (eds.), 2008 – Vegetation of Slovakia. Diagnostic, constant, and dominant species of the higher vegetation units of Slovakia, Veda, Bratislava, pp. 61-62.
22. JENAČKOVIĆ, D., DIMITRIJEVIĆ, D., RANDELOVIĆ, V., 2010 – Macrophytic flora and vegetation of the rivers Svrljiški and Beli Timok (Eastern Serbia), Biologica Nyssana, 1 (1-2), pp. 23-26
23. KAŹMIERCKAK, E., 1997 – The vegetation of kettle-holes in central Poland, Acta Phytogeographica Suecica, 83, Uppsala, 101 p.
24. KIESSLICH, M., DENGLER, J., BERG, C., 2003 – Die Gesellschaften der Bidentetea tripartitae Tx. et al. ex Von Rochow 1951 in Mecklenburg-Vorpommern mit Anmerkunger zur Synsystematik und Nomenklatur der Klasse, Berlin, Feddes Repertorium 114, 1-2, pp. 91-139
25. KRICSFALUSY, V., MIHÁLY, A., 2009 – Flora and vegetation of the Bodrog catchment area (International expedition to the Upper Tisza region*)*, Thaiszia – J. Bot., Košice, 19, Suppl. 1, pp. 135-151
26. KROPÁČ, Z., 2006 – Segetal vegetation in the Czech Republic: synthesis and syntaxonomical revision, Preslia, 78, pp. 123-209
27. KUCHARSKI, L., 2004 – Floristical diversity of weatlands in Central Poland – conditions and changes, Teka Kom. Ochr. Kszt. Środ. Przyr., 1, pp. 116-121
28. LAȚO, A., NEACȘU, A., CRISTA, F., LAȚO, K., RADULOV, I., BERBECEA, A.,. NIȚĂ, L., CORCHEȘ, M., 2013 - Chemical Properties and Soils Fertility in the Timis County Wetlands, Journal of Environmental Protection and Ecology 14, No 4, pp. 1551–1558
29. LISEK, J., 2012 – Synantropic orchard flora in West Mazovia – Central Poland, Journal of Fruit and Ornamental Plant Research, vo. 20 (2), pp. 71-83
30. LOVASZ, H., 1995 – Flora și vegetația din Dealurile Silagiului și Câmpia Buziașului (județul Timiș), PhD Thesis abstract, Universitatea "Babeș-Bolyai" Cluj-Napoca, Facultatea de Biologie-Geografie, Cluj-Napoca.
31. MAKRA, O., 2005 – Checklist of the associations of the Hungarian section of Tsza basin, TISCIA, 35, pp. 9-16
32. MARKOVIĆ, L., 1975 – O vegetaciji sveze Bidention tripartiti u Hrvatskoj, Acta Bot. Croat. 34, pp. 103-120

33. MARKOVIČ, L., 1975 – O vegetaciji sveze Bidention tripartiti u Hrvatskoj, Acta Botanica Croatica, 34, pp. 103-120.
34. MARKOVIĆ, L., 1980 – Zajednica Polygono – Chenopodietum Lohm. 1950 u vegetaciji sprudova rijeke save u Hrvatskoj, Acta Bot. Croat., vol. 39, pp. 121-130
35. MILAN, C., ZDENKA, O., 2003 – Plot sizes used for phytosociological sampling of European vegetation, Journal of Vegetation Science, 14, pp. 563-570
36. MUCINA, L., BÜLTMANN, H., DIERBEN, K., THEURILLAT, J.-P., RAUS, T., ČARNI, A., ŠUMBEROVÁ, K., WILLNER, W., DENGLER, J., GARCÍA, R.G., CHYTRÝ, M., HÁJEK, M., DI PIETRO, R., IAKUSHENKO, D., PALLAS, J., DANIËLS, F.J.A., BERGMEIER, E., GUERRA, A.S., ERMAKOV, N., VALACHOVIČ, M., SCHAMINÉE, J.H.J., LYSENKO, T., DIDUKH, Y.P., PIGNATTI, S., RODWELL, J.S., CAPELO, J., WEBER, H.E., SOLOMESHCH, A., DIMOPOULOS, P., AGUIAR, C., HENNEKENS, S.M., TICHÝ, L., 2016 – Vegetation of Europe: hierarchical floristic classification system of vascular plant, bryophyte, lichen and algal communities. Synthesis, Applied Vegetation Science, 19 (Suppl. 1), pp. 3-264
37. NAHY, J., FIGECZKY, G., PENKSZA, K., FINTHA, I., MOLNÁR, A., TŐTH, Z., KALAPOS, T., 1998 – Contributions to the flora and vegetation of the lake Bence-Tó, NE Hungary, Studia bot.-hung. 27-28, pp. 151-161
38. NEACȘU, A.-G., 2008 – Cercetări asupra biodiversității florei și vegetației unor lacuri de acumulare din județul Timiș, PhD Thesis, U.S.A.M.V.B. Timișoara, Facultatea de Agricultură., Timișoara.
39. NICULESCU, M., 2016 – Diversity, distribution and ecology of the freshwater natural habitats from southern of Oltenia, Romania, Scientific Papers, Series A., Agronomy, vol., LIX, pp. 116-121
40. OPREA, I.V., 1976 – Flora și vegetația din Câmpia Sînnicolaul Mare (județul Timiș), PhD Thesis abstract, Universitatea "Babeș-Bolyai" Cluj-Napoca, Facultatea de Biologie-Geografie,, Cluj-Napoca.
41. PEIA, P., 1978 – Flora vasculară a Depresiunii Almăjului, județul Caraș-Severin. Studiu taxonomic, geobotanic și economic, Universitatea "Babeș-Bolyai" Cluj-Napoca, Faciltatea de Biologie-Geografie
42. POP, E., 1960 – Mlaştinile de turbă din R.P.R., Editura Academiei, Bucureşti.
43. SADLO, J., KOLBEK, J., 1997 – The terrestrial ruderal and segetal vegetation of North Korea: A syntesis, Folia Geobotanica & Phytotaxonomica, 32 (1), pp. 25-40.
44. SANDA, V., BIȚĂ-NICOLAE, C.D., BARABAȘ, N., 2003 – Flora cormofitelor spontane și cultivate din România, Editura "I. Borcea", Bacău.
45. SANDA, V., ÖLLERER, K., BURESCU, P., 2008 – Fitocenozele din România. Sintaxonomie, structură, dinamică și evoluție, Editura Ars Docendi – Universitatea din București, București.
46. SANDA, V., ŐLLERER, K., BURESCU, P., 2008 – Fitocenozele din România – Sintaxonomie, structură, dinamică și evoluție, Editura Ars Docendi, Universitatea din București, p. 166.
47. SANDA, V., POPESCU, A., BARABAŞ, N., 1998 – Cenotaxonomia şi caracterizarea grupărilor vegetale din România, Editura „I. Borcea", Bacău.
48. SANDA, V., POPESCU, A., DOLTU, M. I., NEDELCU, G. A., 1979 – Conspectul vegetaţiei acvatice şi palustre din România, Studii şi Comunicări, 23, Muzeul Brukenthal, Ştiinţe Naturale, Sibiu, pp. 117-162.
49. SANDA, V., POPESCU, A., DOLTU, M.I., 1980 - Cenotaxonomia și chorologia grupărilor vegetale din România, Studii şi Comunicări, 24, Muzeul Brukenthal, Ştiinţe Naturale, Sibiu
50. ŠILC, U., ČARNI, A., 2007 – Formalized classification of the weed vegetation of arable land in Slonevia, Preslia, 79, pp. 283-302
51. ŠUMBEROVA K., 2011 – MB Bidentetea tripartitae Tüxen et al. ex von Rochow 1951. In: Chytrý M. (ed.), 2011 - Vegetace České republiky. 3. Vodní a mokřadní vegetace, Academia, Praha, pp. 347-349.
52. SZAREK-LUKASEZEWSKA, G., GRODZIŃSKA, K., 2007 – Vegatation of a post-mining open pit (Zn/Pb ores): three-year study of colonization, Polish Journal of ecology, 55, 2, pp. 261-282
53. VRBNICANIN, S., STEVANOVIC, Z.D., RADOVANOV, K.J., UDULAĞ, A., 2008 – *Weed vegetation of small grain crops in Serbia: environmental and human impacts*, Turk J Agric For, 33, pp. 325-337

54. VREŠ, B., SELIŠKAR, A., BABIJ, V., 2007 – Flora and vegetation of Man-Made Lakes and adjacent areas in Slovenia, Collection of Papers Devoted to Academician Kiril Micevski, Macedonian Academy of Science and Arts, pp. 191-207
55. ZALIBEROVA, M., 1995 – Ruderal vegetation in Biosphere Reserve East Carpathian, Ekologia-Bratislava, suppl. 2, 14, pp. 29-33.
56. ZALIBEROVÁ, M., JOROLÍMEK, I., 1995 – Ruderal plant communities of north-eastern Slovakia I. Artemisietea, Galio-Urticetea, Bidentetea, Thaiszia – J. Bot., Košice, 5, pp. 31-59
57. https://www.synbiosys.alterra.nl/evc/vegtype.aspx?selectnode=false&vegtype=12QI