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Ruderal vegetation of Ukraine: classes *Galio-Urticetea* Passarge ex Kopecký 1969 and *Bidentetea* R.Tx. et al. ex von Rochow 1951

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Abstract. The current state and syntaxonomic structure of anthropogenic vegetation of the classes *Galio-Urticetea* and *Bidentetea* are revealed. The class *Galio-Urticetea* is represented by 3 phytosociological orders, 6 alliances, and 32 associations. The class *Bidentetea* unites 8 plant associations of 1 order and 2 alliances. The territorial differentiation of the studied plant communities is caused by the limiting factors: soil moisture and the changing hydrological regime. Thus the phytocoenoses of these classes are confined to the natural zones of Polissia and forest-steppe. Based on detrended correspondence analysis, the leading factors differentiating vegetation units were identified. Within the class *Galio-Urticetea*, they include the continentality of climate, precipitation regime, and concentration of mineral nitrogen in the soil. The factors of major significance for *Bidentetea* were soil moisture and the concentration of mineral nitrogen in the substrate.

Key words: syntaxonomy, ordination, phytoindication, anthropogenic vegetation, plant communities, Ukraine

1. Introduction

The increasing human impact on natural ecosystems leads to their transformation, up to the formation of semi-natural and anthropogenic habitats. Alien plant invasions also disturb the entirety and structure of habitats. In Ukraine, hygrophilous ruderal vegetation is represented by 2 phytosociological classes – *Galio-Urticetea* and *Bidentetea*, which develop across wet to moist nutrient-rich habitats, where natural vegetation was disturbed by human activities. Mucina *et al.* (2016) defined *Bidentetea* as summer-annual pioneer vegetation of seasonally flooded nutrient-rich river alluvia, lake shores, and heavily nutrient-loaded anthropogenic habitats of boreo-temperate Europe and North Africa. The class *Galio-Urticetea* unites tall-herb semi-natural perennial vegetation on nutrient-rich moist soils. In the Central European syntaxonomic classification, *Galio-Urticetea* is considered to be a synonym of *Epilobietea angustifolii* R. Tx. et Preising ex von Rochow 1951 (Mucina *et al.* 2016). Both *Galio-Urticetea* and *Bidentetea* consist of natural plant communities as well as ruderal ones. This indicates their vulnerability to anthropogenic transformations. They differ foremost in the history of their formation and further development (Kuzmichev 1992). Within natural vegetation, these processes are dominated by native plant species, while in ruderal phytocoenoses, alien plants are the key elements (Ilyin 1947; Zosimovich 1958; Zozulin 1973). Another distinction is the level of phytocoenotic

barrier, which is lower in ruderal vegetation, as well as the availability of free ecological space (Dubyna *et al.* 2022a). A specific feature of the phytocoenoses of the studied vegetation classes is their position in the successional series, where they take an intermediate position between the forest, shrub, wetland, and anthropogenic vegetation. This feature affects the floristic composition of the communities and their dynamics. The importance of research on such phytocoenoses lies primarily in their prospects for interpreting serial plant communities of natural types (Kostylev 1990). Using the ratio of different genetic and historical species groups and the importance of their role in plant communities, it is possible to assess degradation processes in vegetation more accurately and study the main mechanisms of its synanthropization.

In Europe, much attention has been paid to research on the classes *Galio-Urticetea* and *Bidentetea*. Phytosociological surveys of these classes have been done in the Czech Republic (Chytrý 2009), Slovakia (Jarolímek *et al.* 1997, 2008), Spain and Portugal (Rivas-Martínez *et al.* 2001), Hungary (Borhidi 2003), France (Bardat *et al.* 2004; Fernez & Causse 2015), Germany (Berg *et al.* 2004), Romania (Sanda *et al.* 2008), Bulgaria (Tzonev *et al.* 2009), Poland (Matuszkiewicz 2001; Ratyńska *et al.* 2010; Kącki *et al.* 2013), Italy (Biondi *et al.* 2014), Serbia (Tabašević *et al.* 2021a, 2021b), and separate regions. Some authors described syntaxa new to science or regions (Alves *et al.* 2003; Danu & Irimia-Blaj 2007) and revealed the dynamics of species and community diversity (Pyšek *et al*. 2004; Medvecká *et al.* 2010; Rendeková *et al.* 2017).

For the first time in Ukraine, vegetation of the classes *Galio-Urticetea* and *Bidentetea* was presented by Gutte (1973), who studied nitrophilous vegetation in Kyiv and reported a new plant association *Myosotido sparsiflorae-Alliarietum petiolatae*. Later, a syntaxonomic survey of ruderal plant communities of these classes was presented by Solomakha *et al.* (1992). A lot of information about phytocoenoses of these classes was reported for urban areas, particularly for Cherkasy (Osypenko 2006), Lviv (Kucheryavyi *et al.* 1991), Kryvyi Rig (Smetana 2002; Yeremenko 2019), and Kyiv (Aleshkina 2011; Dziuba *et al.* 2022). In southern Crimea, within the city of Yalta, Levon (1996a, 1996b) described 6 plant associations new to science. Phytocoenoses of both classes were reported as secondary vegetation across disturbed habitats of protected areas, such as the Danube Biosphere Reserve (Dubyna *et al.* 2003), Gorgany Nature Reserve (Klimuk *et al.* 2006), Kremenchuk Plavni Regional Landscape Park (Galchenko 2006), and national nature parks (NNPs): Skole Beskinds NNP (Solomakha *et al.* 2004), Vyzhnytsia NNP (Chorney *et al.* 2005), Pyriatyn NNP (Kovalenko 2016), Synevyr NNP (Solomakha *et al.* 2016), and projected Korostyshiv NNP (Orlov & Yakushenko 2005). Within disturbed natural and anthropogenic habitats, phytocoenoses of these classes were recorded on Poltava Plain (Bayrak & Didukh 1996), Prydniprovska Upland (Irdyn bog) (Shevchyk *et al.* 1997), Ukrainian Roztocze or Roztochchia (Soroka 2008), Cherkasy-Chygyryn geobotanical district (Gaiova 2008), Northern Black Sea Region (Dubyna *et al.* 2004), Khorol River valley (Homlya 2005), estuary of the Dnipro River (Chinkina 2006), Central Polissia (Khomyak 2010, 2022), floodplain ecosystem of Western Bug Basin (Kuzyarin 2005), north-eastern regions of Ukrainian forest-steppe (Goncharenko 2003), Zhytomyr Polissia (Iakushenko 2004), Chernihiv region (Pashkevich & Fitsailo 2009), littoral zone of Kremenchuk Reservoir (Konogray 2013), wetlands of Ukrainian forest-steppe (Chorna 2013), Dnipro River valley across Ukrainian forest-steppe (Makhynya 2015), Bukovina (Tokaryuk *et al.* 2018), and floodplain of Dniester Canyon (Rozenblit 2020). Results of the syntaxonomic studies of the classes *Galio-Urticetea* and *Bidentetea* in Ukraine were summarized by Dubyna *et al.* (2019).

In this study, we aimed to (*i*) review the syntaxonomy of ruderal vegetation of the classes *Galio-Urticetea* and *Bidentetea* for the territory of Ukraine based on recent studies and a large dataset; (*ii*) reveal the main ecological gradients of territorial delimitation of the studied vegetation types.

2. Materials and methods

2.1. Study area

Our study area is located in south-eastern Europe and covers the whole territory of Ukraine. In the first article of this series, we provided detailed characteristics of the natural conditions of Ukraine (Dubyna *et al.* 2022b).

2.2. Data collection and preparation

The data for our analyses come from the database "Anthropogenic vegetation of Ukraine", registered in the Global Index of Vegetation-Plot Databases (Dengler *et al.* 2011) with the code EU-UA-11. The database was created on the platform TURBOVEG version 2.142 (Hennekens & Schaminée 2001). These materials included our original vegetation-plot records (relevés) made during field research in 2015-2020 but also the available plot records presented in publications listed in the introduction as well as unpublished data kindly provided by other authors (listed in the Acknowledgements), collected during the project "Ruderal vegetation of Ukraine" led by M.G. Kholodny Institute of Botany, National Academy of Sciences of Ukraine. The complete database includes 8382 vegetation plots. Based on the list of diagnostic

species presented by Mucina *et al*. (2016), Dubyna *et al*. (2019), and in some other European syntaxonomic syntheses (Jarolímek & Šibík 2008; Chytrý 2009; Kącki *et al.* 2013), we interpreted 887 vegetation plots as belonging to hygrophilous ruderal vegetation of the classes *Galio-Urticetea* and *Bidentetea*. Out of the entire data set, only plots within anthropogenically disturbed habitats were selected for further analysis: on the sites of forest clearings, recreational areas near watercourses, urban environments, abandoned fields, pastures, forest roadsides, and other man-made habitats. After data filtering for syntaxonomic classification, we used only 737 vegetation plots (528 of *Galio-Urticetea* and 209 of *Bidentetea*).

All the 737 relevés were sampled according to the Braun-Blanquet's approach (Braun-Blanquet 1964) on plots of various size, 10-25 m^2. To homogenize and balance the final dataset, all records of juvenile trees and shrubs were deleted because some authors recorded them, while others did not. Data concerning bryophytes and lichens were also removed, as they were not recorded in all of the relevés and are of limited ecological importance in ruderal vegetation.

2.3. Data analysis

Both divisive and agglomerative hierarchical clustering were used to detect the main groups of relevés. In the first step, we applied modified TWINSPAN (Roleček *et al.* 2009) with Whittaker's beta (Whittaker 1978) as heterogeneity of clusters, and a "pseudospecies" cut level as 0%, 5%, 15%, and 25%. As a result, we identified big clusters that corresponded mainly to the alliances of vegetation. Then each cluster was analysed separately using the PC-ORD algorithm (McCune & Mefford 2006) with the Sörensen coefficient (Sörensen 1948) and a "flexible beta" of -0.25. The OptimClass method for identifying the optimal number of clusters was employed (Tichý *et al.* 2010). The results indicate that 35-40 clusters are optimal for *Galio-Urticetea* and 8-10 clusters for *Bidentetea*.

The clusters were identified by their diagnostic species determined by using the *phi*-coefficient as a fidelity measure (Chytrý *et al.* 2002). The threshold values for the *phi*-coefficient were taken at the level of 0.25. Highly diagnostic species have a *phi*-coefficient exceeding 0.5. All groups of relevés were standardized to equal size, and insignificant values of fidelity were removed based on the Fisher extract test ($p<0.001$). At the last stage, the clusters were identified based on the analysis of their floristic composition and comparison with diagnostic species of syntaxa published in foreign and Ukrainian publications (Chytrý 2011; Mucina *et al.* 2016; Dubyna *et al.* 2019). In some cases, we identified a few clusters as one association because vegetation plots differed, for example, by dominance of one of the diagnostic species or some others (very often aliens), while keeping the general similarity of floristic composition. It should be noted that for the communities from the southern coast of Crimea, in most cases, we had access mainly to the nomenclatural types of associations. However, we considered it necessary to include them in the data processing, since they are special in their floristic composition for Ukraine as well as for Europe. We marked diagnostic species by light grey colour in the synoptic table, while the highly diagnostic ones by dark grey.

To clarify the differentiation of plant communities and to explore the relationship with environmental variables, we employed detrended correspondence analysis (Hill & Gauch 1980). The phytoindication analysis was made by using Didukh's (2011) ecological scales in R 4.0.2 (R Core Team 2022) using the library *ggplot2* 3.3.5 (Wickham 2016) to visualize the results. The earlier suggested Ellenberg indicator values concerned 6 environmental variables: soil moisture, concentration of mineral nitrogen in the substrate, soil acidity, light intensity/shading, thermal regime, and continentality (Ellenberg *et al.* 1991), whereas phytoindication scales of Didukh (2011) allow to evaluate vegetation preferences according to 12 environmental factors: soil moisture content, variability of soil moisture, soil acidity, salt regime, calcium carbonate content and mineral nitrogen content of the substrate, soil aeration, thermal regime, ombroregime (aridity-humidity of climate), continentality of climate, cryoregime, and light regime. We used Didukh's (2011) ecological scales for our analysis also because they were developed for the Ukrainian flora and contain complete information on the environmental requirements of a vast majority of species recorded in the plots. In the previous article of the series (Dubyna *et al.* 2022b), we presented a table with the values of environmental factors according to Didukh (2011) and their correlation with Ellenberg indicator values.

2.4. Nomenclature

To unify the nomenclature of taxa in different vegetation plots, we followed Mosyakin & Fedoronchuk (1999). Records of the same species in different layers were merged into one in the final data matrix. Names of syntaxa follow Dubyna *et al.* (2019).

3. Results

3.1. Syntaxonomic classification of the *Galio-Urticetea* and *Bidentetea* classes in Ukraine

1. *Galio-Urticetea* Passarge ex Kopecký 1969
   1.1. *Convolvuletalia sepium* R. Tx. ex Moor 1958
      1.1.1. *Senecionion fluviatilis* R. Tx. ex Moor 1958

1.1.1.1. *Polygono persicariae-Pulicarietum uliginosae* Levon 1996
1.1.1.2. *Ranunculo arvensis-Calepinetum irregularis* Levon 1996
1.1.1.3. *Eupatorietum cannabini* R. Tx. 1937
1.1.1.4. *Rudbeckio laciniatae-Solidaginetum canadensis* R. Tüxen et Raabe ex Anioł-Kwiatkowska 1974
1.1.1.5. *Calystegio sepium-Epilobietum hirsuti* Hilbig et al. 1972
1.1.1.6. *Calystegio sepium-Impatientetum glanduliferae* Hilbig 1972
1.2. *Circaeo lutetianae-Stachyetalia sylvaticae* Passarge 1967
1.2.1. *Impatienti noli-tangere-Stachyion sylvaticae* Görs ex Mucina in Mucina et al. 1993
1.2.1.1. *Stachyo sylvaticae-Impatientetum noli-tangere* Hilbig 1972
1.2.1.2. *Arunco vulgaris-Lunarietum redivivae* Sádlo et Petřík in Chytrý 2009
1.2.1.3. *Carici pendulae-Eupatorietum cannabini* Hadač et al. 1997
1.2.1.4. *Urtico dioicae-Parietarietum officinalis* Klotz 1985
1.3. *Galio-Alliarietalia* Oberd. in Görs et T. Müller 1969
1.3.1. *Aegopodion podagrariae* Tx. 1967
1.3.1.1. *Symphyto officinalis-Anthriscetum sylvestris* Passarge 1975
1.3.1.2. *Elytrigio repentis-Aegopodietum podagrariae* Tx. 1967
1.3.1.3. *Chaerophylletum aromatici* Neuhäuslová-Novotná et al. 1969
1.3.1.4. *Chaerophylletum bulbosi* R. Tx. 1937
1.3.1.5. *Chaerophyllo hirsuti-Cirsietum oleracei* Kostylev in Solomakha et al. 1992
1.3.1.6. *Oenothero biennis-Helianthetum tuberosi* de Bolós et al. 1988
1.3.1.7. *Urtico dioicae-Heracleetum mantegazziani* Klauck 1988
1.3.1.8. *Reynoutrietum japonicae* Görs et Müller in Görs 1975 nom. mut.
1.3.1.9. *Aegopodio-Reynoutrietum sachalinensis* Brzeg in Brzeg et Wojterska 2001
1.3.1.10. *Urtico dioicae-Heracleetum sosnowskyi* Panasenko et al. 2014
1.3.1.11. *Urtico dioicae-Rubetum caesii* Golovanov 2017
1.3.1.12. *Leonuro-Urticetum dioicae* (Solomeshch in Mirkin et al. 1986) A. Ishbirdin et al. 1988
1.3.1.13. *Sambucetum ebuli* Felföldy 1942
1.3.1.14. *Beto trigynae-Urticetum dioicae* Levon 1997
1.3.2. *Geo urbani-Alliarion petiolatae* Lohmeyer et Oberd. in Görs et T. Müller 1969
1.3.2.1. *Alliario officinalis-Chaerophylletum temuli* (Kreh 1935) Lohmeyer 1949
1.3.2.2. *Geo urbani-Chelidonietum maji* Jarolimek et al. 1997
1.3.2.3. *Lepidio graminifolii-Parietarietum serbicae* Levon 1996
1.3.2.4. *Geranio collini-Melissetum officinalis* Levon 1996
1.3.2.5. *Verbeno officinalis-Ornithogaletum pontici* Levon 1996
1.3.2.6. *Myosotido sparsiflorae-Alliarietum petiolatae* Gutte 1973
1.3.3. *Petasition officinalis* Sillinger 1933
1.3.3.1. *Petasitetum hybridi* Imchenetzky 1926
1.3.4. *Rumicion alpini* Scharfetter 1938
1.3.4.1. *Rumicetum alpini* Beger 1922
2. *Bidentetea* R. Tx. et al. ex von Rochow 1951
2.1. *Bidentetalia* Br.-Bl. et R. Tx. ex Klika et Hadač 1944
2.1.1. *Bidention tripartitae* Nordhagen ex Klika et Hadač 1944
2.1.1.1. *Rumici maritimi-Ranunculetum scelerati* Oberd. 1957
2.1.1.2. *Polygonetum hydropiperis* Passarge 1965
2.1.1.3. *Bidentetum tripartitae* Miljan 1933
2.1.1.4. *Myosoto aquatici-Bidentetum frondosae* O. de Bolòs, Montserrat et Romo 1988
2.1.1.5. *Bidentetum cernuae* Slavnić 1951
2.1.1.6. *Junco bufonii-Bidentetum connatae* (Timmermann 1993) Passarge 1996
2.1.2. *Chenopodion rubri* (R. Tx. in Poli et J. Tx. 1960) Hilbig et Jage 1972
2.1.2.1. *Bidenti frondosae-Atriplicetum prostratae* Poli et J. Tx. 1960 corr. Gutermann et Mucina 1993
2.1.2.2. *Chenopodietum rubri* Timár 1950

3.2. Overview and characteristics of the *Galio-Urticetea* and *Bidentetea* classes associations

The structure of the *Galio-Urticetea* and *Bidentetea* classes in Ukraine is characterized by the average European level of phytocoenotic diversity. The class *Galio-Urticetea* is represented by 32 associations belonging to 6 alliances and 3 orders (Appendix 1). It should be noted that the communities of the classes *Galio-Urticetea* and *Bidentetea*, being moisture-depended, are more widespread in the forest and forest-steppe natural zones (Fig. 1A-C).

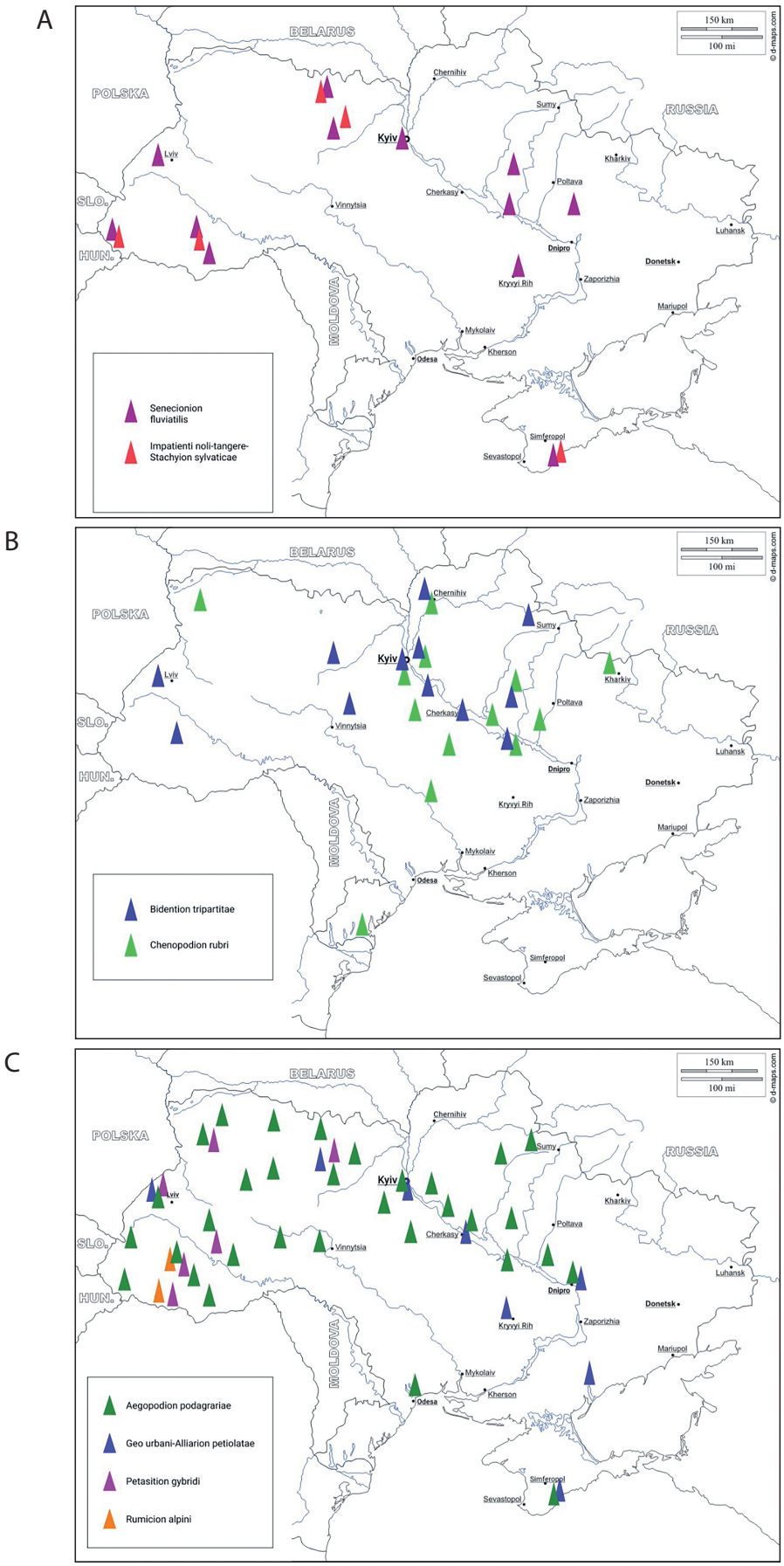

Fig. 1. Distribution maps of the recorded plant communities of phytosociological alliances of the classes *Galio-Urticetea* and *Bidentetea* in Ukraine

Explanations: A – alliances *Senecionion fluviatilis* and *Impatienti noli-tangere-Stachyion sylvaticae* (*Galio-Urticetea*), B – alliances *Aegopodion podagrariae*, *Geo urbani-Alliarion petiolatae*, *Petasition officinalis*, and *Rumicion alpini* (*Galio-Urticetea*), C – alliances of the class *Bidentetea*

The order *Convolvuletalia sepium* includes semi-natural marginal communities along the water courses of the temperate zone of Europe. The alliance *Senecionion fluviatilis* unites nitrophilous vegetation of tall-herb mesohygrophytes along water bodies.

Ass. 1.1.1.1. *Polygono persicariae-Pulicarietum uliginosae* Levon 1996[1]

Diagnostic species: *Arabis sagittata*, *Astragalus glycyphyllos*, *Calepina irregularis*, *Carex cuspidata*, *Juncus inflexus*, *Polypogon viridis*, *Pulicaria uliginosa*.

Habitat: shady nutrient-rich habitats along the river banks and water streams, ditches, which are permanently disturbed. Can withstand short-term flooding but is not resistant to trampling.

Distribution in Ukraine: South Crimea – rare.

Structure: The cover of the herb layer reaches 95-100%. The species composition includes 14-16 species in a separate relevé. The coenoflora, which includes 53 species in total, is dominated by representatives of the class *Galio-Urticetea*. In the herb layer species of *Molinio-Arrhenatheretea* are also quite frequent.

Ass. 1.1.1.2. *Ranunculo arvensis-Calepinetum irregularis* Levon 1996

Diagnostic species: *Calepina irregularis*, *Chenopodium suecicum*, *Ch. urbicum*, *Chrozophora tinctoria*, *Lapsana intermedia*, *Malva sylvestris*, *Medicago denticulata*, *Mercurialis annua*, *Ranunculus arvensis*, *Solanum dulcamara*, *S. zelenetzkii.*

Habitat: areas with insufficient light regime and excessive watering (flower beds, abandoned gardens). Plant communities are rarely affected by reclamation measures. Across the wastelands, destroyed buildings, and outskirts of construction sites they are less frequent.

Distribution in Ukraine: South Crimea – rare.

Structure: The cover of the herb layer, which is usually two-layered, is dense; its total coverage usually reaches up to 100%. The floristic composition includes 18-20 species per relevé. The coenoflora, which consists of 48 species in total, is dominated by *Galio-Urticetea* representatives.

Ass. 1.1.1.3. *Eupatorietum cannabini* Tx. 1937

Diagnostic species: *Angelica sylvestris*, *Carex vesicaria*, *Eupatorium cannabinum*, *Geum rivale*, *Lysimachia vulgaris*, *Lythrum salicaria*, *Myosoton aquaticum*, *Poa compressa*, *Melandrium album*, *Valeriana officinalis*, *Veronica longifolia.*

Habitat: slightly disturbed areas with nitrified soils along water reservoirs and on the edges of black alder forests.

Distribution in Ukraine: forest and forest-steppe zones – sporadically.

Structure: The total cover of the herb layer ranges from 70 to 95%. The floristic composition includes 8-17 species in a separate relevé. The coenoflora, which includes 49 species in total, is dominated by *Galio-Urticetea* representatives.

Ass. 1.1.1.4. *Rudbeckio laciniatae-Solidaginetum canadensis* R. Tüxen et Raabe ex Anioł-Kwiatkowska 1974

Diagnostic species: *Rudbeckia laciniata*, *Solidago canadensis*, *S. serotinoides.*

Habitat: along disturbed banks of linear watercourses, on abandoned cemeteries, along the roadsides, near landfills and dumps.

Distribution in Ukraine: forest and forest-steppe zones – sporadically.

Structure: The total coverage ranges from 40 to 100%. The floristic composition of the separate plot includes 4-38 species. The coenoflora, which includes 247 species in total, is dominated by species that are characteristic of *Galio-Urticetea*.

Ass. 1.1.1.5. *Calystegio sepium-Epilobietum hirsuti* Hilbig et al. 1972

Diagnostic species: *Agrostis gigantea*, *Alopecurus arundinaceus*, *Bidens tripartita*, *Calystegia sepium*, *Carex riparia*, *Echinocystis lobata*, *Epilobium hirsutum*, *Euphorbia palustris*, *Galium palustre*, *Lathyrus palustris*, *Lycopus europaeus*, *Rorippa palustris*, *Stachys palustris*, *Symphytum officinale*, *Thalictrum flavum*, *Urtica galeopsifolia.*

Habitat: areas along the banks of watercourses, especially streams, on mechanically disturbed banks of large rivers and ditches with clay and loamy nitrified soils. Phytocoenoses are sensitive to deep drying of the substrate and therefore grow only where the soil remains moist even in summer.

Distribution in Ukraine: Polissia, Forest-Steppe, Carpathians, Transcarpathia – rare.

Structure: The herb cover is dense, ranging from 55 to 100%. The floristic composition includes 89 species (from 7 to 24 in separate relevé). Species from the

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[1] We present this association as well as associations *Ranunculo arvensis-Calepinetum irregularis*, *Lepidio graminifolii-Parietarietum serbicae*, *Geranio collini-Melissetum officinalis* and *Verbeno officinalis-Ornithogaletum pontici* only on the basis of literary data, in particular, nomenclature types and description of these vegetation units by O. Levon (1997) who described these associations because we are not able to confirm or refute their existence with up-to-date phytosociological data due to the difficulties in organizing and conducting research on the temporarily occupied territory of Crimea. We also kept the original syntaxonomical affiliation of abovementioned associations since many more data are required for subject discussion.

Galio-Urticetea class are prevailing. They are often accompanied by species of the ecologically related classes *Artemisietea vulgaris* and *Bidentetea.*

Ass. 1.1.1.6. *Calystegio sepium-Impatientetum glanduliferae* Hilbig 1972

Diagnostic species: *Ajuga reptans*, *Artemisia vulgaris*, *Calystegia sepium*, *Elytrigia intermedia*, *Geranium sibiricum*, *Impatiens glandulifera*, *I. parviflora*, *Lapsana communis*, *Phalacroloma annuum*, *Plantago major*, *Solidago canadensis*, *Tussilago farfara.*

Habitat: wetlands within urban areas, banks of ditches, reclamation canals, roadsides and railways, forest road edges, wet landfills. Habitats are mostly semi-shaded, with moist to slightly dry clay and clay-sandy nutrient-rich soils.

Distribution in Ukraine: cis-Carpathian region – sporadically.

Structure: The total coverage is dense, up to 95-100%. The floristic diversity of association consists of 68 species (from 16 to 30 per plot). Species of the *Galio-Urticetea* class, often together with representatives of *Artemisietea vulgaris* and *Plantaginetea majoris*, are dominants in the stands of association.

The order *Circaeo lutetianae-Stachyetalia sylvaticae* unites tall-herb mesohygrophytic nitrophilous communities of forest cleanings on the rich soils of the forest zone of Europe. The alliance *Impatienti noli-tangere-Stachyion sylvaticae* includes nitrophilous tall-herb phytocoenoses of shaded forest clearings on clay soils of the plains and foothills of Central Europe.

Ass. 1.2.1.1. *Stachyo sylvaticae-Impatientetum noli-tangere* Hilbig 1972

Diagnostic species: *Alopecurus geniculatus*, *Athyrium filix-femina*, *Centaurium erythraea*, *Dryopteris filix-mas*, *Impatiens noli-tangere*, *Phegopteris connectilis*, *Stachys sylvatica.*

Habitat: shaded edges, meadows, roadsides, disturbed shores of lakes and rivers among mesophytic deciduous forests.

Distribution in Ukraine: western regions (mostly in the lower forest belt of Ukrainian Carpathians and cis-Carpathians) – sporadically.

Structure: The cover of stands ranges from 60 to 100%. The floristic composition of separate phytocoenoses includes from 7 to 25 species. The coenoflora, which numbers 110 species in total, is dominated by *Galio-Urticetea* and natural flora species. Species from the classes *Artemisietea vulgaris* and *Plantaginetea majoris* are less represented.

Ass. 1.2.1.2. *Arunco vulgaris-Lunarietum redivivae* Sádlo et Petřík in Chytrý 2009

Diagnostic species: *Aruncus dioicus*, *Athyrium filix-femina*, *Carex pendula*, *C. sylvatica*, *Chaerophyllum aromaticum*, *Ch. hirsutum*, *Chamerion angustifolium*, *Circaea lutetiana*, *Dentaria bulbifera*, *Filipendula denudata*, *Galium odoratum*, *G. sylvaticum*, *Impatiens noli-tangere*, *Lamium galeobdolon*, *L. maculatum*, *Lunaria rediviva*, *Mercurialis perennis*, *Mycelis muralis*, *Pulmonaria obscura*, *Senecio nemorensis*, *Symphytum popovii.*

Habitat: steep slopes affected by erosive runoff during rains, edges of the forest roads.

Distribution in Ukraine: Transcarpathia – sporadically.

Structure: The total coverage reaches 80-100%. The floristic composition includes 30 species in total (from 13 to 20 per plot), mostly representatives of the *Galio-Urticetea* class and natural flora species.

Ass. 1.2.1.3. *Carici pendulae-Eupatorietum cannabini* Hadač et al. 1997

Diagnostic species: *Ajuga reptans*, *Carex pendula*, *C. remota*, *C. sylvatica*, *Chaerophyllum temulum*, *Circaea lutetiana*, *Cirsium oleraceum*, *Equisetum arvense*, *Eupatorium cannabinum*, *Galium odoratum*, *Impatiens parviflora*, *Juncus effusus*, *Lamium galeobdolon*, *Lysimachia nemorum*, *Mycelis muralis*, *Petasites albus*, *Poa nemoralis*, *Salvia glutinosa*, *Scirpus sylvaticus*, *Senecio nemorensis*, *Veronica chamaedrys.*

Habitat: permanently or temporarily mechanically disturbed semi-shaded wetlands, forest roads, disturbed forest springs, wood dumps and meadows with loamy soils.

Distribution in Ukraine: Transcarpathia – sporadically.

Structure: The cover of the herb layer is usually dense, and ranges from 80 to 100%. The floristic composition includes 37 species in total (from 14 to 20), mainly from *Galio-Urticetea* class and natural flora species.

Ass. 1.2.1.4. *Urtico dioicae-Parietarietum officinalis* Klotz 1985

Diagnostic species: *Achillea millefolium*, *Hordeum leporinum*, *Parietaria officinalis.*

Habitat: temporarily moist or dry in summer soils, often rubble or stony. They are usually shaded by the crowns of surrounding trees or grow near shady foot slopes. Vegetation occurs in parks and gardens, on roadsides, near the foundations of buildings, and on old walls.

Distribution in Ukraine: Transcarpathia – sporadically.

Structure: The herb cover can reach up to 90-100%. The floristic composition includes 15 species, most of which are representatives of *Galio-Urticetea* vegetation.

The order *Galio-Alliarietalia* combines ruderal and semi-natural communities of nitrophilous biennial, perennials and tall dicotyledonous mesophytes. The alliance *Aegopodion podagrariae* includes nitrophilous

communities of perennial dicotyledonous high- growing plants of mesophilous forest cleanings.

Ass. 1.3.1.1. *Symphyto officinalis-Anthriscetum sylvestris* Passarge 1975

Diagnostic species: *Anisantha sterilis*, *Anthriscus sylvestris*, *Lamium purpureum*, *Myosotis ramosissima.*

Habitat: forest edges with nutrient-rich loose soils.

Distribution in Ukraine: forest and forest-steppe zones – sporadically.

Structure: The cover of the herbs is dense (up to 80-100%). The separate relevé includes from 8 to 22 species. The coenoflora, which includes 145 species in total, is dominated by *Galio-Urticetea* representatives.

Ass. 1.3.1.2. *Elytrigio repentis-Aegopodietum podagrariae* Tx. 1967

Diagnostic species: *Aegopodium podagraria*, *Dryopteris carthusiana.*

Habitat: ruderalized mesophytic habitats with loose nitrogen-enriched soils: on adjacent areas, on the banks of watercourses and reservoirs, wet roadsides, etc.

Distribution in Ukraine: forest and forest-steppe zones, Ukrainian Carpathians (forest belt) – often.

Structure: The total coverage ranges from 60 to 100%. The floristic composition includes from 5 to 17 species per plot. The coenoflora, which includes 100 species in total, is dominated by *Galio-Urticetea* and *Artemisietea vulgaris* herbs.

Ass. 1.3.1.3. *Chaerophylletum aromatici* Neuhäuslová-Novotná et al. 1969

Diagnostic species: *Asarum europaeum*, *Chaerophyllum aromaticum*, *Dactylis glomerata*, *Fragaria vesca*, *Hypericum perforatum*, *Mentha arvensis*, *Pulmonaria obscura*, *Ranunculus repens.*

Habitat: areas on fresh and moist soils of shaded ruderalized habitats.

Distribution in Ukraine: western regions of the forest zone – rare.

Structure: The total coverage can reach up to 80-100%. The floristic composition includes from 8 to 23 species. Species that are characteristic of the *Galio-Urticetea* class, dominate in stands. The species of the classes *Artemisietea vulgaris* and *Molinio-Arrhenatheretea* are also frequent in the stands.

Ass. 1.3.1.4. *Chaerophylletum bulbosi* R. Tx. 1937

Diagnostic species: *Athyrium filix-femina*, *Chaerophyllum bulbosum*, *Impatiens noli-tangere*, *Oxalis acetosella*, *Stellaria nemorum.*

Habitat: shaded roadsides with fresh, mineral-enriched, loose soils.

Distribution in Ukraine: western regions – rare.

Structure: The total coverage ranges from 75 to 90%. The floristic composition includes 8-14 species per plot. The coenoflora, which includes 20 species in total, is dominated by *Galio-Urticetea* herbs.

Ass. 1.3.1.5. *Chaerophyllo hirsuti-Cirsietum oleracei* Kostylev in Solomakha et al. 1992

Diagnostic species: *Caltha palustris*, *Campanula abietina*, *Carduus personata*, *Chaerophyllum hirsutum*, *Cirsium oleraceum*, *Filipendula ulmaria*, *Hypericum maculatum*, *Leontodon autumnalis*, *Myosotis scorpioides*, *Rumex confertus.*

Habitat: disturbed nitrified areas along watercourses.

Distribution in Ukraine: cis-Carpathians – sporadically.

Structure: The total coverage ranges from 70 to 100%. The floristic composition can count 10–19 species per plot. The species composition of the coenoflora is dominated by representatives of the class *Galio-Urticetea*, together with hydrophilous *Molinio-Arrhenatheretea* vegetation. The coenoflora of the association has 58 species in total.

Ass. 1.3.1.6. *Oenothero biennis-Helianthetum tuberosi* de Bolós et al. 1988

Diagnostic species: *Ambrosia artemisiifolia*, *Atriplex sagittata*, *A. patula*, *Conyza canadensis*, *Eragrostis minor*, *Helianthus tuberosus*, *Iva xanthiifolia*, *Lactuca serriola*, *Oenothera biennis*, *Sisymbrium loeselii.*

Habitat: banks and floodplains of rivers, along roads and railways, in landfills, and settlements, on pastures. Soils are fresh and moist to dry, rich in nutrients, and both clay floodplain and anthropogenic substrates of different compositions.

Distribution in Ukraine: forest and forest-steppe zone, Transcarpathia – sporadically.

Structure: The total coverage ranges from 50 to 100%. The floristic composition includes from 6 to 21 species. The coenoflora is dominated by representatives of the classes *Galio-Urticetea* and *Artemisietea vulgaris*. The coenoflora of the association has 73 species in total.

Ass. 1.3.1.7. *Urtico dioicae-Heracleetum mantegazziani* Klauck 1988

Diagnostic species: *Artemisia absinthium*, *Heracleum mantegazzianum*, *Tripleurospermum inodorum*, *Urtica dioica.*

Habitat: abandoned meadows and gardens, ditches, roadsides, banks of the watercourses. Soils are mainly wet to moist, neutral to alkaline, and rich in humus and nutrients, especially nitrogenous compounds.

Distribution in Ukraine: western regions – rare.

Structure: The total cover of herbs ranges from 90 to 100%. The floristic composition includes from 4 to 33 species per plot. The coenoflora, which includes 35 species in total, is dominated by *Galio-Urticetea* species.

Ass. 1.3.1.8. *Reynoutrietum japonicae* Görs et Müller in Görs 1975
Diagnostic species: *Reynoutria japonica.*
Habitat: disturbed nitrified shaded or semi-shaded areas along roads and watercourses.
Distribution in Ukraine: forest and forest-steppe zones (more often in western regions, in particular in Roztochia) – sporadically.
Structure: The total coverage ranges from 50 to 100%. The floristic composition includes from 5 to 21 species in separate relevé. The coenoflora is dominated by representatives of the classes *Galio-Urticetea* and *Artemisietea vulgaris*. The diagnostic species of *Polygono-Poetea annuae* are also frequent. The coenoflora of the association has 127 species in total.

Ass. 1.3.1.9. *Aegopodio-Reynoutrietum sachalinensis* Brzeg in Brzeg et Wojterska 2001
Diagnostic species: *Aegopodium podagraria*, *Ambrosia artemisiifolia*, *Calamagrostis epigeios*, *Helianthus tuberosus*, *Lamium maculatum*, *Phragmites australis*, *Reynoutria sachalinensis*, *Rubus hirtus*, *Solidago canadensis.*
Habitat: disturbed nitrified areas along roadsides and watercourses, parks, and pastures.
Distribution in Ukraine: Transcarpathia – sporadically.
Structure: The cover of herbs is dense (can reach to 100%). The floristic composition of separate relevé can count from 8 to 14 species. The coenoflora, which includes 20 species in total, is dominated by representatives of the classes *Galio-Urticetea* and *Artemisietea vulgaris*.

Ass. 1.3.1.10. *Urtico dioicae-Heracleetum sosnowskyi* Panasenko et al. 2014
Diagnostic species: *Agrostis stolonifera*, *Amelanchier ovalis*, *Bidens frondosa*, *Carex acuta*, *C. pilosa*, *Phalacroloma annuum*, *Heracleum sosnowskyi*, *Lappula squarrosa*, *Rumex aquaticus*, *Viola suavis*.
Habitat: outskirts of fields, roadsides, wastelands, fallows, old gardens, farms vicinity.
Distribution in Ukraine: forest-steppe zone – rare.
Structure: The total cover ranges from 60 to 100%. The floristic composition of the separate plot includes from 7 to 24 species. The diagnostic species of *Artemisietea vulgaris*, *Salicetea purpureae*, and *Stellarietea mediae* are most frequent in stands of association. The coenoflora of the association has 119 species in total.

Ass. 1.3.1.11. *Urtico dioicae-Rubetum caesii* Golovanov 2017
Diagnostic species: *Dryopteris filix-mas*, *Rubus caesius.*
Habitat: disturbed forest edges, along forest paths, various man-made shaded areas.
Distribution in Ukraine: forest zone – rare.
Structure: The total cover of herbs ranges from 75 to 100%. The species richness per plot varies from 7 to 36 species. The coenoflora, which includes 107 species in total, is dominated by *Galio-Urticetea* herbs.

Ass. 1.3.1.12. *Leonuro-Urticetum dioicae* (Solomeshch in Mirkin et al. 1986) A. Ishbirdin et al. 1988
Diagnostic species: *Urtica dioica.*
Habitat: areas across wastelands, landfills, near buildings on moist soils, and substrates of different structures, with a high content of mineral nitrogen.
Distribution in Ukraine: forest and forest-steppe zones – often, steppe zone – rare.
Structure: The coverage ranges from 60 to 100%. The floristic composition of the separate plot can include 8-26 species. The coenoflora, which in total includes 198 species, is dominated by *Galio-Urticetea* representatives. Such coenoses usually stay for a long time without significant changes in floristic composition.

Ass. 1.3.1.13. *Sambucetum ebuli* Felföldy 1942
Diagnostic species: *Glechoma hirsuta*, *Heracleum sphondylium*, *Sambucus ebulus*, *Torilis japonica.*
Habitat: edges and afforestation areas near housing.
Distribution in Ukraine: forest-steppe zone, Southern Crimea – rare.
Structure: The total cover ranges from 60 to 100%. The floristic composition of the association includes 84 species (from 8 to 26 in a particular relevé). Characteristic species of the *Galio-Urticetea* class are outnumbered.

Ass. 1.3.1.14. *Beto trigynae-Urticetum dioicae* Levon 1997
Diagnostic species: *Arctium lappa*, *Aristolochia clematitis*, *Beta trigyna*, *Bryonia alba*, *Clematis vitalba*, *Sonchus oleraceus.*
Habitat: shady places, abandoned old buildings, along roads, near gardens with loose soils.
Distribution in Ukraine: Southern Crimea – rare.
Structure: The total cover of herbs is dense (reach 100%). The floristic composition of the separate plot can include 7-9 species. The coenoflora, which numbers 21 species in total, is dominated by *Galio-Urticetea* species.

The alliance *Geo urbani-Alliarion petiolatae* includes nitrophilous communities of tall biennial and perennials that form on the edges of thermophilous forests and shrub habitats.

Ass. 1.3.2.1. *Alliario officinalis-Chaerophylletum temuli* (Kreh 1935) Lohmeyer 1949
Diagnostic species: *Alliaria petiolata*, *Chaerophyllum temulum*, *Glechoma hederacea*, *Viola odorata.*
Habitat: nitrified edges of deciduous forests on soils without mechanical damage.
Distribution in Ukraine: western regions (Ivano-Frankivsk, Lviv, Chernivtsi) – sporadically.

Structure: The total cover ranges from 80 to 100%. The floristic composition includes from 5 to 17 species per plot. The coenoflora, which numbers 37 species in total, is dominated by *Galio-Urticetea* plants.

Ass. 1.3.2.2. *Geo urbani-Chelidonietum maji* Jarolimek et al. 1997

Diagnostic species: *Chelidonium majus*.

Habitat: littered areas along river banks, roads, abandoned areas, landfills in shaded areas on fresh, nitrogen-rich soils and substrates.

Distribution in Ukraine: forest and forest-steppe zones– often, steppe zone – sporadically.

Structure: The coverage ranges from 50 to 100%. The floristic composition includes from 3 to 19 species per plot. The composition of the coenoflora (86 species in total) is dominated by representatives of the class *Galio-Urticetea*.

Ass. 1.3.2.3. *Lepidio graminifolii-Parietarietum serbicae* Levon 1996

Diagnostic species: *Erysimum cheiranthoides*, *Geranium rotundifolium*, *Lamium amplexicaule*, *Lepidium graminifolium*, *Parietaria serbica.*

Habitat: slightly lit old walls.

Distribution in Ukraine: Southern Crimea – rare.

Structure: This vegetation is sparse with coverage from 45 to 50%. The floristic composition includes from 12 to 14 species in separate relevé. The coenoflora, which includes 26 species in total, is dominated by *Galio-Urticetea* representatives.

Ass. 1.3.2.4. *Geranio collini-Melissetum officinalis* Levon 1996

Diagnostic species: *Calamintha parviflora*, *Geranium collinum*, *Hedera taurica*, *Melilotus officinalis*, *Ornithogalum ponticum*, *Ruscus ponticus*, *Torilis nodosa*, *Verbena officinalis*, *Vicia bithynica*, *V. loiseleurii.*

Habitat: shaded, moderately humid slopes in parks and gardens, low areas along the banks of water streams.

Distribution in Ukraine: Southern Crimea – rare.

Structure: The coverage ranges from 90 to 100%. The species richness per plot counts 19-20 species. The coenoflora of the association has 54 species in total. In addition to species of the class *Galio-Urticetea*, diagnostic species of the classes *Stellarietea mediae* and *Planaginetea majoris* are also frequent.

Ass. 1.3.2.5. *Verbeno officinalis-Ornithogaletum pontici* Levon 1996

Diagnostic species: *Astragalus glycyphyllos*, *Cardaria draba*, *Equisetum telmateia*, *Euphorbia esula*, *Geranium collinum*, *Lepidium campestre*, *Ornithogalum ponticum*, *O. woronowii*, *Verbena officinalis.*

Habitat: well-lit depressions along the banks of streams and ditches, shaded park areas.

Distribution in Ukraine: Southern Crimea – rare.

Structure: The cover of the herb layer is dense (90-95%). The floristic composition of the separate plots includes 18-20 species. Coenoflora has a total of 61 species. Communities border on the phytocoenoses of the class *Bidentetea* and contain its representatives in floristic composition.

1.3.2.6. Ass. *Myosotido sparsiflorae-Alliarietum petiolatae* Gutte 1973

Diagnostic species: *Alliaria petiolata*, *Asperugo procumbens*, *Carex praecox*, *Corydalis solida*, *Impatiens parviflora*, *Gagea minima*, *Myosotis sparsiflora*, *Ranunculus ficaria*, *Taraxacum officinale*.

Habitat: parks, forest edges, roadsides and wet suburban slopes, predominantly shady and semi-shady habitats.

Distribution in Ukraine: suburbs of Kyiv – rare.

Structure: The coverage ranges from 40-60 to 80-90%. The floristic composition of the separate plots includes 11-14 species. The coenoflora, which numbers 29 species in total, is dominated by *Galio-Urticetea* plants.

The alliance *Petasition officinalis* includes high-grass vegetation of depleted alluvial soils on the banks of mountain streams.

Ass. 1.3.3.1. *Petasitetum hybridi* Imchenetzky 1926

Diagnostic species: *Alchemilla gracilis*, *Cardaminopsis arenosa*, *Cirsium rivulare*, *Coccyganthe flos-cuculi*, *Equisetum fluviatile*, *Fragaria ×ananassa*, *Geranium phaeum*, *Glyceria notata*, *Hesperis candida*, *Hypericum tetrapterum*, *Lythrum salicaria*, *Myosotis laxa*, *Petasites hybridus*, *Poa pratensis*, *P. trivialis*, *Ranunculus lanuginosus*, *R. polyanthemos*, *Veronica serpyllifolia*, *Vicia sepium*, *V. villosa.*

Habitat: disturbed banks of streams and rivers, along roadside ditches.

Distribution in Ukraine: Carpathians, cis-Carpathians, Roztochia.

Structure: The cover of the herb layer is 80-100%. The floristic composition includes 10-29 species per plot. The composition of the coenoflora is dominated by representatives of the class *Galio-Urticetea*. In total, it has 93 species.

The alliance *Rumicion alpini* unites subalpine nitrophilic communities.

Ass. 1.3.4.1 *Rumicetum alpini* Beger 1922

Diagnostic species: *Adoxa moschatellina*, *Agrostis capillaris*, *Campanula abietina*, *C. patula*, *Cardamine pratensis*, *Carex lachenalii*, *Centaurea carpatica*, *Cerastium holosteoides*, *Deschampsia cespitosa*, *Geranium phaeum*, *Hypericum maculatum*, *H. montanum*, *Hypochaeris radicata*, *Milium effusum*, *Phleum alpinum*, *Poa annua*, *P. chaixii*, *P. trivialis*, *Rumex acetosa*, *R. alpinus*, *R. rugosus*, *Stellaria nemorum*,

Trifolium arvense, *Veronica serpyllifolia*, *V. urticifolia*, *Viola declinata.*
Habitat: sloping flat areas along the upper border of the forest, flat tops of secondary ridges, terraces, and other places of cattle camps.
Distribution in Ukraine: Ukrainian Carpathians (Gorgany, Chornogora, Svydovets, Chyvchyno-Gryniavski and Marmaros'ki Mountains, Beskydy) – sporadically.
Structure: The cover of the herb layer is dense and reaches up to 95-100%. The floristic composition includes 10-17 species in each separate plot. The composition of the coenoflora is dominated by representatives of the class *Galio-Urticetea* and in total has 65 species.

The class *Bidentetea* represented by 8 phytosociological associations belonged to 2 vegetation alliances and 1 order (Appendix 2).

The order *Bidentetalia* unites ruderalized communities of hygrophilous species in anthropogenically disturbed, often nitrified, silted habitats. The alliance *Bidention tripartitae* includes communities of annuals, mainly of the genera *Bidens*, *Persicaria* and *Ranunculus*, on moist nutrient-rich substrates.

Ass. 2.1.1.1. *Rumici maritimi-Ranunculetum sceleratі* Oberd. 1957
Diagnostic species: *Juncus effusus*, *Lepidium ruderale*, *Rumex maritimus.*
Habitat: disturbed littoral zones of closed and low-flowing eutrophic reservoirs with silty and silty-clay soils.
Distribution in Ukraine: forest, forest-steppe zones – sporadically, steppe zone (valleys and estuaries of big rivers) – rare.
Structure: The cover of the herb layer is 60-75%. The floristic composition includes 5-15 species per relevé. The coenoflora has 22 species in total ans is dominated by representatives of the classes *Bidentetea* and *Galio-Urticetea*.

Ass. 2.1.1.2. *Polygonetum hydropiperis* Passarge 1965
Diagnostic species: *Agrostis canina*, *Odontites vulgaris*, *Persicaria hydropiper*, *Potentilla anserina.*
Habitat: disturbed riverbanks, littoral zones of ponds, reservoirs, streams, and canals with silty, silty-sandy and loamy soils.
Distribution in Ukraine: forest, forest-steppe zones – usually, steppe zone – sporadically.
Structure: The cover of the herb layer is 60-100%. The floristic composition includes 3-23 species per plot. The coenoflora has 147 species in total. The species of the class *Bidentetea* are often accompanied by diagnostic taxa of the classes *Molinio-Arrhenatheretea*, *Phragmito-Magnocaricetea*, *Artemisietea vulgaris* and *Stellarietea mediae*.

Ass. 2.1.1.3. *Bidentetum tripartitae* Miljan 1933
Diagnostic species: *Ambrosia artemisiifolia*, *Bidens tripartita*, *Eragrostis pilosa*, *Gratiola officinalis.*
Habitat: disturbed littoral zones of ponds, reservoirs, streams and canals with silty-sandy, much less often – sandy soils.
Distribution in Ukraine: forest, forest-steppe zones – usually, steppe zone – sporadically.
Structure: The cover of the herb layer varies from 30 to 100%. The floristic composition includes 7-14 species per plot. Coenoflora has 74 species in total. Together with species of the class *Bidentetea*, diagnostic species of the classes *Molinio-Arrhenatheretea*, *Phragmito-Magnocaricetea* and *Artemisietea vulgaris* are also frequent.

Ass. 2.1.1.4. *Myosoto aquatici-Bidentetum frondosae* O. de Bolòs, Montserrat et Romo 1988
Diagnostic species: *Bidens cernua*, *B. frondosa*, *B. radiata*, *Galium palustre*, *Glyceria maxima*, *Lycopus europaeus*, *Lythrum salicaria*, *Mentha arvensis*, *Myosoton aquaticum*, *Phalaroides arundinacea*, *Persicaria amphibia*, *Polygonum lapathifolium*, *Ranunculus sceleratus*, *Rumex hydrolapathum*, *Scirpus lacustris*, *Sium latifolium*, *Sparganium erectum.*
Habitat: disturbed littoral zones of ponds, reservoirs, streams, and canals with silty-sandy, much less often – sandy soils.
Distribution in Ukraine: forest, forest-steppe zones – usually, steppe zone – sporadically.
Structure: The cover of the herb layer is 40-80%. The floristic composition includes 13-21 species in separate relevé. Coenoflora has 36 species in total. In addition to the species of the class *Bidentetea*, diagnostic species of the class *Phragmito-Magnocaricetea* are also frequent.

Ass. 2.1.1.5. *Bidentetum cernuae* Slavnić 1951
Diagnostic species: *Bidens cernua*, *Carex acuta*, *Chamerion angustifolium*, *Eleocharis acicularis*, *Eupatorium cannabinum*, *Juncus capitatus*, *Leersia oryzoides*, *Peucedanum palustre*, *Rumex confertus.*
Habitat: riverbanks, littoral zones of ponds, reservoirs, streams, canals, bottoms of dried-up reservoirs on muddy and muddy-sandy soils.
Distribution in Ukraine: forest, forest-steppe zones – usually, steppe zone – sporadically.
Structure: The cover of the herb layer is 80-100%. The floristic composition includes 8-18 species per plot. The coenoflora, which includes 88 species in total, is dominated by *Bidentetea* and *Galio-Urticetea* diagnostic species often accompanied by representatives of the classes *Phragmito-Magnocaricetea*, *Artemisietea vulgaris* and *Stellarietea mediae.*

Ass. 2.1.1.6. *Junco bufonii-Bidentetum connatae* (Timmermann 1993) Passarge 1996

Diagnostic species: *Bidens connata*, *Cicuta virosa*, *Equisetum sylvaticum*, *Galium aparine*, *Juncus bufonius*, *Senecio vulgaris*, *Thelypteris palustris*, *Urtica dioica.*
Habitat: disturbed edge areas of swamps, alder margins, depressions in turf meadows with muddy and peaty soils.
Distribution in Ukraine: forest, forest-steppe zones (Dnipro River Valley) – sporadically.
Structure: The cover of the herb layer is 80-100%. The floristic composition includes 8-18 species per plot. The coenoflora, which includes 75 species in total, is dominated by *Bidentetea* species. The diagnostic species of the classes *Phragmito-Magnocaricetea*, *Plantaginetea majoris* and *Stellarietea mediae* are also frequent.

The alliance *Chenopodion rubri* comprises vegetation of annual species of the genera *Atriplex* and *Chenopodium* on saline nitrified soils.

Ass. 2.1.2.1. *Bidenti frondosae-Atriplicetum prostratae* Poli et J. Tx. 1960 corr. Gutermann et Mucina 1993
Diagnostic species: *Atriplex prostrata*, *Bidens frondosa*, *Scutellaria galericulata*, *Sonchus oleraceus*, *Xanthium albinum.*
Habitat: disturbed littoral areas near rivers, ponds, reservoirs, artificial canals, roadsides, recreational trails, landfills.
Distribution in Ukraine: forest, forest-steppe zones – sporadically, steppe zone – rare.
Structure: The cover of the herb layer is 40-100%. The floristic composition includes 5-19 species per plot. The coenoflora, which includes 124 species in total, is dominated by *Bidentetea*, *Phragmito-Magnocaricetea*, *Galio-Urticetea* and *Plantaginetea majoris* representatives.

Ass. 2.1.2.2. *Chenopodietum rubri* Timár 1950
Diagnostic species: *Atriplex patula*, *Ballota nigra*, *Caltha palustris*, *Capsella bursa-pastoris*, *Chenopodium glaucum*, *Cichorium intybus*, *Daucus carota*, *Fallopia convolvulus*, *Galinsoga parviflora*, *Iva xanthiifolia*, *Malva neglecta*, *Oenanthe aquatica*, *Polygonum aviculare*, *P. lapathifolium*, *Rorippa amphibia*, *Rumex hydrolapathum*, *Sisymbrium loeselii*, *Sonchus arvensis.*
Habitat: littoral areas of water bodies with sandy and silty-sandy soils, as well as moist compacted, sometimes saline anthropogenic substrates, mostly along roadsides and paths, on pastures with moderate grazing, lawns, slopes and dams.
Distribution in Ukraine: forest, forest-steppe zones – sporadically, steppe zone (valleys and estuaries of big rivers) – rare.
Structure: The cover of the herb layer is 40-100%. The floristic composition includes 8-19 species per plot. The coenoflora, which includes 64 species in total, is dominated by *Bidentetea*, *Phragmito-Magnocaricetea*, *Galio-Urticetea*, *Plantaginetea majoris* and *Artemisietea vulgaris* diagnostic taxa.

3.3. Ordinal and phytoindication analysis of the classes *Galio-Urticetea* and *Bidentetea*

According to the results of the ordination analysis, we found that soil moisture content and its variability are of significant importance in the ecological differentiation of the studied vegetation (Fig. 2). The ecological separation of montane nitrophilous vegetation, which belongs to the alliances *Petasition officinalis* and *Rumicion alpini*, is also significantly affected by ombroregime (aridity-humidity of climate).

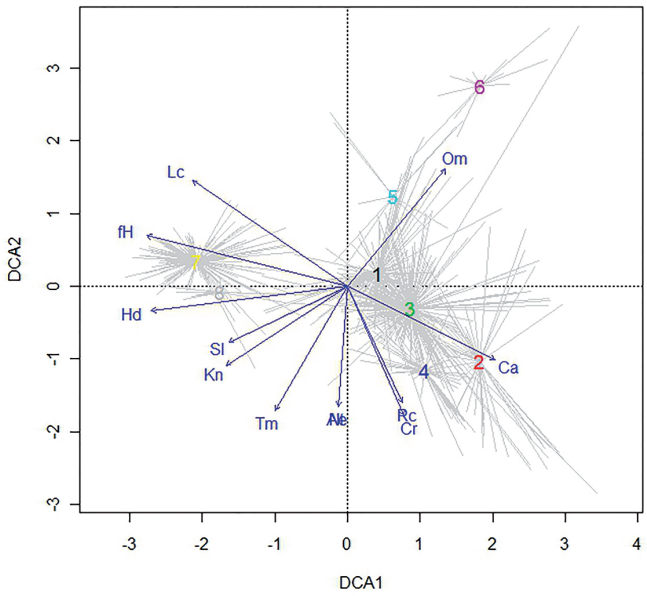


Fig. 2. Results of the detrended correspondence analysis of alliances of the classes *Galio-Urticetea* and *Bidentetea* based on environmental factors

Explanations: Hd – soil moisture content, fH – variability of soil moisture, Rc – soil acidity, Sl – salt regime of the soil, Ca – calcium carbonate content of the soil, Nt – mineral nitrogen in the soil, Ae – soil aeration, Tm – thermal regime, Om – ombroregime (aridity-humidity of climate), Kn – continentality of climate, Cr – cryoregime, Lc – light regime. Alliances: 1 – *Senecionion fluviatilis*; 2 – *Impatienti noli-tangere-Stachyion sylvaticae*; 3 – *Aegopodion podagrariae*; 4 – *Geo urbani-Alliarion petiolatae*; 5 – *Petasition hybridi*; 6 – *Rumicion alpini*; 7 – *Bidention tripartitae*; 8 – *Chenopodion rubri*

Phytoindication analysis of the class *Galio-Urticetea* based on soil moisture shows that the vast majority of the recorded plant associations are typical of moderately moist sites (Fig. 3). However, communities of the alliances *Impatienti noli-tangere-Stachyion sylvaticae*, *Petasition hybridi*, and *Rumicion alpini* are formed in conditions of high soil moisture content. We found the broadest ecological tolerance to moisture changes in associations of the alliance *Senecionion fluviatilis*.

Other plant communities of the class *Galio-Urticetea* are more sensitive to changes in the water regime of the soil. The comparison of plant associations in terms of soil moisture content indicates that they occupy more or less moist habitats. The exceptions are communities of the alliances *Senecionion fluviatilis* and *Petasition hybridi*, which occupy periodically flooded sites. Thus *Senecionion fluviatilis* is characteristic of ruderalized littoral zones of water bodies, while *Petasition hybridi* is typical of littoral zones of mountain watercourses with large fluctuations in water levels during the year. The alliances *Aegopodion podagrariae* and *Senecionion fluviatilis* show the broadest ecological amplitudes in relation to the variability of soil moisture content within the class. Differentiation of *Galio-Urticetea* phytocoenoses in relation to soil aeration reveal their exceptional hemiaerophobicity, i.e. preference for moderately aerated soils. Regarding the width of the ecological amplitude, its broadest range is characteristic of *Senecionion fluviatilis*, and the narrowest is characteristic of nitrophilous vegetation on the slopes and banks of mountain streams – *Petasition hybridi* and *Rumicion alpini* (Fig. 3).

Phytoindication analysis of *Galio-Urticetea* according to soil acidity reveals that the plant associations are subacidophilous. All of them are quite sensitive to changes in soil pH and show narrow ranges of tolerance. The distribution of *Galio-Urticetea* associations in relation to the total salt regime of the soil shows that they are semieutrophic. Plant associations of the alliances *Senecionion fluviatilis* and *Aegopodion podagrariae* have the broadest ecological amplitudes according to this gradient, while *Impatienti noli-tangere-Stachyion sylvaticae* is the most sensitive to its changes.

Results of the phytoindication analysis based on calcium carbonate concentration in the soil reveal that phytocoenoses of *Impatienti noli-tangere-Stachyion sylvaticae*, *Petasition hybridi*, and *Rumicion alpini* avoid calcium-rich substrates. In contrast, communities of the alliances *Senecionion fluviatilis*, *Aegopodion podagrariae*, and *Geo urbani-Alliarion petiolatae* are able to withstand low concentrations of these compounds. The *Rumicion alpini* had the lowest ecological tolerance to this factor. Vegetation of the alliance *Senecionion fluviatilis* develops in the broadest range of calcium carbonate content of the soil.

The distribution of *Galio-Urticetea* associations according to the content of mineral nitrogen in the soil indicates their nitrophily. The subalpine communities *Rumicion alpini* were the most sensitive to changes in this factor, whereas the broadest ecological amplitudes were demonstrated by *Senecionion fluviatilis* and *Aegopodion podagrariae* (Fig. 3).

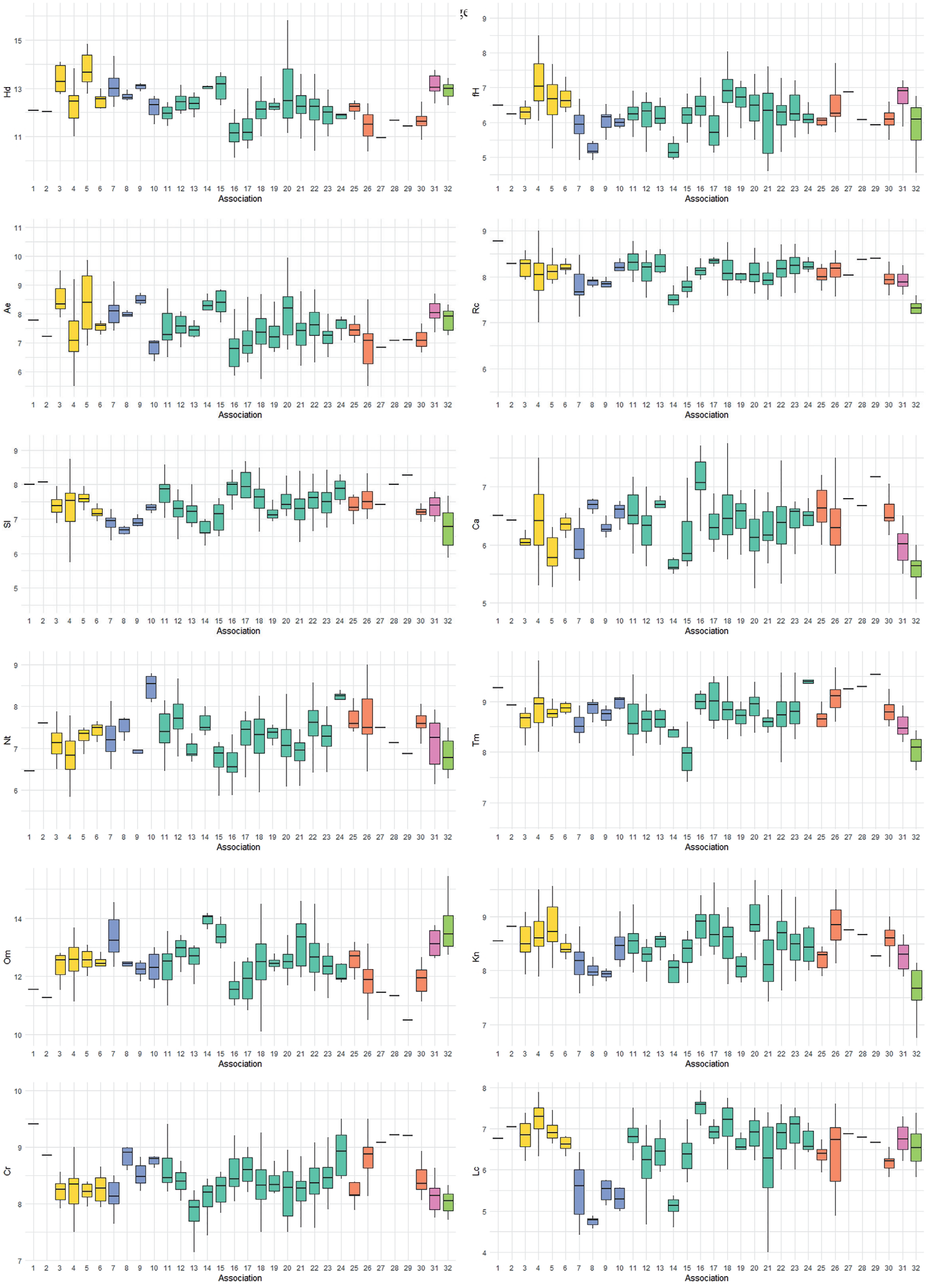
Ecological differentiation of *Galio-Urticetea* vegetation according to the main parameters of climate shows that in relation to the thermal regime, phytocoenoses of this class are submesothermic. According to climate aridity-humidity, subombrophytic communities predominate that is, those that develop in conditions of medium aridity of the climate. More arid conditions are tolerated only by thermophilic plant communities of the alliance *Geo urbani-Alliarion petiolatae*. Regarding the degree of climate continentality, they are hemicontinental, with the exception of the hemioceanic subalpine vegetation of *Rumicion alpini*. The distribution of syntaxa in respect of cryoregime reveals that they are hemicryophytic, that is, average frost resistance. In respect of light regime all *Galio-Urticetea* communities are heliosciophytic (shade-tolerant) (Fig. 3).

The phytoindication analysis of *Bidentetea* associations reveals that they mostly occupy hygromesophytic habitats. However, the associations *Myosoto aquatici-Bidentetum frondosae*, *Bidentetum cernuae*, and *Junco buffonii-Bidentetum connatae* require more moist substrates (Fig. 4).

All the vegetation of the class *Bidentetea* develops in conditions of extremely irregular moistening of the root layer of the soil and its poor aeration. The ecological amplitudes of the analysed gradients differ significantly only in some syntaxa. Thus, *Myosoto aquatici-Bidentetum frondosae* communities are the most sensitive to soil water regime and its changes. The broadest ecological range in terms of the water regime of the substrate and the degree of its aeration is characteristic of *Chenopodietum rubri*, while the variability of soil moisture content has the broadest range in *Bidenti frondosae-Atriplicetum prostratae* (Fig. 4). The differentiation of *Bidentetea* associations according to the main environmental factors shows that the phytocoenoses of the class mostly develop within habitats with a slightly acidic soil pH, low soil salinity, well provided with nitrogen compounds and low carbonate content (Fig. 4).

The ranges of *Bidentetea* associations according to the main indicators of climate reveal that vegetation of this class is mesothermal, mostly subaridophytic except for subombrophytic *Rumici maritimi-Ranunculetum scelerati* phytocoenoses, hemicontinental, and subcryophytic. These indicators correspond to the conditions of the temperate climate zone in which the territory of Ukraine is located. Phytoindication analysis of the phytocoenoses according to the light regime of the habitat showed that they are scioheliophytic (shade-tolerant) and able to withstand slight shading (Fig. 4).

The taxonomic composition of communities of the classes *Galio-Urticetea* and *Bidentetea* is characterized by many alien plant species with an invasive potential. The class *Galio-Urticetea* includes 117 alien species, and the level of its anthropogenization reaches 19.1%. The class *Bidentetea* includes 45 alien species, and the


Hd
fH
Ae
Rc
Sl
Ca
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Tm
Om
Kn
Cr
Lc
Association
Alliance
Aegopodion podagrariae
Geo urbani-Alliarion petiolatae
Impatienti noli-tangere-Stachyion sylvaticae
Petasition officinalis
Ruminion alpini
Senecionion fluviatilis

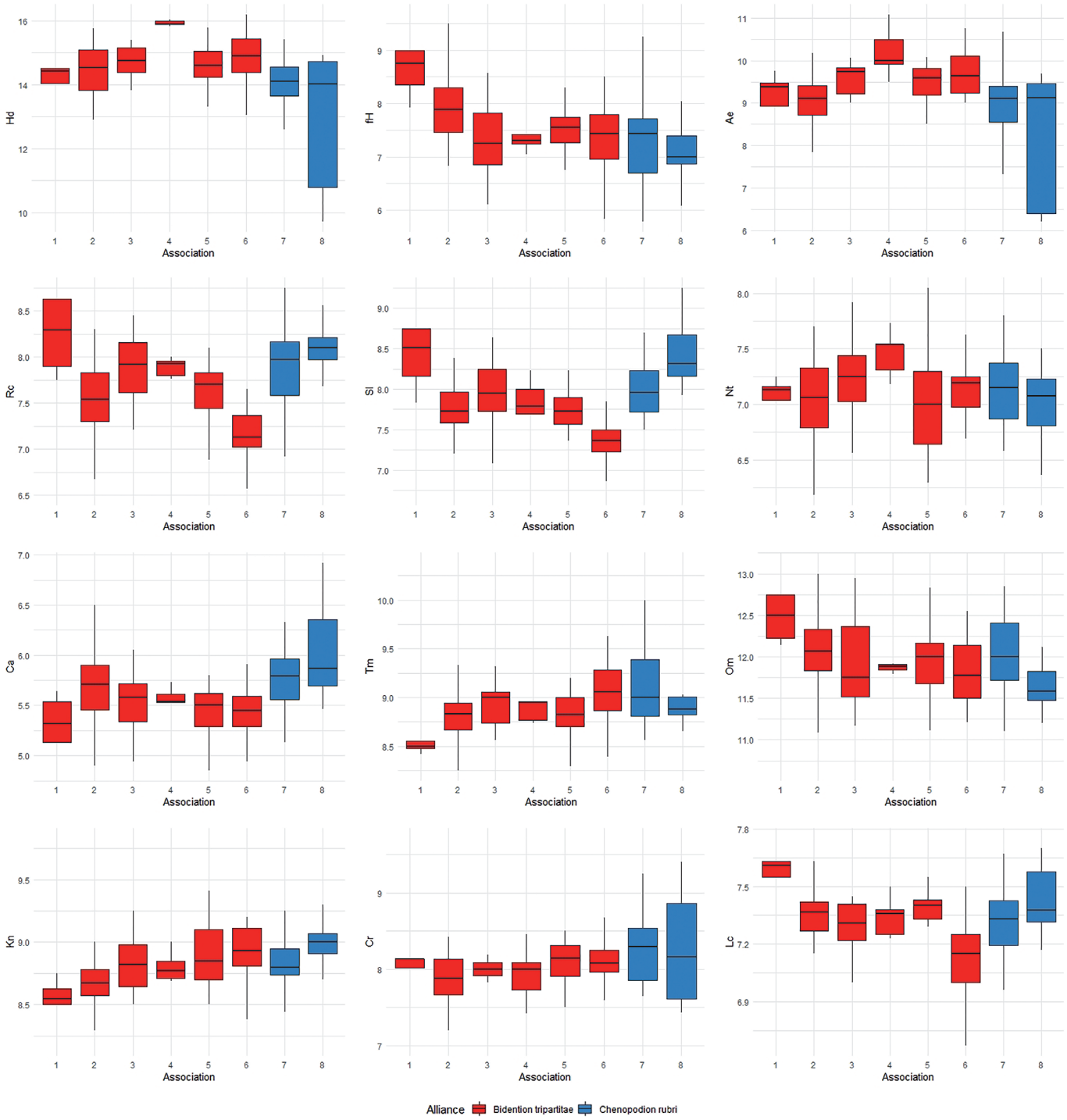

Fig. 4. Ranges of variation of environmental factors, according to Didukh's (2011) scales, in plant associations of the class *Bidentetea*

Explanations: Hd – soil moisture content; fH – variability of soil moisture content; Ae – soil aeration; Rc – soil acidity; SI – salt regime; Ca – calcium carbonate content of the soil; Nt – mineral nitrogen content of the soil; Tm – thermal regime; Om – ombroregime (aridity-humidity of climate); Kn – continentality of climate; Cr – cryoregime (frosty climate); Lc – light regime. Associations: 1 – *Rumici maritimi-Ranunculetum scelerati*; 2 – *Polygonetum hydropiperis*; 3 – *Bidentetum tripartitae*; 4 – *Myosoto aquatici-Bidentetum frondosae*; 5 – *Bidentetum cernuae*; 6 – *Junco bufonii-Bidentetum connatae*; 7 – *Bidenti frondosae-Atriplicetum prostratae*; 8 – *Chenopodietum rubri*

Fig. 3. Ranges of variation of environmental factors, according to Didukh's (2011) scales, in plant associations of the class *Galio-Urticetea*

Explanations: Hd – soil moisture content; fH – variability of soil moisture content; Ae – soil aeration; Rc – soil acidity; SI – salt regime; Ca – calcium carbonate content of the soil; Nt – mineral nitrogen content of the soil; Tm – thermal regime; Om – ombroregime (aridity-humidity of climate); Kn – continentality of climate; Cr – cryoregime (frosty climate); Lc – light regime. Associations: 1 – *Polygono persicariae-Pulicarietum uliginosae*; 2 – *Ranunculo arvensis-Calepinetum irregularis*; 3 – *Eupatorietum cannabini*; 4 – *Rudbeckio laciniatae-Solidaginetum canadensis*; 5 – *Calystegio sepium-Epilobietum hirsuti*; 6 – *Calystegio sepium-Impatientetum glanduliferae*; 7 – *Stachyo sylvaticae-Impatientetum noli-tangere*; 8 – *Arunco vulgaris-Lunarietum redivivae*; 9 – *Carici pendulae-Eupatorietum cannabini*; 10 – *Urtico dioicae-Parietarietum officinalis*; 11 – *Symphyto officinalis-Anthriscetum sylvestris*; 12 – *Elytrigio repentis-Aegopodietum podagrariae*; 13 – *Chaerophylletum aromatici*; 14 – *Chaerophylletum bulbosi*; 15 – *Chaerophyllo hirsuti-Cirsietum oleracei*; 16 – *Oenothero biennis-Helianthetum tuberosi*; 17 – *Urtico dioicae-Heracleetum mantegazziani*; 18 – *Reynoutrietum japonicae*; 19 – *Aegopodio-Reynoutrietum sachalinensis*; 20 – *Urtico dioicae-Heracleetum sosnowskyi*; 21 – *Urtico dioicae-Rubetum caesii*; 22 – *Leonuro-Urticetum dioicae*; 23 – *Sambucetum ebuli*; 24 – *Beto trigynae-Urticetum dioicae*; 25 – *Alliario officinalis-Chaerophylletum temuli*; 26 – *Geo urbani-Chelidonietum maji*; 27 – *Lepidio graminifolii-Parietarietum serbicae*; 28 – *Geranio collini-Melissetum officinalis*; 29 – *Verbeno officinalis-Ornithogaletum pontici*; 30 – *Myosotido sparsiflorae-Alliarietum petiolatae*; 31 – *Petasitetum hybridi*; 32 – *Rumicetum alpini*

level of its anthropogenization is 19.3%. *Amaranthus retroflexus*, *Bidens frondosa*, *Capsella bursa-pasroris*, *Cichorium intybus*, *Conyza canadensis*, *Echinocystis lobata*, *Galinsoga parviflora*, *Impatiens glandulifera*, *Iva xanthiifolia*, *Phalacroloma annuum*, *Setaria pumila*, and *S. viridis* are the most invasive species and common to both classes (Dubyna *et al.* 2022a).

4. Discussion

In scientific terms, the phytocoenoses formed by both non-synanthropic and synanthropic species are of special interest. Plant communities of the class *Bidentetea* is considered by some phytosociologists as pioneer ephemeral or wetland vegetation (Rivas-Martínez *et al.* 2001; Bardat *et al.* 2004; Tzonev *et al.* 2009; Chytrý 2011; Biondi *et al.* 2014), while other researchers classify them as anthropogenic (Mucina *et al.* 2016; Abramova & Golovanov 2016) or azonal semi-natural (Borhidi 2003). Considering that high mineral nitrogen levels in the littoral zones of water bodies are favourable for the spread of nitrophilous species (Bissels *et al.* 2005), plant communities of the class *Bidentetea* are linked closely with phytocoenoses of nitrophilous weeds of the order *Chenopodietalia albi* (belonging to the class *Stellarietea mediae*). This is also reflected in the syntaxonomic position of the alliance *Chenopodion rubri*, which is sometimes included in the classes *Chenopodietea* or *Stellarietea mediae*, so it is still uncertain and debatable (Galchenko 2006).

According to the EuroVegChecklist (Mucina *et al.* 2016), the class *Galio-Urticetea* is a syntaxonomic synonym of *Epilobietea angustifolii*. Its syntaxonomic position needs to be clarified. The European nitrophilous forest edges were proposed to be considered within the class *Artemisietea vulgaris* Lohmeyer *et al.* in Tx. ex von Rochow 1951 (Dengler *et al.* 2007), but later within *Epilobietea angustifolii* (Mucina *et al.* 2016). European scientists also proposed to include eutrophic synanthropic fringe communities (order *Convolvuletalia sepium*) in the class *Phragmito-Magnocaricetea* (Dengler *et al.* 2004) or even in a separate class named *Filipendulo ulmariae-Calystegietea sepii* Géhu et Géhu-Franck 1987 (De Foucault 2011; Fernez & Causse 2015). We believe that *Galio-Urticetea* species, as components of the herb layer in *Epilobietea angustifolii* phytocoenoses, can indicate a successional stage, but they also develop as independent communities in habitats with alluvial soils along riverbanks, wet nitrified areas near farms, at forest edges, in shady habitats rich in organic sediments near settlements, etc. The floristic core of the class *Galio-Urticetea* is formed by nitrophilous mesophytes, unlike that of *Epilobietea angustifolii*, where most species are acidophilous. The plant communities are also well differentiated by habitats: between nutrient-rich substrates and soils poor in minerals (Dubyna *et al.* 2021). Therefore, in our opinion, the syntaxonomic position of the class *Galio-Urticetea* still requires further research involving large phytosociological databases.

Our study shows that phytocoenoses of the classes *Galio-Urticetea* and *Bidentetea* are formed both naturally and semi-naturally (partly ruderalized), as well as actually ruderalized, depending on habitat type, its origin, and the level of human disturbance (Dubyna *et al.* 2021, 2022a). Natural communities develop across newly formed alluvial habitats with permanent moisture and flooding. Semi-natural and ruderal vegetation occupies man-made or disturbed habitats that are favourable for the development of weeds and the introduction of alien species with a significant invasive potential. These processes are possible due to the presence of free ecological space and a reduced level of phytocoenotic barrier. Our data are consistent with the theory of fluctuating resource availability (Davis *et al*. 2001), regarding the vulnerability of the environment to invasion. The cited authors noted that even highly productive communities can be uninvaded for a long time, although they can become susceptible to invasion if periodic disturbances occur. In addition, some highly invasive species (co-called "transformers") have an ability to change the structure and functions of habitats, transforming them by ruderalization, which is observed in the communities of the studied vegetation classes.

Wetlands are extremely vulnerable to climate change (Fay *et al.* 2016; Grieger *et al.* 2020) as well as to other natural and anthropogenic disturbances (Bagella *et al.* 2016; Tomaselli *et al.* 2020). Therefore, they can be good bioindicators for monitoring and conservation of newly formed habitats (Ernandes *et al.* 2017), as well as for monitoring and management of synanthropic complexes.

5. Conclusions

We have verified the syntaxonomy of ruderal vegetation of the classes *Galio-Urticetea* and *Bidentetea* in Ukraine on the basis of modern data. Our results show that the class *Galio-Urticetea* in Ukraine is characterized by a high diversity of plant communities. In terms of the number of associations, it ranks third among the classes of ruderal vegetation in Ukraine (after *Artemisietea vulgaris* and *Stellarietea mediae*) and is represented by 3 orders, 6 alliances, and 32 associations. The class *Bidentetea* is represented by 1 order, 2 alliances, and 8 associations. The communities of the classes *Galio-Urticetea* and *Bidentetea* are distributed mainly in anthropogenic habitats of the forest and forest-steppe zones, since the limiting factors of their territorial differentiation are soil moisture content and

the changing hydrological regime. The main factors of ecological differentiation of syntaxa within the class *Galio-Urticetea* are the degree of climate continentality, precipitation regime, and mineral nitrogen content of the soil. The main environmental gradients that influenced the territorial and ecological distribution of *Bidentetea* vegetation are soil moisture content and the concentration of mineral nitrogen in the substrate.

Our findings can help to determine the inherent features and linkages of synanthropic and natural phytocoenoses, their proper management, and prediction of vegetation development in anthropogenically affected sites and unchanged natural areas.

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Writing the article: T. P. Dziuba, S. M. Iemelianova

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Appendices

Appendix 1. Synoptic table of *Galio-Urticetea* communities with *phi*-coefficient

Number of association	1.1.1.1	1.1.1.2	1.1.1.3	1.1.1.4	1.1.1.5	1.1.1.6
Number of plots	1	1	7	90	16	7
D. Sp. *Polygono persicariae-Pulicarietum uliginosae*:						
Polypogon viridis	97.9	-	-	-	-	-
Pulicaria uliginosa	97.9	-	-	-	-	-
Arabis sagittata	97.9	-	-	-	-	-
Juncus inflexus	95.9	-	-	-	-	-
Carex cuspidata	95.9	-	-	-	-	-
D. Sp. *Ranunculo arvensis-Calepinetum irregularis*:						
Mercurialis annua	-	97.9	-	-	-	-
Chrozophora tinctoria	-	97.9	-	-	-	-
Lapsana intermedia	-	97.9	-	-	-	-
Medicago denticulata	-	97.9	-	-	-	-
Chenopodium urbicum	-	97.9	-	-	-	-
Ranunculus arvensis	-	97.9	-	-	-	-
Solanum zelenetzkii	-	97.9	-	-	-	-
Chenopodium suecicum	-	97.9	-	-	-	-
Solanum dulcamara	-	95.9	-	-	-	-
Malva sylvestris	-	83.7	-	-	-	-
D. Sp. *Eupatorietum cannabini*:						
Poa compressa	-	-	46.7	-	-	-
Myosoton aquaticum	-	-	40.5	-	-	-
Melandrium album	-	-	38.5	-	-	-
Veronica longifolia	-	-	37.3	-	-	-
Lysimachia vulgaris	-	-	34.9	-	24.4	-
Carex vesicaria	-	-	30.5	-	-	-
Geum rivale	-	-	29.0	-	-	-
Angelica sylvestris	-	-	26.1	-	-	-
Valeriana officinalis	-	-	25.7	-	-	-
D. Sp. *Rudbeckio laciniatae-Solidaginetum canadensis*:						
Solidago serotinoides	-	-	-	39.7	-	-
Rudbeckia laciniata	-	-	-	31.5	-	-
D. Sp. *Calystegio sepium-Epilobietum hirsuti*:						
Epilobium hirsutum	-	-	-	-	62.3	-
Agrostis gigantea	-	-	-	-	49.4	-
Symphytum officinale	-	-	-	-	47.8	-
Echinocystis lobata	-	-	-	-	46.5	-
Galium palustre	-	-	-	-	42.7	-
Lycopus europaeus	-	-	-	-	42.3	-
Stachys palustris	-	-	-	-	41.9	-
Rorippa palustris	-	-	-	-	41.3	-
Euphorbia palustris	-	-	-	-	34.9	-
Lathyrus palustris	-	-	-	-	34.9	-
Urtica galeopsifolia	-	-	-	-	34.9	-
Alopecurus arundinaceus	-	-	-	-	34.9	-
Thalictrum flavum	-	-	-	-	34.9	-
Carex riparia	-	-	-	-	31.7	-
Bidens tripartita	-	-	-	-	29.0	-
D. Sp. *Calystegio sepium-Impatientetum glanduliferae*:						
Impatiens glandulifera	-	-	-	-	-	98.8

1.2.1.1	1.2.1.2	1.2.1.3	1.2.1.4	1.3.1.1	1.3.1.2	1.3.1.3	1.3.1.4	1.3.1.5	1.3.1.6
25	6	6	6	24	24	6	5	8	17
-	-	-	-	-	-	-	-	-	-
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-	-	-	-	-	-	-	-	-	-
-	-	-	-	4.9	-	-	-	-	-
-	-	-	-	4.9	-	-	-	-	-
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7.4	-	-	-	-	-	-	-	-	-
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23.9	-	-	-	-	-	-	-	-	-
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Phalacroloma annuum	-	-	-	13.0	-	53.1
Elytrigia intermedia	-	-	-	-	-	49.8
Geranium sibiricum	-	-	-	11.3	-	46.5
Lapsana communis	-	-	-	-	-	43.5
Tussilago farfara	-	-	-	-	-	37.5
Plantago major	-	-	-	-	-	36.9
Artemisia vulgaris	-	-	-	6.4	-	28.5
D. Sp. *Stachyo sylvaticae-Impatientetum noli-tangere*:						
Stachys sylvatica	-	-	-	-	-	-
Phegopteris connectilis	-	-	-	-	-	-
Alopecurus geniculatus	-	-	-	-	-	-
Centaurium erythraea	-	-	-	-	-	-
D. Sp. *Arunco vulgaris-Lunarietum redivivae*:						
Lunaria rediviva	-	-	-	-	-	-
Aruncus dioicus	-	-	-	-	-	-
Mercurialis perennis	-	-	-	-	-	-
Symphytum popovii	-	-	-	-	-	-
Dentaria bulbifera	-	-	-	-	-	-
Filipendula denudata	-	-	24.3	-	-	-
Chamerion angustifolium	-	-	-	-	-	-
Geranium sylvaticum	-	-	-	-	-	-
D. Sp. *Carici pendulae-Eupatorietum cannabini*:						
Carex remota	-	-	-	-	-	-
Salvia glutinosa	-	-	-	-	-	-
Petasites albus	-	-	-	-	-	-
Lysimachia nemorum	-	-	-	-	-	-
Juncus effusus	-	-	-	-	-	-
Equisetum arvense	-	-	-	9.3	-	-
Scirpus sylvaticus	-	-	-	-	-	-
Poa nemoralis	-	-	-	-	-	-
Veronica chamaedrys	-	-	-	-	-	-
D. Sp. *Urtico dioicae-Parietarietum officinalis*:						
Parietaria officinalis	-	-	-	-	-	-
Hordeum leporinum	-	-	-	-	-	-
Achillea millefolium	-	-	-	-	-	-
D. Sp. *Symphyto officinalis-Anthriscetum sylvestris*:						
Anthriscus sylvestris	-	-	-	-	-	-
Myosotis ramosissima	-	-	-	-	-	-
Anisantha sterilis	-	-	-	-	-	-
Lamium purpureum	-	-	-	-	-	-
D. Sp. *Elytrigio repentis-Aegopodietum podagrariae*:						
Dryopteris carthusiana	-	-	-	-	-	-
D. Sp. *Chaerophylletum aromatici*:						
Hypericum perforatum	-	-	-	-	-	-
Asarum europaeum	-	-	-	-	-	-
Mentha arvensis	-	-	-	-	-	-
Fragaria vesca	-	-	-	-	-	-
Dactylis glomerata	-	-	-	-	-	-
Ranunculus repens	-	-	-	-	-	-
D. Sp. *Chaerophylletum bulbosi*:						
Chaerophyllum bulbosum	-	-	-	-	-	-
Oxalis acetosella	-	-	-	-	-	-
D. Sp. *Chaerophyllo hirsuti-Cirsietum oleracei*:						
Carduus personata	-	-	-	-	-	-
Filipendula ulmaria	-	-	-	-	-	-

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-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	24.5
33.8	-	-	-	-	-	-	-	-	-
27.9	-	-	-	-	-	-	-	-	-
27.9	-	-	-	-	-	-	-	-	-
27.9	-	-	-	-	-	-	-	-	-
-	100.0	-	-	-	-	-	-	-	-
-	100.0	-	-	-	-	-	-	-	-
-	81.2	-	-	-	-	-	-	-	-
-	57.1	-	-	-	-	-	-	-	-
-	53.5	-	-	-	-	-	-	-	-
-	45.1	-	-	-	-	-	-	-	-
-	39.5	-	-	-	-	-	-	-	-
3.4	33.5	-	-	-	-	-	-	-	-
-	-	98.0	-	-	-	-	-	-	-
-	-	68.9	-	-	-	-	-	-	-
-	-	61.6	-	-	-	-	-	-	-
-	-	57.1	-	-	-	-	-	-	-
9.8	-	53.2	-	-	-	-	-	-	-
-	-	49.7	-	-	-	-	-	-	-
-	-	46.9	-	-	-	-	-	-	-
-	-	45.4	-	15.6	-	-	-	-	-
-	-	30.1	-	-	-	-	-	-	-
-	-	-	89.4	-	-	-	-	-	-
-	-	-	40.3	-	-	-	-	-	-
-	-	-	27.4	-	-	-	-	-	-
-	-	-	-	34.9	-	-	-	-	-
-	-	-	-	29.9	-	-	-	-	-
-	-	-	-	28.4	-	-	-	-	-
-	-	-	-	25.6	-	-	-	-	-
-	-	-	-	-	26.0	-	-	-	-
-	-	-	-	-	-	75.7	-	-	-
-	-	-	-	-	-	64.8	-	-	-
-	-	-	-	-	-	63.9	-	-	-
-	-	-	-	-	-	59.3	-	-	-
-	-	-	-	-	-	32.7	-	-	-
18.2	-	-	-	-	-	28.0	-	-	-
9.3	-	-	-	-	-	-	79.3	-	-
17.7	-	-	-	-	-	-	38.6	-	-
-	-	-	-	-	-	-	-	70.1	-
-	-	-	-	-	-	-	-	62.0	-

Leontodon autumnalis	-	-	-	-	-	-
Myosotis scorpioides	-	-	-	-	-	-
Caltha palustris	-	-	-	-	-	-
Rumex confertus	-	-	-	-	-	-
D. Sp. *Oenothero biennis-Helianthetum tuberosi*:						
Oenothera biennis	-	-	-	-	-	-
Eragrostis minor	-	-	-	-	-	-
Conyza canadensis	-	-	-	-	-	-
Iva xanthiifolia	-	-	-	-	-	-
Sisymbrium loeselii	-	-	-	-	-	-
Lactuca serriola	-	-	-	-	-	-
Atriplex sagittata	-	-	-	-	-	-
Atriplex patula	-	-	-	-	-	-
D. Sp. *Galio-Urticetea*:						
Calystegia sepium	-	-	-	-	33.4	28.5
Chaerophyllum hirsutum	-	-	-	-	-	-
Chaerophyllum aromaticum	-	-	-	-	-	-
Chaerophyllum temulum	-	-	-	-	-	-
Aegopodium podagraria	-	-	-	-	-	-
Alliaria petiolata	-	-	-	-	-	-
Solidago canadensis	-	-	-	30.1	-	52.1
Impatiens parviflora	-	-	-	-	-	28.0
Impatiens noli-tangere	-	-	-	-	-	-
Other species:						
Astragalus glycyphyllos	68.1	-	-	-	-	-
Calepina irregularis	68.1	68.1	-	-	-	-
Lythrum salicaria	-	-	49.0	-	19.4	-
Eupatorium cannabinum	-	-	45.9	-	-	-
Ajuga reptans	-	-	-	-	-	34.0
Dryopteris filix-mas	-	-	-	-	-	-
Mycelis muralis	-	-	-	-	-	-
Senecio nemorensis	-	-	-	-	-	-
Galium odoratum	-	-	-	-	-	-
Circaea lutetiana	-	-	-	-	-	-
Lamium maculatum	-	-	-	-	-	-
Lamium galeobdolon	-	-	-	-	-	-
Carex pendula	-	-	-	-	-	-
Carex sylvatica	-	-	-	-	-	-
Pulmonaria obscura	-	-	-	-	-	-
Cirsium oleraceum	-	-	-	-	-	-
Stellaria nemorum	-	-	-	-	-	-
Campanula abietina	-	-	-	-	-	-
Hypericum maculatum	-	-	-	-	-	-
Helianthus tuberosus	-	-	-	-	-	-
Ambrosia artemisiifolia	-	-	-	-	-	-
Athyrium filix-femina	-	-	-	-	-	-
Artemisia absinthium	-	-	-	-	-	-
Phragmites australis	-	-	-	-	-	-
Calamagrostis epigeios	-	-	-	10.3	21.2	-
Rubus caesius	-	-	-	-	-	17.0
Urtica dioica	-	-	-	-	-	-
Glechoma hederacea	-	-	-	-	-	-
Deschampsia cespitosa	-	-	-	-	-	-

Explanation: Numbers of associations correspond to those given in the classification scheme

-	-	-	-	-	-	-	-	54.5	-
-	-	-	-	-	-	-	-	49.0	-
-	-	-	-	-	-	-	-	47.4	-
-	-	-	-	15.3	-	-	-	34.9	-
-	-	-	-	-	-	-	-	-	53.6
-	-	-	-	-	-	-	-	-	40.1
-	-	-	-	-	-	-	-	-	33.9
-	-	-	-	-	-	-	-	-	32.5
-	-	-	-	-	-	-	-	-	29.2
-	-	-	-	-	-	-	-	-	28.4
-	-	-	-	-	-	-	-	-	28.2
-	-	-	-	-	-	-	-	-	27.2
-	-	-	-	-	-	-	-	-	-
-	61.5	-	-	-	-	-	-	61.5	-
-	29.1	-	-	-	-	63.4	-	-	-
-	-	44.7	-	-	-	-	-	-	-
14.6	-	-	24.3	-	31.2	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	33.7	-	-	-	-	-	-	-
34.0	31.0	21.6	-	-	-	-	38.5	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	45.9	-	-	-	-	-	-	-
-	-	40.3	-	-	-	-	-	-	-
30.3	-	-	-	-	-	-	-	-	-
-	70.1	40.6	-	-	-	-	-	-	-
-	65.6	31.2	-	-	-	-	-	-	-
-	52.7	66.8	-	-	-	-	-	-	-
-	42.8	58.3	-	-	-	-	-	-	-
-	39.0	-	-	-	16.9	-	-	-	-
-	38.0	38.0	-	-	-	-	-	-	-
-	37.2	58.6	-	-	-	-	-	-	-
-	31.4	48.6	-	-	-	-	-	-	-
-	30.9	-	-	-	-	47.9	-	-	-
-	-	46.6	-	-	-	-	-	53.0	-
14.5	-	-	-	-	-	-	57.3	-	-
-	-	-	-	-	-	-	-	34.7	-
-	-	-	-	-	-	-	-	32.6	-
-	-	-	-	-	-	-	-	-	75.5
-	-	-	-	-	-	-	-	-	41.7
25.3	48.0	-	-	-	-	-	45.9	-	-
-	-	-	-	-	-	-	-	-	15.7
-	-	-	-	-	-	-	-	-	18.8
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	18.2	-	-	-	-	-	-
-	-	-	-	-	13.2	-	-	-	-
8.7	-	-	-	-	-	24.4	-	-	-

Continuation of appendix 1

Number of association	1.3.1.7	1.3.1.8	1.3.1.9	1.3.1.10	1.3.1.11	1.3.1.12
Number of plots	4	38	7	23	18	82
D. Sp. *Urtico dioicae-Heracleetum mantegazzianii*:						
Heracleum mantegazzianum	100.0	-	-	-	-	-
Artemisia absinthium	50.2	-	-	-	-	-
Tripleurospermum inodorum	49.4	-	-	-	-	-
D. Sp. *Reynoutrietum japonicae*:						
Reynoutria japonica	-	99.4	-	-	-	-
D. Sp. *Aegopodio-Reynoutrietum sachalinensis*:						
Reynoutria sachalinensis	-	-	100.0	-	-	-
Rubus hirtus	-	-	75.1	-	-	-
Phragmites australis	-	-	32.1	-	-	-
Calamagrostis epigeios	-	-	30.7	-	-	-
D. Sp. *Urtico dioicae-Heracleetum sosnowskyi*:						
Heracleum sosnowskyi	-	-	-	99.4	-	-
Rumex aquaticus	-	-	-	61.9	-	-
Bidens frondosa	-	-	-	48.6	-	-
Amelanchier ovalis	-	-	-	46.0	-	-
Lappula squarrosa	-	-	-	41.2	-	-
Carex pilosa	-	-	-	41.2	-	-
Viola suavis	-	-	-	35.6	-	-
Carex acuta	-	-	-	35.6	-	-
Agrostis stolonifera	-	21.6	-	29.2	-	-
D. Sp. *Urtico dioicae-Rubetum caesii*:						
Rubus caesius	-	-	17.0	-	36.4	-
D. Sp. *Leonuro-Urticetum dioicae*:						
Urtica dioica	21.6	-	-	19.5	13.8	25.4
D. Sp. *Sambucetum ebuli*:						
Sambucus ebulus	-	-	-	-	-	-
Heracleum sphondylium	-	-	-	-	-	-
Torilis japonica	-	-	-	-	-	-
Glechoma hirsuta	-	-	-	-	-	-
D. Sp. *Beto trigynae-Urticetum dioicae*:						
Bryonia alba	-	-	-	-	-	-
Clematis vitalba	-	-	-	12.5	-	-
Beta trigyna	-	-	-	-	-	-
Sonchus oleraceus	-	-	-	-	-	-
Aristolochia clematitis	-	-	-	-	-	-
Arctium lappa	-	-	-	-	-	9.2
D. Sp. *Alliario officinalis-Chaerophylletum temuli*:						
Viola odorata	-	-	-	-	-	-
Glechoma hederacea	-	-	-	-	-	-
D. Sp. *Geo urbani-Chelidonietum maji*:						
Chelidonium majus	-	-	-	-	-	6.2
D. Sp. *Lepidio graminifolii-Parietarietum serbicae*:						
Lamium amplexicaule	-	-	-	-	-	-
Lepidium graminifolium	-	-	-	-	-	-
Geranium rotundifolium	-	-	-	-	-	-
Parietaria serbica	-	-	-	-	-	-
Erysimum cheiranthoides	-	-	-	-	-	-
D. Sp. *Geranio collini-Melissetum officinalis*:						

1.3.1.13	1.3.1.14	1.3.2.1	1.3.2.2	1.3.2.3	1.3.2.4	1.3.2.5	1.3.2.6	1.3.3.1	1.3.4.1
27	5	9	42	1	1	1	21	15	13
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	8.7	-	-	-	-	-	-	-	-
73.5	-	-	-	-	-	-	-	-	-
35.9	-	-	-	-	-	-	-	-	-
31.5	-	-	-	-	-	-	-	-	-
25.7	-	-	-	-	-	-	-	-	-
-	91.8	-	-	-	-	-	-	-	-
-	67.6	-	-	-	-	-	-	-	-
-	62.6	-	-	-	-	-	-	-	-
-	43.2	-	-	-	-	-	-	-	-
-	42.5	-	-	-	-	-	-	-	-
-	32.7	-	-	-	-	-	-	-	-
-	-	66.3	-	-	-	-	-	-	-
-	-	25.6	-	-	-	-	-	-	-
-	-	-	29.6	-	-	-	16.4	-	-
-	-	-	-	98.8	-	-	-	-	-
-	-	-	-	98.8	-	-	-	-	-
-	-	-	-	98.8	-	-	-	-	-
-	-	-	-	98.2	-	-	-	-	-
-	-	-	3.8	96.5	-	-	-	-	-

Hedera taurica	-	-	-	-	-	-
Torilis nodosa	-	-	-	-	-	-
Ruscus ponticus	-	-	-	-	-	-
Calamintha parviflora	-	-	-	-	-	-
Vicia bithynica	-	-	-	-	-	-
Vicia bithynica	-	-	-	-	-	-
Geranium collinum	-	-	-	-	-	-
Ornithogalum ponticum	-	-	-	-	-	-
Verbena officinalis	-	-	-	-	-	-
Melilotus officinalis	-	-	-	-	-	-
D. Sp. *Verbeno officinalis-Ornithogaletum pontici*:						
Ornithogalum woronowii	-	-	-	-	-	-
Cardaria draba	-	-	-	-	-	-
Lepidium campestre	-	-	-	-	-	-
Euphorbia esula	-	-	-	-	-	-
Equisetum telmateia	-	-	-	-	-	-
D. Sp. *Myosotido sparsiflorae-Alliarietum petiolatae*:						
Myosotis sparsiflora	-	-	-	-	-	-
Gagea minima	-	-	-	-	-	-
Asperugo procumbens	-	-	-	-	-	-
Corydalis solida	-	-	-	-	-	-
Taraxacum officinale	-	-	-	-	-	-
Carex praecox	-	-	-	-	-	-
Ranunculus ficaria	-	-	-	-	-	-
D. Sp. *Petasitetum hybridi*:						
Petasites hybridus	-	-	-	-	-	-
Coccyganthe flos-cuculi	-	-	-	-	-	-
Alchemilla gracilis	-	-	-	-	-	-
Cirsium rivulare	-	-	-	-	-	-
Vicia villosa	-	-	-	-	-	-
Cardaminopsis arenosa	-	-	-	-	-	-
Fragaria x ananassa	-	-	-	-	-	-
Equisetum fluviatile	-	-	-	-	-	-
Glyceria notata	-	-	-	-	-	-
Myosotis laxa	-	-	-	-	-	-
Hesperis candida	-	-	-	-	-	-
Hypericum tetrapterum	-	-	-	-	-	-
Ranunculus polyanthemos	-	-	-	-	-	-
Vicia sepium	-	-	-	-	-	-
Ranunculus lanuginosus	-	-	-	-	-	-
Poa pratensis	-	-	-	-	-	-
D. Sp. *Rumicetum alpini*:						
Rumex alpinus	-	-	-	-	-	-
Poa chaixii	-	-	-	-	-	-
Cardamine pratensis	-	-	-	-	-	-
Hypericum montanum	-	-	-	-	-	-
Agrostis capillaris	-	-	-	-	-	-
Adoxa moschatellina	-	-	-	-	-	-
Poa annua	-	-	-	-	-	-
Deschampsia cespitosa	-	-	-	-	-	-
Rumex acetosa	-	-	-	-	-	-
Viola declinata	-	-	-	-	-	-
Rumex rugosus	-	-	-	-	-	-
Hypochoeris radicata	-	-	-	-	-	-
Veronica urticifolia	-	-	-	-	-	-

-	-	-	-	-	97.9	-	-	-	-
-	-	-	-	-	97.9	-	-	-	-
-	-	-	-	-	97.9	-	-	-	-
-	-	-	-	-	97.9	-	-	-	-
-	-	-	-	-	97.9	-	-	-	-
-	-	-	-	-	97.9	-	-	-	-
-	-	-	-	-	68.1	68.1	-	-	-
-	-	-	-	-	68.1	68.1	-	-	-
-	-	-	-	-	67.1	67.1	-	-	-
-	-	-	-	-	96.1	-	-	-	-
-	-	-	-	-	-	97.9	-	-	-
-	-	-	-	-	-	97.9	-	-	-
-	-	-	-	-	-	97.9	-	-	-
-	-	-	-	-	-	97.9	-	-	-
-	-	-	-	-	-	96.0	-	-	-
-	-	-	-	-	-	-	93.8	-	-
-	-	-	-	-	-	-	61.1	-	-
-	-	-	-	-	-	-	51.9	-	-
-	-	-	-	-	-	-	37.3	-	-
-	-	24.0	-	-	-	-	33.2	-	-
-	-	-	-	-	-	-	30.4	-	-
-	-	-	-	-	-	-	28.4	-	-
-	-	-	-	-	-	-	-	86.3	-
-	-	-	-	-	-	-	-	51.0	-
-	-	-	-	-	-	-	-	51.0	-
-	-	-	-	-	-	-	-	48.9	-
-	-	-	-	-	-	-	-	36.0	-
-	-	-	-	-	-	-	-	36.0	-
-	-	-	-	-	-	-	-	36.0	-
-	-	-	-	-	-	-	-	36.0	-
-	-	-	-	-	-	-	-	36.0	-
-	-	-	-	-	-	-	-	36.0	-
-	-	-	-	-	-	-	-	36.0	-
-	-	-	-	-	-	-	-	36.0	-
-	-	-	-	-	-	-	-	31.3	-
-	-	-	-	-	-	-	-	31.2	-
-	-	-	-	-	-	-	-	31.1	-
-	-	-	-	-	-	-	-	26.4	-
-	-	-	-	-	-	-	-	-	83.7
-	-	-	-	-	-	-	-	-	54.9
-	-	-	-	-	-	-	-	-	54.9
-	-	-	-	-	-	-	-	-	54.9
-	-	-	-	-	-	-	-	-	51.3
-	-	-	-	-	-	-	-	-	46.8
-	-	-	-	-	-	-	-	-	45.9
-	-	-	-	-	-	-	-	-	45.4
-	-	-	-	-	-	-	-	-	43.5
-	-	-	-	-	-	-	-	-	38.7
-	-	-	-	-	-	-	-	-	38.7
-	-	-	-	-	-	-	-	-	38.7
-	-	-	-	-	-	-	-	-	38.7

Carex lachenalii	-	-	-	-	-	-
Phleum alpinum	-	-	-	-	-	-
Centaurea carpatica	-	-	-	-	-	-
Trifolium arvense	-	-	-	-	-	-
Milium effusum	-	-	-	-	-	-
Poa trivialis	-	-	-	-	-	-
Veronica serpyllifolia	-	-	-	-	-	-
Geranium phaeum	-	-	-	-	-	-
Campanula patula	-	-	-	-	-	-
Cerastium holosteoides	-	-	-	-	-	-
D. Sp. *Galio-Urticetea*:						
Calystegia sepium	-	8.4	21.3	-	-	-
Chaerophyllum hirsutum	-	-	-	-	-	-
Chaerophyllum aromaticum	-	-	-	-	-	-
Chaerophyllum temulum	-	-	-	-	-	-
Aegopodium podagraria	-	-	31.2	-	-	-
Alliaria petiolata	-	-	-	-	-	-
Solidago canadensis	-	-	35.5	-	-	-
Impatiens parviflora	-	-	-	-	-	-
Impatiens noli-tangere	-	-	-	-	-	-
Other species:						
Astragalus glycyphyllos	-	-	-	-	-	-
Lythrum salicaria	-	-	-	-	-	-
Ajuga reptans	-	-	-	-	10.9	-
Dryopteris filix-mas	-	-	-	-	30.0	-
Lamium maculatum	-	-	32.7	-	-	-
Pulmonaria obscura	-	-	-	-	-	-
Stellaria nemorum	-	-	-	-	-	-
Campanula abietina	-	-	-	-	-	-
Hypericum maculatum	-	-	-	-	-	-
Helianthus tuberosus	-	-	41.3	-	-	-
Ambrosia artemisiifolia	-	-	33.0	-	-	-
Myosoton aquaticum	-	-	-	-	-	-
Lysimachia vulgaris	-	-	-	19.8	-	-
Valeriana officinalis	-	-	-	-	-	-
Symphytum officinale	-	-	-	-	-	9.8
Phalacroloma annuum	-	-	-	-	-	-
Artemisia vulgaris	-	-	22.2	-	-	-
Chamerion angustifolium	-	-	-	-	-	-
Veronica chamaedrys	-	-	-	-	18.4	-
Achillea millefolium	-	-	-	-	-	-
Lamium purpureum	-	-	-	-	-	12.1
Dactylis glomerata	-	-	-	-	-	-
Ranunculus repens	-	-	-	-	-	-
Oxalis acetosella	-	-	-	-	14.2	-
Filipendula ulmaria	-	-	-	-	-	-

Explanation: Numbers of associations correspond to those given in the classification scheme

-	-	-	-	-	-	-	-	-	38.7
-	-	-	-	-	-	-	-	-	38.7
-	-	-	-	-	-	-	-	-	38.7
-	-	-	-	-	-	-	-	-	37.3
-	-	-	-	-	-	-	-	-	30.7
-	-	-	-	-	-	-	-	42.2	29.3
-	-	-	-	-	-	-	-	36.5	31.2
-	-	-	-	-	-	-	-	33.6	39.2
-	-	-	-	-	-	-	-	23.1	27.0
-	-	-	-	-	-	-	-	22.7	26.4
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	61.1	-	-	-	-	13.0	-	-
-	-	-	-	-	-	-	-	14.6	-
-	-	35.6	-	-	-	-	33.4	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	22.3	-	-	-	36.5	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	68.1	-	-	-
-	-	-	-	-	-	-	-	27.1	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	11.4	-	-
-	-	-	-	-	-	-	-	-	42.8
-	-	-	-	-	-	-	-	-	31.9
-	-	-	-	-	-	-	-	-	29.9
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	11.7	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	24.2	-
-	-	-	-	-	-	-	-	-	-
15.0	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	16.8
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	20.3	-
-	-	-	-	-	-	-	-	-	-
17.4	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	17.5	-
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	24.6	-

Appendix 2. Synoptic table of *Bidentetea* communities with *phi*-coefficient

Number of associations	2.1.1.1	2.1.1.2	2.1.1.3	2.1.1.4	2.1.1.5	2.1.1.6	2.1.2.1	2.1.2.2
Number of relevés	4	76	15	9	25	35	31	14
D. Sp. *Rumici maritimi-Ranunculetum scelerati*:								
Rumex maritimus	96.4	-	-	-	-	-	-	-
Juncus effusus	77.3	-	-	-	-	-	-	-
Lepidium ruderale	47.5	-	-	-	-	-	-	-
D. Sp. *Polygonetum hydropiperis*:								
Persicaria hydropiper	-	35.2	-	-	-	-	-	-
Potentilla anserina	-	33.5	-	-	-	-	-	-
Odontites vulgaris	-	32.4	-	-	-	-	-	-
Agrostis canina	-	25.8	-	-	-	-	-	-
D. Sp. *Bidentetum tripartitae*:								
Eragrostis pilosa	-	-	34.4	-	-	-	-	-
Ambrosia artemisiifolia	-	-	29.7	-	-	-	-	-
Gratiola officinalis	-	-	28.0	-	-	-	-	-
D. Sp. *Myosoto aquatici-Bidentetum frondosae*:								
Bidens radiata	-	-	-	89.4	-	-	-	-
Myosoton aquaticum	-	-	-	82.9	-	-	-	-
Scirpus lacustris	-	-	-	63.0	-	-	-	-
Glyceria maxima	-	-	-	62.3	-	-	-	-
Persicaria amphibia	-	-	-	50.0	-	-	-	-
Sium latifolium	-	-	-	48.1	-	-	-	-
D. Sp. *Bidentetum cernuae*:								
Leersia oryzoides	-	-	-	-	33.7	-	-	-
Rumex confertus	-	-	-	-	33.5	-	-	-
Juncus capitatus	-	-	-	-	32.7	-	-	-
Eleocharis acicularis	-	-	-	-	31.9	-	-	-
Humulus lupulus	-	-	-	-	30.2	-	-	-
Eupatorium cannabinum	-	-	-	-	27.6	-	-	-
Peucedanum palustre	-	-	-	-	26.6	-	-	-
Crepis tectorum	-	-	-	-	26.6	-	-	-
Chamerion angustifolium	-	-	-	-	26.6	-	-	-
D. Sp. *Junco bufonii-Bidentetum connatae*:								
Bidens connata	-	-	-	-	-	95.8	-	-
Juncus bufonius	-	-	-	-	-	71.7	-	-
Thelypteris palustris	-	-	-	-	-	49.6	-	-
Cicuta virosa	-	-	-	-	-	45.4	-	-
Urtica dioica	-	-	-	-	-	32.4	-	-
Galium aparine	-	-	-	-	-	29.8	-	-
Equisetum sylvaticum	-	-	-	-	-	27.5	-	-
Senecio vulgaris	-	-	-	-	-	26.0	-	-
D. Sp. *Bidenti frondosae-Atriplicetum prostratae*:								
Sonchus oleraceus	-	-	-	-	-	-	29.3	-
Scutellaria galericulata	-	-	-	-	-	-	29.1	-
Atriplex prostrata	-	-	-	-	-	-	26.6	-
D. Sp. *Chenopodietum rubri*:								
Malva neglecta	-	-	-	-	-	-	-	91.7
Chenopodium glaucum	-	-	-	-	-	-	-	91.7
Polygonum aviculare	-	-	-	-	-	-	-	71.6

Rorippa amphibia	-	-	-	-	-	-	-	48.8
Cichorium intybus	-	-	-	-	-	-	-	42.3
Galinsoga parviflora	-	-	-	-	-	-	-	35.7
Fallopia convolvulus	-	-	-	-	-	-	-	35.7
Sisymbrium loeselii	-	-	-	-	-	-	-	35.7
Capsella bursa-pastoris	-	-	-	-	-	-	-	33.7
Sonchus arvensis	-	-	-	-	-	-	-	31.2
Iva xanthiifolia	-	-	-	-	-	-	-	31.2
Atriplex patula	-	-	-	-	-	-	-	31.2
Ballota nigra	-	-	-	-	-	-	-	31.2
Caltha palustris	-	-	-	-	-	-	-	30.4
Daucus carota	-	-	-	-	-	-	-	28.5
D. Sp. *Bidentetea*:								
Bidens tripartita	-	19.1	32.2	-	16.9	-	-	-
Bidens cernua	-	-	-	42.3	42.3	-	-	-
Rumex hydrolapathum	-	-	-	38.2	-	-	-	28.0
Polygonum lapathifolium	-	-	-	29.8	-	-	-	32.8
Bidens frondosa	-	-	-	26.8	-	-	26.8	-
Xanthium albinum	-	16.8	-	-	-	-	25.5	-
Other species:								
Sparganium erectum	-	-	-	27.9	-	-	-	26.6
Phalaroides arundinacea	-	-	-	59.9	-	-	-	17.3
Mentha arvensis	-	-	-	57.0	-	-	-	23.4
Galium palustre	-	-	-	48.2	-	-	-	17.2
Ranunculus sceleratus	-	-	-	34.1	-	-	-	22.1
Lythrum salicaria	-	-	-	28.5	14.6	-	-	-
Lycopus europaeus	-	-	-	27.5	-	14.3	-	-
Oenanthe aquatica	-	-	-	22.1	-	-	-	31.4
Carex acuta	-	-	-	-	27.7	14.1	-	-

Explanation: Numbers of associations correspond to those given in the classification scheme