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A CONTRIBUTION TO STUDIES OF THE RUDERAL VEGETATION OF SOUTHERN SREM, SERBIA

SNEŽANA JARIĆ[1], MIROSLAVA MITROVIĆ[1], S. VRBNIČANIN[2], B. KARADŽIĆ[1], L. DJURDJEVIĆ[1], OLGA KOSTIĆ[1], MARINA MAČUKANOVIĆ-JOCIĆ [2], GORDANA GAJIĆ[1] and P. PAVLOVIĆ[1]

[1] *Department of Ecology, Institute for Biological Research 'Siniša Stanković', University of Belgrade,* 11060 Belgrade, Serbia
[2]*Faculty of Agriculture, University of Belgrade,* 11080 Zemun, Serbia

Abstract - Floristic research investigating the presence and phytocoenological differentiation of ruderal vegetation, and how it is conditioned structurally and anthropogenically, was undertaken over a period of several years (2007-10) in the south Srem region. The ruderal flora of the research area comprised 249 plants categorized into 63 families, of which the most frequent were: *Asteraceae* (36), *Poaceae* (29), *Fabaceae* (18), *Lamiaceae* (15), *Polygonaceae* (15), *Brassicaceae* (11) and *Rosaceae* (11). Three ruderal communities are analyzed in this work: *Asclepietum syriacae* Kojić et al., 2004, as well as *Chenopodio-Ambrosietum artemisiifoliae* ass. nova and *Amorpho-Typhaetum* ass. nova, which are described for the first time. It was established that the level of moisture at the habitat, anthropogenic factors, and the immediate proximity to cultivated areas had the most pronounced effect on the differentiation of the researched vegetation.

Key words: Ruderal vegetation, plant communities, anthropogenic factors, biodiversity

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INTRODUCTION

Ruderal vegetation represents a highly dynamic floristic/vegetational complex, which develops most often in human settlements, but also in other environments which are permanently or temporarily exposed to anthropogenic influences. Anthropogenic factors are of key significance in the formation, survival, distribution, diversity and dynamics of this type of vegetation. The specificity and diversity of ruderal habitats are conditioned by their location.

The first significant findings on ruderal flora and vegetation in Serbia dates back to the early 20th century when Adamović (1909) described the different formations of ruderal and segetal plants in the central Balkans: at rubbish dumps, along roadsides and in abandoned fields. This type of vegetation was later the subject of research by numerous botanists (Slavnić, 1951; Šajinović, 1968; Jovanović, 1993, 1994; Stanković-Kalezić, 2007, Stanković-Kalezić et al. 2008, 2009; Kojić et al., 2004; Perišić et al., 2004; Jovanović and Mitrović, 1998; Prodanović et al., 2008; Pajazitaj, 2009; Jarić, 2009). In addition to the extensive research into the flora and vegetation of major cities in the world (Erhart, 2002; Sukopp, 2002; Brandes, 2004), a significant number of researchers have also dealt with the problems of the diversity of ruderal flora and vegetation along roadsides (Heindl and Ulman, 1991; Wrobel, 2006), within large agrarian complexes (Prach, et al., 2001), and in the vicinity of large forest complexes (Akbar et al., 2003).

In this work, three communities are analyzed: *Asclepietum syriacae* ass. nova Kojić, 2004, developed on raised flood defense levees and in expansive meadows, *Chenopodio-Ambrosietum artemisiifoliae* ass. nova in abandoned fields and along roadsides, and *Amorpho Typhaetum* ass. nova in the zone of drainage canals. The aim of this research is to establish: the floristic composition of the associations found; the abundance and cover of species; the phytocoenological differentiation of the associations into appropriate syntaxa; life forms; floral elements; syntaxonomic elements; the impact of ecological factors on the differentiation of ruderal vegetation; and the presence of non-native plants.

MATERIAL AND METHODS

The research area (between the village of Boljevci and the Forest Estate Management Unit 'Progarska ada - Crni lug – Zidine – Drenska') lies in the borough of Surčin and is situated 72-74 m above sea level (Fig.1). Relevés of the described communities were marked on the flood defense levee, in meadows, in abandoned fields, along roadsides, and in the zone of drainage canals.

During the analytical phase of the research, the qualitative and quantitative composition of the plants in each relevé was established. The recorded plant species were established on the basis of several literary sources (Josifović, 1970-1980; Javorka and Chapody, 1975; Tutin, 1964-1980; Aichele and Golte-Bechtle, 1997; Grey-Wilson and Blamey, 1979), and their abundance in the analyzed relevés was determined by the Westhoff and van der Maarel combined abundance/cover scale, which is an entirely numerical method and, as such, is completely applicable in the mathematical processing of data (Westhoff and van der Maarel, 1973). During the synthetic phase of research, which was based on the association table method (Müller-Dombois and Ellenberg, 1975; Gauch, 1982), groups of those relevés most similar in terms of flora were selected. The software package 'FLORA' was used for rearranging the phytocoenological tables (Karadžić et al., 1998). Literary sources were used to establish life forms (Raunkiaer, 1934; Stevanović, 1992) and floral elements (Gajić, 1984; Stevanović, 1992a), as well as the connection between the recorded plant species and the corresponding syntaxonomic units (Ellenberg, 1979; Kojić et al., 1997, 1998). The correlation between environmental factors and the ruderal communities described was established by using canonical correlation analysis CCA (ter Brak, 1986, 1988, 1994).

RESULTS AND DISCUSSION

The phytocoenological tables which show the floristic composition and differentiation into lower syntaxonomic categories (subassociations and facies) of the newly-described communities *Chenopodio-Ambrosietum artemisiifoliae* ass. nova and ass. *Amorpho-Typhaetum* ass. nova, as well as ass. *Asclepietum syriacae* Kojić et al., 2004, can be obtained from the authors via email: nena2000@ibiss.bg.ac.rs

The ruderal habitats where this research was undertaken can be grouped into three categories in relation to the complex of anthropologic influences, as the key to the development of this vegetation type: trampled ruderal areas, untrodden ruderal areas, and wet, hydrophilic ruderal areas (Jovanović, 1994). The ruderal flora of the research area comprised 249 plants categorized into 63 families, the most frequent of which were: *Asteraceae* (36), *Poaceae* (29), *Fabaceae* (18), *Lamiaceae* (15), *Polygonaceae* (15), *Brassicaceae* (11) and *Rosaceae* (11).

The plant species detected compose the ruderal vegetation differentiated into three associations: *Asclepietum syriacae* Kojić et al., 2004, *Chenopodio–Ambrosietum artemisiifoliae* ass. nova, and *Amorpho-Typhaetum* ass. nova.

Ass. *Asclepietum syriacae* Kojić et al., 2004

The association *Asclepietum syriacae* was found at the flood defense levee and in meadows and was differentiated into subass. *stellarietosum* (at the levee) and *vicietosum sativae* (in the meadows), Appendix 1. Moisture is the basic ecological factor leading to its differentiation, and in the syntaxonomic spectrum hygromesophytic species of the vegetation class *Molinio-Arrhenatheretea* predominate.

Syntaxonomic affiliation

Class: *Bidentetea tripartiti* Tx., Lohm. et Prsg.1950

Order: *Bidentetalia tripartiti* Br.-Bl. et Tx. 1943

Alliance: *Bidention tripartiti* Nordh. 1940

Association: *Asclepietum syriacae* Kojić et al., 2004

Structural characteristics

The ass. *Asclepietum syriacae* was determined on the basis of 11 phytocoenological relevés and is a graminoid ruderal community. Within the research area, it colonizes places which have been covered with soil, such as the levee, but also meadow areas which directly adjoin the levee. This association comprises 142 plant species, 131 of which are present in the composition of two or more relevés (92.3%). The ediphicator of the community is the non-native plant *Asclepias syriaca* and the typical set includes 49 (34.5%) more species. The species with the highest frequency are quite uniformly present in all relevés, which points to the existence of a relatively homogenous set of plants. The following species were recorded in all the relevés of the ass. *Asclepietum syriacae*: *Galium mollugo*, *Alopecurus pratensis*, *Poa palustris*, *Cirsium arvense*, *Rumex palustris*, *Silene vulgaris*, *Holcus lanatus* and *Trifolium pratense*. In addition to these species, other species characterized by high abundance are: *Rubus caesius*, *Bromus mollis*, *Arrhenatherum elatius*, *Achillea millefolium*, *Plantago lanceolata*, *Medicago lupulina*, *Potentilla reptans* and *Dactylis glomerata.* Characteristic species are of great diagnostic importance because they give the association a specific appearance through their habitus, while their high levels of abundance and cover point to the stability of coenotic relations.

Twenty species from the family *Poaceae* also contribute to the physiognomy of the ass. *Asclepietum syriacae*. Among them are 10 from the group of characteristic species, which gives it a special quality. This is also the fundamental reason why the areas on which these stands have developed are mown from time to time, so as to use the existing biomass for fodder or bedding for animals. In addition, the other xenobionts of the association also have a direct influence on its structural/coenotic and physiognomic characteristics.

Ass. *Chenopodio-Ambrosietum artemisiifoliae* ass. nova

The association *Chenopodio-Ambrosietum artemisiifoliae* ass. nova was recorded along the edge of roads and in abandoned fields; it was differentiated into the subass. *bidentetosum* and *rubetosum caesiae*, as well as the facies *lepidiosum*. This association is dominated by species of the segetal weed communities of cultivated areas (class *Stellarietea mediae* Tx., Lohm. et Prsg. 1950).

Syntaxonomic affiliation

Class: *Chenopodietea albae* Br.-Bl. 1951. em. Lohm., R. et J. Tx. 1961

Order: *Sisymbrietalia* J. Tx. 1961. em. Görs 1968

Alliance: *Bromo-Hordeion murini* Hejny 1978

Association: *Chenopodio–Ambrosietum artemisiifoliae* ass. nova

Structural characteristics

The ass. *Chenopodio–Ambrosietum artemisiifoliae* is extremely rich floristically: it contains 185 species, 135 (73%) of which are present in the composition of two or more relevés, which points to this association having a certain degree of floristic stability and established coenotic relations, Appendix 2. The basic ediphicators of this association are *Chenopodium album* and the non-native species *Ambrosia artemisiifolia*, while a typical set includes a further 11 species (7%): *Erigeron canadensis, Lactuca serriola, Cirsium arvense, Galega officinalis, Daucus carota, Calystegia sepium, Cichorium intybus, Stenactis annua, Medicago lupulina, Convolvulus arvensis* and *Amorpha fruticosa*. In addition to their high degree of presence

(V, IV), the species mentioned are also characterized by high levels of abundance and cover, all of which conditions the specific physiognomy of this association on whose formation and survival anthropogenic factors (mowing, treading, etc.) have the greatest influence.

Ass. *Amorpho-Typhaetum* ass. nova

The association *Amorpho-Typhaetum* ass. nova was recorded at the habitats of the drainage canals, including the canals themselves, their banks, and the areas around the banks. It is differentiated into facies: *typhosum*, *butomosum* and *sambucosum*, and almost all ecological factors have virtually the same impact on its differentiation, as these are completely open habitats where the only fluctuating variables during the year are the water levels in the canals or the degree of moisture in the riparian areas. The syntaxonomic spectrum is dominated by hygromesophytic species of the vegetation class Molinio-Arrhenatheretea Tx. 1937.

Syntaxonomic affiliation

Class: *Phragmitetea communis* Tx. et Prsg. 1942

Order: *Nasturtio-Glycerietalia* Pign. 1953

Alliance: *Glycerio-Sparganion* Br.-Bl. et Siss. ex Boer 1942

Association: *Amorpho-Typhaetum* ass. nova

Structural characteristics

The association *Amorpho–Typhaetum* was established on the basis of 10 phytocoenological relevés and is rich and varied in terms of flora: it comprises 178 plant species, 136 (76.4%) of which are present in the composition of two or more releves, Appendix 3. The ediphicators of the association are the non-native species *Amorpha fruticosa* and *Typha latifolia*. A typical set comprises 38 species (21.35%), and in each of the stands of the association, besides the characteristic species *Amorpha fruticosa*, the following were also noted: *Stenactis annua, Lolium perenne, Lythrum salicaria, Mentha aquatica, Bidens tripartitus* and *Calystegia sepium*. The high presence of the species in the typical set and their high abundance and cover is an indicator of the stable coenotic relations of the fully formed association *Amorpho-Typhaetum*. A significant feature of the community is the presence of aquatic species in the drainage canals, and their abundance is a direct result of ecological factors, above all water level, the amount of nitrogen, and water temperature.

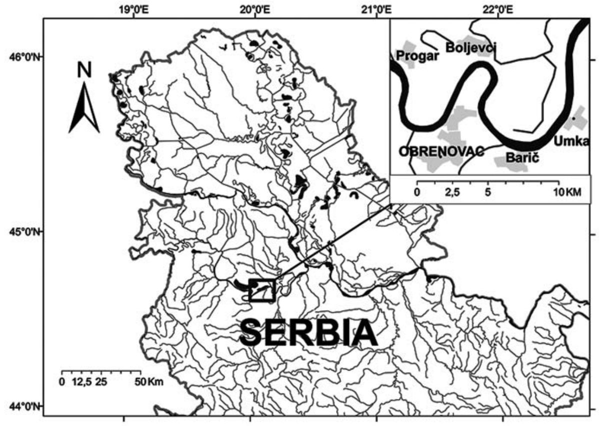

Fig 1. Geographical position of investigated area

Biological spectrum

The biological spectrum of the vegetation of the recorded ruderal associations in the southern Srem region is hemicryptophytic in character and the most common hemicryptophytes are: *Galega officinalis, Cichorium intybus, Plantago major, Plantago lanceolata, Ranunculus repens,* and *Lythrum salicaria* (Fig. 2).

The high proportion of hemicryptophytes is in keeping with the dominant presence of this life form in the flora of Serbia, which, according to Turrill and Raunkiaer, makes the climate of this region, as well as that of the whole Temperate Zone, 'hemicryptophytic' (Diklić, 1984). A particular characteristic of the biological spectrum of the researched vegetation is the presence of therophytes, which is directly

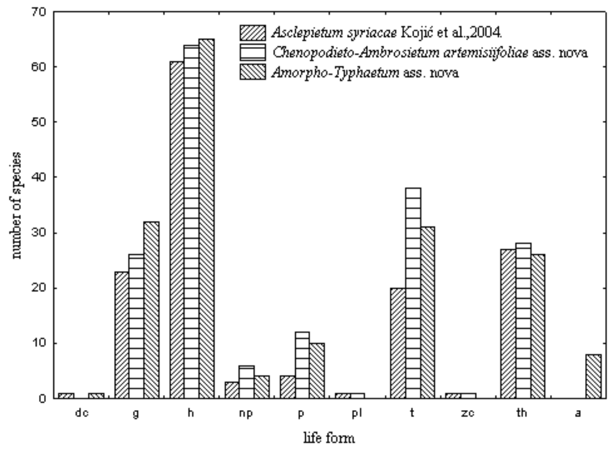

Fig 2. Biological spectrum (**dc**-woody chamaephytes; **g**-geophytes; **h**-hemicryptophytes; **np**-nanophanerophytes; **p**-phanerophytes; **pl**-phanerophytic lianas; **t**-therophytes; **zc**-herbaceous chamaephytes; **th**-thero-hemicryptophytes; **a**-helohydrophytes)

connected to the instability of the majority of ruderal habitats where man hinders the development of plants (particularly perennials) through his activities, thus removing time as an ecological factor. As a rule, the less the impact of anthropogenic factors on a particular ruderal habitat, the lower the percentage of therophytes and the greater the proportion of biennial and perennial plant species in the composition of the biological spectrum (Kojić, et al., 1997). The most invasive therophyte in the research area is *Ambrosia artemisiifolia*. Thero-hemicryptophytes also constitute a high proportion of the biological spectrum of the described associations. The most frequent of these are: *Daucus carota, Dipsacus laciniatus, Dipsacus sylvester, Erigeron canadensis, Stenactis annua* and *Pastinaca sativa*. In terms of the total number of representatives, the geophyte life-form category is the second most numerous in the ass. *Amorpho-Typhaetum* and has a great influence on the physiognomy of the association, where hygro-helophyte geophytes (*Alisma plantago-aquatica*, *Butomus umbelatus*, *Iris pseudacorus*, *Sparganium ramosum*, *Typha angustifolia* and *Typha latifolia*) are especially prominent. The most frequent geophytes in the ass. *Asclepietum syriacae* and *Chenopodio-Ambrosietum artemisiifoliae* are: *Asclepias syriaca*, *Cirsium arvense, Calystegia sepium, Convolvulus arvensis* and *Sorghum halepense*. In terms of quality and quantity, the presence of phanerophytes in the identified associations is not high; most often they are present sporadically along roadsides and in the riparian zone of the drainage canals. A significant feature of the ass. *Amorpho-Typhaetum* is the presence of aquatic helohydrophytes (4.5%): amphibian and floating hydrophytes (*Salvinia natans, Trapa natans*, *Nymphoides flava*, *Lemna minor*, *Lemna trisulca* and *Hydrocharis morsus-ranae*) and submerged hydrophytes (*Ceratophyllum submersum* and *Potamogeton fluitans*). The percentage of the other life forms (dc, np, pl, zc) is low in terms of presence, occurring only sporadically in the stands of the research area.

Phytogeographic analysis

A phytogeographic analysis of the ruderal vegetation of the associations *Asclepietum syriacae, Chenopodio-Ambrosietum artemisiifoliae* and *Amorpho – Typhaetum* in the research area shows the high diversity of floral elements (25), as well as the domination of geoelements of wide distribution (Evr., Subevr., Subse.) (Fig. 3).

Spreading mainly anthropochorially, ruderal species first colonize open, biologically empty

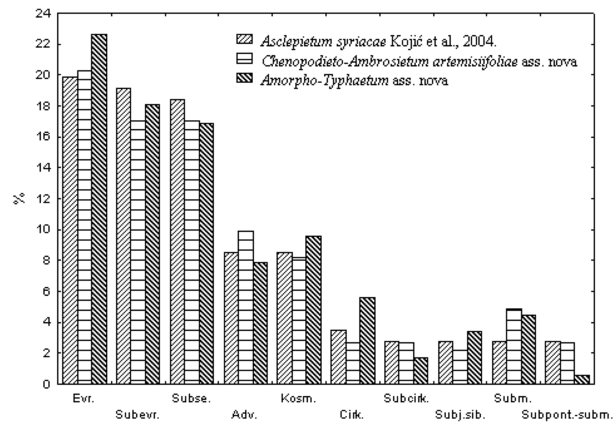

Fig 3. Spectrum of floral elements (**Evr**-Euroasian; **Subevr**-sub-Eurasian; **Subse**-sub-Central European; **Adv**-Adventive; **Kosm**-Cosmopolitan; **Cirk**-Circumpolar; **Subcirk**- sub-Circumpolar; **Subj.Sib**- sub-South Siberian; **Subm**-sub-Mediterranean; **Subpont**-sub-Pontic)

habitats, which are not stable enough in terms of coenology and competitiveness, and are mainly open, sunny, thermophilic, hygrophilically unstable habitats, and as a rule nitrophilous (Jovanović, 1994). The adventitive area type, a conditional chorological category, is represented by 22 species and is third in terms of total presence in the spectrum of floral elements, while the following cosmopolites are prominent in terms of their quantitative presence: *Convolvulus arvensis, Polygonum aviculare, Typha latifolia,* and *Verbena officinalis*. Among the circum-Holarctic species (Cirk, Subcirk.), the majority are hydrophytes and hygrophytes, which only serves to confirm the fact that water environments lead to the equalization of ecological conditions on a wider geographical plan (*Polygonum lapathifolium*, *Polygonum hydropiper*, *Stachys palustris*, *Typha angustifolia*, *Juncus articulatus*, *Juncus conglomeratus*). The presence of other geoelements (primarily Subj. Sib., Subm. and Subpont.-subm.), as well as the entire biological spectrum is a direct result of the geographic position of the research area, which is situated on the main belt for the spread of Mediterranean ruderal species from the eastern Mediterranean towards Europe on the one hand, and from Central Europe and the Pannonian Basin on the other.

Syntaxonomic spectrum

The associations *Asclepietum syriacae* and *Amorpho-Typhaetum* are dominated by hygromesophytic syntaxa represented by the class Molinio-Arrhenatheretea, while the ass. *Chenopodio-Ambrosietum artemisiifoliae* is dominated by syntaxa of segetal weed communities of crops and small grains represented by the class Stellarietea mediae (Fig. 4).

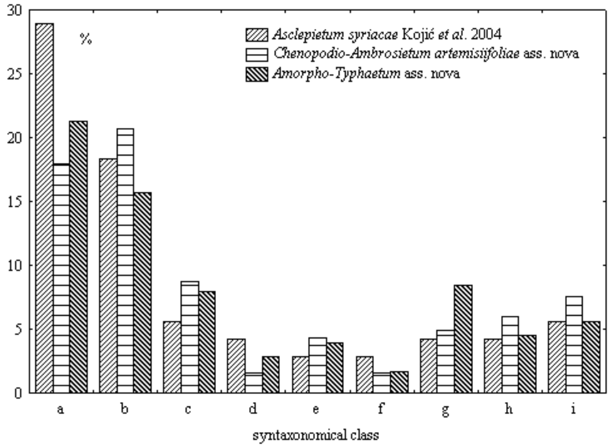

Fig 4. Syntaxonomic spectrum (**a**-*Molinio-Arrhenatheretea* Tx. 1937; **b**-*Stellarietea mediae* Tx., Lohm. et Prsg. 1950; **c**-*Artemisietea vulgaris* Lohm., Prsg. et Tx. 1950; **d**- *Bidentetea tripartiti* Tx., Lohm. et Prsg. 1950; **e**-*Chenopodietea albae* Br.- Bl. 1951. em. Lohm. et Tx; **f**- *Plantaginetea majoris* Tx. et Prsg. 1950; **g**-*Phragmitetea communis* Tx. et Prsg. 1942; **h**-*Qurco-Fagetea* Br.-Bl. et Vlieg. 1937; **i**-*Festuco-Brometea* Br.-Bl. et Tx. 1943)

The pronounced influence of anthropogenic factors on the habitats of the stands of the described phytocoenoses is also manifested through the presence of ruderal syntaxa grouped into the classes Artemisietea vulgaris, Bidentetea tripartiti, Chenopodietea albae and Plantaginetea majoris. Pond and marsh vegetation is represented by the class Phragmitetea communis with the largest number of representatives in the association *Amorpho-Typhaetum*, the most frequent of which in terms of quantity are: *Phragmites communis*, *Typha latifolia*, *Typha angustifolia*, *Alisma plantago-aquatica*, *Epilobium parviflorum*, and *Sonchus palustris*. In the syntaxonomic spectrum of the identified ruderal associations, syntaxa of the class Querco-Fagetea also have a significant presence (*Cornus sanguineus*, *Crataegus oxiacantha*, *Frangula alnus*, *Fraxinus angustifolia*, *Populus nigra*, *Quercus robur*, *Rosa canina*, *Salix alba* and *Ulmus laevis*). In the associations *Asclepietum syriacae, Chenopodio-Ambrosietum artemisiifoliae* and *Amorpho-Typhaetum* a significant number of syntaxa of the class Festuco-Brometea were recorded (*Achillea millefolium*, *Alopecurus pratensis*, *Centaurium umbellatum*, *Dactylis glomerata*, *Daucus carota*, *Dipsacus laciniatus*, *Galega officinalis*, *Glechoma hederacea*, *Lotus corniculatus*, *Lysimachia nummularia*, *Medicago lupulina*).

The similarity between ruderal and segetal vegetation is also shown by the presence of the vegetation class Chenopodietea, within which the association *Chenopodio-Ambrosietum artemisiifoliae* exists. The high presence of segetal species in ruderal habitats is

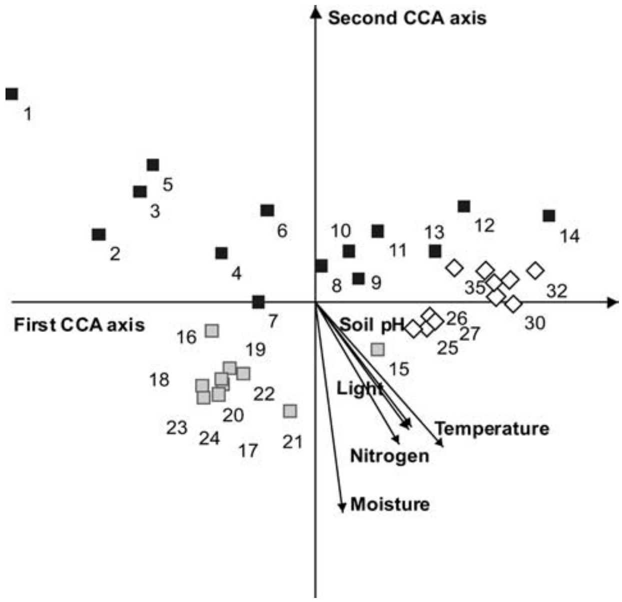

Fig 5. Ecological differentiation of ruderal vegetation

conditioned by the topography of the terrain itself, as well as by direct contact with cultivated areas.

The spectrum of syntaxonomic affiliation of the ruderal vegetation in the identified phytocoenoses is a reflection of the ecological conditions of the habitat itself, the influence of surrounding vegetation, and the impact of anthropogenic factors.

Ecological differentiation of ruderal vegetation

The results of the CCA show that moisture plays the key role in the differentiation of ruderal vegetation (Fig. 5).

Stands of the ass. *Amorpho-Typhaetum* ass. nova are developed in the moistest habitats (stands 15-24), stands of the ass. *Asclepietum syriacae* Kojić et al., 2004 (stands 25-35) in somewhat drier areas, and plant species of the ass. *Chenopodio-Ambrosietum artemisiifoliae* ass. nova (stands 1-14) colonize the driest areas.

Temperature has a somewhat lesser, but nonetheless important influence on differentiating these associations. Due to the mosaic layout and complete openness of those habitats where the moisture is greatest, in a great number of cases the temperature is also highest, and vice versa.

The remaining ecological factors (soil pH, light, and the nitrogen content of the habitat) have similar values, and hence the habitats of ass. *Amorpho-Typhaetum* ass. nova are the most nitrophyllic, acidic and heliophyllic, which is to be entirely expected as these are 'open' habitats.

The ruderal flora and vegetation of the research area has a number of similarities with that of Belgrade (Jovanović, 1994), Pančevački rit (Stanković-Kalezić, 2007) and eastern Srem (Kojić et al., 2004). Similarities can be seen in the following areas: in the large number of common species, because it is the same type of vegetation; in the domination of species from the family *Asteraceae*; in the greatest presence of hemicryptophytic and therophytic life forms; in the high presence of floral elements of wide distribution (Evr., Subevr., Subse., Submed., Cirk., Kosm. and Adv.); and the presence of a significant number of non-native plant species. The ass. *Asclepietum syriaca* Kojić et al., 2004 has been described in eastern Srem, close to New Belgrade and Zemun, in abandoned fields, along roadsides and in the areas between cultivated fields, as well as on the slopes of the flood defense levees along the River Sava, and it is floristically similar [ISs=38%] to the association with the same name found in the southern Srem region, because it colonizes similar habitats (the slopes of levees and expansive meadows).

The ruderal flora and vegetation of the research area, unlike that found in the urban part of Belgrade, is characterized by a significant presence of segetal plants, which is the result of it being in the immediate vicinity of agrophytocoenoses. However, the reverse process is also pronounced – the invasion of ruderal plants into cultivated areas. Edaphic conditions and strong anthropogenic pressure, with elements of a land cultivation system and the application of suitable measures for weed control in cultivated areas, have an indirect influence on the development and survival of this type of vegetation. Moisture as an

Appendix 2. Floristic composition of community *Chenopodio–Ambrosietum artemisiifoliae* ass. nova

No. of releve	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Size of releve (m^2)	100	250	100	**400**	**250**	**700**	**200**	**300**	**600**	**400**	**400**	**300**	**400**	**600**
Ambrosia artemisiifolia L.	5	5	5	5	5	5	5	5	3	7	7	3	5	.
Stenactis annua (L.) Nees.	5	3	3	5	5	8	7	8	5	5	7	7	3	.
Convonvulus arvensis L.	5	7	5	.	7	5	5	5	7	7	5	3	5	5
Cirsium arvense (L.) Scop.	7	8	8	8	5	8	5	5	5	5	7	5	.	.
Galega officinalis L.	5	3	2	2	5	7	7	2	5	7	5	5	.	.
Daucus carota L.	5	7	2	2	3	5	5	2	3	7	5	5	.	.
Calystegia sepium (L.) Br.	5	7	.	3	5	9	5	5	5	.	5	7	.	.
Erigeron canadensis L.	7	7	5	7	9	5	5	.	5	3	.	3	5	.
Lactuca serriola Torn.	5	5	2	5	3	5	5	.	3	3	.	3	.	.
Chenopodium album L.	7	7	7	5	7	7	5	.	5	5	5	3	5	.
Cichorium intybus L.	5	.	.	3	5	5	5	5	5	5	5	5	.	.
Amorpha fruticosa L.	.	1	3	2	.	5	.	3	9	5	8	9	5	.
Medicago lupulina L.	.	.	5	5	5	5	2	5	5	5	5	5	.	.
Bidens tripartitus L.	5	5	5	5	8	7	5	.	.	.	.	.	.	.
Epilobium parviflorum Schreb.	5	5	3	3	3	7	5	.	.	.	5	.	.	.
Rumex palustris Sm.	5	5	5	3	.	7	5	.	.	.	5	.	.	.
Ranunculus repens L.	1	3	.	5	5	5	5	5	5	.	.	.	.	.
Plantago major L.	7	5	.	5	5	5	7	7	.	.	5	.	.	.
Roripa prolifera (Heuff.) Neilr.	8	2	3	5	.	.	.	2	.	.	.	.	.	.
Eupatorium cannabinum L.	5	3	2	.	.	5	.	2	.	.	5	.	.	.
Polygonum persicaria L.	5	.	5	5	7	.	.	2	5	.	.	.	.	.
Poa palustris L.	3	1	3	.	.	5	.	.	.	.	.	.	.	.
Sonchus asper (L.) Mill.	7	5	.	5	5	.	.	.	.	.	.	.	.	.
Verbena officinalis L.	3	3	.	3	5	5	.	.	.	.	.	.	.	.
Anagalis arvensis L.	7	5	.	.	.	3	.	2	.	.	.	.	.	.
Epilobium hirsutum L.	5	3	.	.	.	3	5	.	.	.	.	.	.	.
Solanum nigrum L.	7	.	5	5	.	5	.	2	.	.	.	.	.	.
Panicum crus-galli L.	.	8	3	.	5	.	.	1	.	.	.	.	.	.
Taraxacum officinale Web.	.	2	.	5	3	.	.	5	.	.	.	.	.	.
Phleum pratense L.	.	1	.	.	1	.	5	2	.	.	.	.	.	.
Rumex obtusifolius L.	.	.	.	3	3	7	.	.	.	.	.	.	.	.
Foeniculum vulgare Mill.	2	.	.	.	7	.	.	.	.	.	.	.	.	.
Centaurium umbellatum Gilib.	7	.	.	.	.	3	.	.	.	.	.	.	.	.
Juncus compressus Jacq.	5	.	.	.	.	3	.	.	.	.	.	.	.	.
Lythrum hyssopifolia L.	8	.	.	.	2	8	.	.	.	.	.	.	.	.
Cyperus fuscus L.	8	.	.	.	.	7	.	.	.	.	.	.	.	.
Atriplex patula L.	.	1	5	.	5	.	.	.	.	.	.	.	.	.
Chenopodium polyspermum L.	.	.	7	.	8	.	.	.	.	.	.	.	.	.
Rorippa sylvestris (L.) Bes.	.	.	.	5	5	.	.	.	.	.	.	.	.	.
Galium aparine L.	.	.	.	5	5	.	.	.	.	.	.	.	.	.
Brassica nigra (L.) Koch.	.	1	.	.	1	1	.	.	.	.	.	.	.	.
Sonchus palustris L.	2	5	.	.	7	5	3	.	3	.	5	.	.	.
Sonchus arvensis L.	2	.	5	.	5	2	.	.	2	2	.	.	.	.
Polygonum aviculare L.	5	5	5	.	.	7	7	7	.	7	.	.	.	.
Polygonum lapathifolium L.	7	8	5	3	.	8	.	.	.	5	.	.	.	.
Xanthium strumarium L.	7	5	5	7	.	3	5	.	.	.	7	.	.	.
Anthemis arvensis L.	5	5	5	5	.	5	3	5	.	5	.	.	.	.

Appendix 2. Continued

No. of releve	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Size of releve (m²)	100	250	100	**400**	**250**	**700**	**200**	**300**	**600**	**400**	**400**	**300**	**400**	**600**
Lythrum salicaria L.	5	3	3	5	3	7	7	.	3	.	5	.	.	.
Agropyrum repens (L.) P. B.	5	7	5	5	5	.	.	5	.	5	5	.	.	.
Sorghum halepense (L.) Pers.	5	7	5	9	2	5	.	.	3	.	5	3	.	.
Urtica dioica L.	.	.	.	5	.	3	5	5	7	.	7	7	.	.
Melilotus officinalis (L.) Pall.	.	.	.	.	.	3	5	5	5	5	2	5	5	.
Populus alba L.	.	.	.	.	.	1	1	.	2	5	5	5	3	.
Plantago lanceolata L.	.	.	.	.	.	5	8	.	5	7	5	7	5	5
Rubus caesius L.	.	.	.	.	.	8	9	3	7	7	8	8	5	7
Asclepias syriaca L.	.	.	.	.	.	5	3	2	5	1	8	5	3	5
Galeopsis speciosa Mill.	.	.	.	.	.	5	.	3	2	.	7	5	.	.
Hypericum acutum Mnch.	.	.	.	.	.	5	.	3	3	5	.	5	3	.
Vitis sylvestris Gmel.	.	.	.	.	.	.	.	.	3	3	8	5	3	.
Glycyrrhiza echinata L.	.	.	.	.	.	5	.	.	5	5	7	5	5	.
Melilotus albus Med.	.	.	.	.	.	7	.	.	3	.	5	5	.	.
Sambucus ebulus L.	.	.	.	.	.	5	.	.	8	5	5	.	5	.
Humulus lupulus L.	.	.	.	.	.	5	.	.	3	5	5	7	.	.
Althaea officinalis L.	.	.	.	.	.	2	.	.	3	.	3	3	.	.
Lotus corniculatus L.	.	.	.	.	.	2	.	.	.	5	.	5	5	5
Cornus sanguineus L.	.	.	.	.	.	.	.	.	2	.	5	5	.	5
Stachys palustris L.	5	.	5	3	.	2	.	5	5	.	.	5	.	.
Helminthia echioides (L.) Gaertn.	5	8	3	.	5	8	.	.	5	.	.	5	.	.
Bromus arvensis L.	.	.	.	3	.	.	.	3	3	.	7	.	3	5
Amaranthus retroflexus L.	.	2	2	.	5	.	.	.	3	.	.	.	.	.
Silene vulgaris (Mnch.) Gar.	.	.	.	.	.	7	.	.	5	8	.	5	7	7
Trifolium repens L.	.	.	.	5	.	5	.	5	.	.	.	.	.	.
Prunella vulgaris L.	.	.	.	2	.	.	5	5	.	.	.	.	.	.
Sonchus oleraceus L	.	1	.	.	5	.	.	3	.	.	.	.	.	.
Pastinaca sativa L.	.	.	2	3	5	3	.	3	5	5	.	5	3	.
Artemisia vulgaris L.	.	.	5	3	.	7	.	5	5	5	5	.	5	.
Dipsacus laciniatus L.	5	.	.	2	.	5	5	.	5	3	5	7	.	.
Dipsacus sylvester Huds.	3	.	.	2	.	5	.	2	5	.	5	7	3	.
Trifolium pratense L.	.	1	.	5	.	3	5	5	3	.	5	5	.	5
Tragopogon dubius Scop.	.	.	.	.	3	5	.	.	3	2	.	5	3	3
Hypericum perforatum L.	.	.	.	2	.	.	3	2	3	1	2	.	.	.
Consolida regalis S. F. Gray	3	.	.	2	.	.	.	.	.	2	.	.	.	.
Lycopus europaeus L.	.	.	5	.	5	.	3	.	.	.	3	.	.	.
Setaria glauca (L.) P. B.	.	.	.	9	3	.	.	.	.	3	.	.	.	.
Mentha aquatica L.	.	.	3	.	5	.	.	.	5	.	.	.	.	.
Euphorbia salicifolia Host.	5	3	.	3	.	3	.	.	.	3	.	.	.	1
Tussilago farfara L.	.	3	.	.	5	.	8	.	.	5	.	.	.	.
Malva sylvestris L.	.	.	5	.	3	.	.	2	.	2	.	.	2	.
Conium maculatum L.	.	.	.	3	.	.	.	3	.	.	.	.	.	.
Setaria viridis (L.) P. B.	5	.	.	.	5	5	5	.	.	5	5	.	.	.
Arctium lappa L.	.	3	.	5	.	.	1	1	.	1	.	.	3	.
Lolium perenne L.	.	.	.	7	.	3	.	5	.	.	3	.	.	.
Lathyrus hirsutus L.	.	.	.	.	.	.	5	5	.	2	.	.	.	.
Lathyrus tuberosus L.	.	.	.	.	3	5	1	3	.	.	.	.	.	1
Stachys annua L.	.	3	.	.	.	5	.	2	.	.	5	.	.	.

Appendix 2. Continued

No. of releve	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Size of releve (m^2)	100	250	100	**400**	**250**	**700**	**200**	**300**	**600**	**400**	**400**	**300**	**400**	**600**
Ballota nigra L.	.	.	.	.	5	.	5	3	5	.	.	5	.	.
Quercus robur L.	.	.	.	1	.	.	.	2	.	.	.	1	.	.
Linaria vulgaris Mill.	.	.	.	.	.	.	.	3	.	3	.	.	.	.
Rumex crispus L.	.	.	.	.	.	7	.	.	5	.	.	.	.	.
Papaver dubium L.	.	.	.	.	.	1	.	.	.	1	.	.	.	.
Medicago sativa L.	.	.	.	.	.	5	.	2	.	3	3	.	.	.
Poa pratensis L.	.	.	.	3	3	.	.	5	.	.	.	.	.	3
Verbascum lychnitis L.	.	.	.	.	1	3	5	.	3	5	.	.	5	.
Verbascum blattaria L.	.	.	.	1	.	.	.	.	.	5	.	.	.	.
Leucanthemum vulgare Lam.	.	.	.	5	.	.	.	.	.	.	.	.	.	2
Capsella bursa-pastoris (L.) Med.	.	.	.	.	7	5	.	.	.	.	.	.	.	5
Morus alba L.	.	.	.	.	.	1	.	.	.	.	2	.	.	.
Equisetum arvense L.	.	.	2	8	.	.	.	.	.	.	.	.	.	5
Oenothera biennis L.	1	.	.	.	.	2	.	.	2	2	.	3	.	.
Populus euroamericana (Dode) Guin.	.	.	.	.	.	3	.	.	2	5	.	.	3	.
Robinia pseudacacia L.	.	.	.	.	.	1	.	.	.	.	3	.	.	.
Euphorbia platyphyllos L.	.	.	.	.	.	.	.	2	.	.	.	3	.	.
Galium mollugo L.	.	.	.	.	3	.	.	5	.	.	.	.	.	5
Helianthus tuberosus L.	.	.	.	.	.	.	.	.	.	3	.	.	5	.
Solidago serotina Ait.	.	.	.	.	.	.	.	.	.	.	5	3	.	.
Iris pseudacorus L.	.	.	.	.	.	7	.	.	.	.	.	5	.	3
Galium verum L.	.	.	.	.	.	.	.	.	.	2	.	5	.	.
Frangula alnus Mill.	.	.	.	.	.	.	.	.	.	.	2	3	.	.
Dactylis glomerata L.	.	.	.	.	.	5	.	5	5	.	.	5	.	7
Fraxinus angustifolia Vahl.	.	.	.	.	.	.	.	.	.	.	2	5	.	.
Populus nigra L.	.	.	.	.	.	.	.	.	.	.	1	5	.	.
Silene alba (L.) Kr.	.	.	.	.	.	.	.	.	.	.	.	5	1	.
Sambucus nigra L.	.	.	.	.	.	.	.	.	.	.	3	8	.	2
Agrostis alba L.	.	.	.	.	.	5	.	.	.	.	.	.	.	5
Hieracium bauhini Schult.	.	.	.	.	.	2	.	.	.	.	.	2	.	2
Clematis vitalba L.	.	.	.	.	.	.	.	.	.	.	5	7	.	5
Euphorbia cyparissias L.	.	.	.	1	.	.	.	1	.	3	.	5	.	7
Arrhenatherum elatius L.	.	.	.	.	.	.	.	.	.	.	.	.	1	5
Poa anuua L.	.	.	2	.	.	.	.	.	.	.	.	.	.	5
Ajuga reptans L.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
Veronica anagallis-aquatica L.	3	.	.	.	.	.	.	.	.	.	.	.	.	.
Kickxia elatine (L.) Dum.	7	.	.	.	.	.	.	.	.	.	.	.	.	.
Crepis setosa Hall.	3	.	.	.	.	.	.	.	.	.	.	.	.	.
Rumex conglomeratus Murr.	5	.	.	.	.	.	.	.	.	.	.	.	.	.
Carlina vulgaris L.	2	.	.	.	.	.	.	.	.	.	.	.	.	.
Leonurus cardiaca L.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Scutellaria galericulata L.	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Cynodon dactylon (L.) Pers.	.	3	.	.	.	.	.	.	.	.	.	.	.	.
Hibiscus trionum L.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
*Cuscuta epithymum*L.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
Datura stramonium L.	.	.	3	.	.	.	.	.	.	.	.	.	.	.
Salix caprea L.	.	.	2	.	.	.	.	.	.	.	.	.	.	.

Appendix 2. Continued

No. of releve	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Size of releve (m^2)	100	250	100	**400**	**250**	**700**	**200**	**300**	**600**	**400**	**400**	**300**	**400**	**600**
Rumex acetosa L.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
Bilderdykia convolvulus L.	.	.	2	.	.	.	.	.	.	.	.	.	.	.
Chenopodium hybridum L.	.	.	3	.	.	.	.	.	.	.	.	.	.	.
Veronica persica Poir.	.	.	.	5	.	.	.	.	.	.	.	.	.	.
Carduus acanthoides L.	.	.	.	3	.	.	.	.	.	.	.	.	.	.
Juglans regia L.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Hordeum murinum L.	.	.	.	.	2	.	.	.	.	.	.	.	.	.
Veronica chamaedris L.	.	.	.	.	5	.	.	.	.	.	.	.	.	.
Bellis perennis L.	.	.	.	.	5	.	.	.	.	.	.	.	.	.
Alisma plantago-aquatica L.	.	.	.	.	.	5	.	.	.	.	.	.	.	.
Brassica oleracea L.	.	.	.	.	.	3	.	.	.	.	.	.	.	.
Coronilla varia L.	.	.	.	.	.	3	.	.	.	.	.	.	.	.
Sherardia arvensis L.	.	.	.	.	.	2	.	.	.	.	.	.	.	.
Poa trivialis L.	.	.	.	.	.	3	.	.	.	.	.	.	.	.
Angelica sylvestris L.	.	.	.	.	.	.	2	.	.	.	.	.	.	.
Lapsana communis L.	.	.	.	.	.	.	.	3	.	.	.	.	.	.
Ranunculus acris L.	.	.	.	.	.	.	.	3	.	.	.	.	.	.
Geum urbanum L.	.	.	.	.	.	.	.	3	.	.	.	.	.	.
Melissa officinalis L.	.	.	.	.	.	.	.	2	.	.	.	.	.	.
Alliaria officinalis Andrz.	.	.	.	.	.	.	.	2	.	.	.	.	.	.
Ranunculus sardous Cr. var. *turbeculatus*	.	.	.	.	.	.	.	2	.	.	.	.	.	.
Cucubalus baccifer L.	.	.	.	.	.	.	.	2	.	.	.	.	.	.
Mentha longifolia (L.) Nath.	.	.	.	.	.	.	.	2	.	.	.	.	.	.
Alopecurus pratensis L.	.	.	.	.	.	.	.	2	.	.	.	.	.	.
Oxalis stricta L.	.	.	.	.	.	.	.	2	.	.	.	.	.	.
Lamium purpureum L.	.	.	.	.	.	.	.	.	5	.	.	.	.	.
Clematis sp.	.	.	.	.	.	.	.	.	3	.	.	.	.	.
Agrimonia eupatoria L.	.	.	.	.	.	.	.	.	3	.	.	.	.	.
Matricaria chamomilla L.	.	.	.	.	.	.	.	.	.	3	.	.	.	.
Salix purpurea L.	.	.	.	.	.	.	.	.	.	2	.	.	.	.
Calamagrostis epigeios (L.) Roth.	.	.	.	.	.	.	.	.	.	5	.	.	.	.
Salix alba L.	.	.	.	.	.	.	.	.	.	.	5	.	.	.
Ulmus laevis Pall.	.	.	.	.	.	.	.	.	.	.	5	.	.	.
Lactuca saligna L.	.	.	.	.	.	.	.	.	.	.	3	.	.	.
Aristolochia clematitis L.	.	.	.	.	.	.	.	.	.	.	.	5	.	.
Alyssum montanum L.	.	.	.	.	.	.	.	.	.	.	.	.	1	.
Achillea millefolium L.	.	.	.	.	.	.	.	.	.	.	.	.	3	.
Lepidium draba L.	.	.	.	.	.	.	.	.	.	.	.	.	.	7
Verbascum sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
Euphorbia palustris L.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
Bromus mollis L.	.	.	.	.	.	.	.	.	.	.	.	.	.	5
Rosa canina L.	.	.	.	.	.	.	.	.	.	.	.	.	.	1

Appendix 3. Floristic composition of community *Amorpho–Typhaetum* ass. nova

No. of releve	1	2	3	4	5	6	7	8	9	10
Size of releve (m^2)	200	210	560	560	250	400	300	**200**	**250**	**400**
Amorpha fruticosa L.	8	5	8	7	5	3	5	3	5	5
Stenactis annua (L.) Nees.	7	5	5	5	5	5	3	5	5	5
Lolium perenne L.	5	7	7	5	5	7	2	5	7	5
Lythrum salicaria L.	5	8	7	8	7	8	5	5	5	5
Mentha aquatica L.	5	7	7	7	8	8	5	5	5	5
Bidens tripartitus L.	8	7	7	7	7	8	7	7	5	5
Calystegia sepium (L.) Br.	5	7	5	7	7	8	5	5	3	5
Asclepias syriaca L.	7	3	5	3	3	.	2	.	3	5
Medicago lupulina L.	7	3	5	7	5	5	.	.	5	.
Anthemis arvensis L.	5	5	5	3	5	5	.	.	5	5
Galega officinalis L.	5	7	7	5	5	7	.	5	5	5
Cirsium arvense (L.) Scop.	8	7	7	5	8	8	.	7	7	7
Rubus caesius L.	7	5	7	5	8	5	.	8	7	7
Helminthia echioides (L.) Gaertn.	5	7	5	7	8	8	5	.	7	.
Roripa prolifera (Heuff.) Neilr.	.	1	3	5	5	3	.	.	5	.
Dipsacus sylvester Huds.	7	5	5	5	7	.	5	7	5	5
Dipsacus laciniatus L.	7	5	5	5	7	.	5	7	3	5
Plantago major L.	5	5	5	5	7	5	5	5	5	.
Populus euroamericana (Dode) Guin.	1	.	1	1	1	3	.	.	1	1
Erigeron canadensis L.	5	5	8	7	5	7	5	7	5	.
Convonvulus arvensis L.	.	5	5	7	5	8	.	5	3	5
Stachys palustris L.	.	8	5	7	5	2	5	5	.	2
Lycopus europaeus L.	5	9	7	8	7	9	7	7	.	5
Artemisia vulgaris L.	5	5	3	5	5	8	5	5	.	7
Daucus carota L.	5	5	3	7	5	7	5	8	.	5
Pastinaca sativa L.	5	.	5	5	5	5	5	7	5	5
Cichorium intybus L.	.	3	5	7	7	8	5	7	5	5
Urtica dioica L.	.	3	7	3	5	5	5	5	.	7
Epilobium hirsutum L.	.	7	5	5	5	.	5	3	.	5
Plantago lanceolata L.	5	1	3	5	2	5	5	5	.	.
Medicago sativa L.	.	2	2	5	5	7	1	5	3	.
Trifolium pratense L.	7	5	7	8	5	7	5	8	.	.
Typha latifolia L.	5	.	5	9	.	5	9	.	5	3
Melilotus officinalis (L.) Pall.	5	1	5	.	.	5	3	5	3	5
Ceratophyllum submersum L.	7	5	7	5	8	.	8	5	.	5
Mentha longifolia (L.) Nath.	7	9	8	8	5	7	5	5	.	.
Salix alba L.	1	.	2	3	5	5	2	1	5	.
Tussilago farfara L.	.	.	5	.	7	5	5	5	.	8
Setaria glauca (L.) P. B.	5	5	.	.	.	.	.	.	.	.
Hydrocharis morsus-ranae L.	5	5	.	7	.	.	.	.	.	.
Rorippa sylvestris (L.) Bes.	.	5	1	.	.	.	.	.	.	.
Xanthium strumarium L.	5	5	5	5	.	.	.	.	.	.
Myosotis arvensis (L.) Hill.	3	.	5	.	.	.	.	.	.	.
Inula britannica L.	2	5	3	3	.	.	.	.	.	.
Equisetum arvense L.	.	5	5	.	.	.	.	.	.	.
Symphytum officinale L.	.	3	2	.	.	.	.	.	.	.
Rumex conglomeratus Murr.	.	3	1	.	1	.	.	.	.	.

Appendix 3. Continued

No. of releve	1	2	3	4	5	6	7	8	9	10
Size of releve (m^2)	200	210	560	560	250	400	300	**200**	**250**	**400**
Pycreus serotinus (Rott.) Hayek	.	5	5	3	.	.	.	.	.	.
Juncus conglomeratus L.	.	5	5	.	.	.	.	.	3	.
Bromus mollis L.	.	5	5	.	5	.	.	.	.	.
Typha angustifolia L.	.	5	5	5	5	.	.	.	.	.
Lepidium draba L.	.	2	3	3	3	.	.	.	.	.
Leucanthemum vulgare Lam.	5	.	1	.	.	.	.	.	.	.
Panicum crus-galli L.	5	.	5	8	.	.	.	.	.	.
Setaria viridis (L.) P. B.	.	.	5	3	.	.	.	.	.	.
Juncus compressus Jacq.	.	.	5	5	.	.	.	.	.	.
Valeriana officinalis L.	.	.	1	1	.	.	.	.	.	.
Ranunculus sardous Cr. var. *turbeculatus*	.	.	2	5	.	.	.	.	.	.
Lemna minor L.	5	.	5	5	7	.	.	.	.	7
Rumex crispus L.	.	.	5	3	5	.	.	.	1	.
Juncus articulatus L.	.	.	7	5	.	.	.	5	.	.
Alisma plantago-aquatica L.	.	.	5	8	5	.	5	3	.	.
Epilobium parviflorum Schreb.	.	.	5	7	5	5	5	5	.	.
Sorghum halepense (L.) Pers.	.	.	5	5	3	5	5	3	.	.
Carduus acanthoides L.	.	1	2	.	1	5	5	5	.	.
Rumex obtusifolius L.	.	.	.	.	5	5	3	1	.	.
Butomus umbellatus L.	.	.	.	.	5	7	5	3	.	.
Nymphoides flava Hill.	.	.	.	.	.	3	8	5	.	.
Verbena officinalis L.	.	.	.	.	.	5	5	5	.	.
Achillea millefolium L.	1	.	.	.	.	2	.	5	.	.
Rosa canina L.	.	.	.	1	.	2	.	3	.	.
Fraxinus angustifolia Vahl.	.	.	.	.	.	3	1	.	.	.
Sparganium ramosum Huds.	.	.	.	.	.	5	7	.	.	.
Prunella vulgaris L.	.	.	.	.	.	5	.	7	.	.
Helianthus tuberosus L.	.	.	.	.	1	.	3	.	.	.
Cornus sanguinea L.	.	.	.	.	.	.	.	3	3	5
Sambucus ebulus L.	.	.	.	.	.	.	5	5	3	7
Bromus arvensis L.	5	7	7	5	7	.	.	.	.	5
Phragmites communis Trin.	3	9	5	.	7	.	.	2	7	.
Sinapis arvensis L.	5	5	5	.	5	2	.	.	3	7
Carex vulpina L.	.	.	5	3	.	5	.	3	3	.
Ballota nigra L.	.	.	5	.	1	5	5	.	.	5
Hypericum acutum Mnch.	2	.	.	.	3	.	.	.	.	.
Calamagrostis epigeios (L.) Roth.	5	.	5	.	.	.	.	.	.	5
Potamogeton fluitans Roth.	5	.	3	.	7	.	.	.	.	.
Hypericum perforatum L.	5	3	.	.	.	.	.	5	.	2
Trifolium repens L.	5	5	5	5	.	5	.	3	.	.
Lathyrus tuberosus L.	.	.	3	3	.	.	.	.	.	3
Lactuca saligna L.	3	.	.	.	.	3	.	.	.	.
Glycyrrhiza echinata L.	5	.	3	7	5	.	.	3	5	.
Melilotus albus Med.	5	.	5	3	5	5	.	.	.	.
Galium aparine L.	.	5	5	.	5	.	.	2	.	.
Ambrosia artemisifolia L.	7	5	5	7	.	7	5	.	.	.
Dactylis glomerata L.	.	3	5	5	5	.	.	3	.	.

Appendix 3. Continued

No. of releve	1	2	3	4	5	6	7	8	9	10
Size of releve (m²)	200	210	560	560	250	400	300	**200**	**250**	**400**
Polygonum aviculare L.	7	.	7	7	7	7	5	.	.	.
Lotus corniculatus L.	7	3	.	.	.	3	.	7	.	.
Poa palustris L.	.	5	7	.	7	5	.	3	5	.
Linaria vulgaris Mill.	5	.	3	7	.	7	3	.	.	.
Myosoton aquaticum (L.) Mnch.	.	.	5	.	.	.	2	.	3	.
Taraxacum officinale Web.	.	2	5	.	2	5	.	1	5	.
Euphorbia palustris L.	.	.	3	.	3	.	.	.	.	.
Eupatorium cannabinum L.	5	5	.	.	5	.	3	7	.	.
Matricaria chamomilla L.	3	.	5	.	.	.	5	.	.	.
Phleum pratense L.	.	.	.	.	.	.	.	1	3	.
Conium maculatum L.	.	.	5	.	1	.	2	.	.	.
Salix caprea L.	.	1	.	.	.	.	.	1	.	.
Polygonum lapathifolium L.	.	.	5	.	8	.	.	5	.	5
Sonchus asper (L.) Mill.	.	3	5	.	5	7	3	.	.	5
Lysimachia vulgaris L.	.	3	.	.	.	5	.	.	.	.
Poa anuua L.	.	.	.	3	.	7	.	.	7	.
Sonchus palustris L.	.	7	5	5	8	7	5	.	.	.
Agropyrum repens (L.) P. B.	.	2	7	7	7	7	.	5	.	5
Euphorbia salicifolia Host.	.	1	1	.	1	.	.	.	3	.
Ranunculus repens L.	.	3	5	.	7	7	5	.	5	.
Lactuca serriola Torn.	.	7	2	5	.	5	7	.	.	.
Senecio erucifolius L.	.	2	1	.	.	.	.	3	.	.
Morus alba L.	2	.	.	.	.	1	.	3	.	.
Populus alba L.	.	2	1	.	3	3	2	.	.	.
Arctium lappa L.	.	1	1	5	5	3	.	5	.	.
Juglans regia L.	.	.	.	1	.	1	.	.	.	.
Lathyrus pratensis L.	.	.	.	1	.	1	.	.	.	.
Chenopodium album L.	5	.	7	.	5	5	7	5	.	.
Polygonum hydropiper L.	.	5	5	.	5	8	7	.	.	.
Althaea officinalis L.	2	3	.	.	.	.	5	5	2	.
Polygonum persicaria L.	.	7	.	.	.	.	7	.	.	.
Lapsana communis L.	.	.	.	.	5	5	.	.	.	.
Humulus lupulus L.	.	.	5	.5	.	.	7	2	.	7
Hordeum murinum L.	.	.	5	.	.	5	3	.	.	.
Poa pratensis L.	.	.	2	.	2	.	2	1	.	.
Potentilla reptans L.	.	.	7	.	.	5	5	.	.	.
Malva sylvestris L.	.	.	3	2	2	3	3	5	.	.
Galium verum L.	.	.	3	.	.	.	.	5	.	.
Crataegus oxyacantha L.	.	.	.	.	1	.	.	3	.	.
Crepis setosa Hall.	.	.	.	2	.	.	.	8	.	.
Rumex palustris Sm.	3	5	.	5	7	5	.	.	5	.
Trapa natans L.	.	.	.	.	.	.	.7	.	.	5
Quercus robur L.	1	.	.	.	.	.	.	.	.	.
Silene alba (L.) Kr.	3	.	.	.	.	.	.	.	.	.
Verbascum lychnitis L.	5	.	.	.	.	.	.	.	.	.
Oenothera biennis L.	2	.	.	.	.	.	.	.	.	.
Agrostis alba L.	5	.	.	.	.	.	.	.	.	.

Appendix 3. Continued

No. of releve	1	2	3	4	5	6	7	8	9	10
Size of releve (m²)	200	210	560	560	250	400	300	**200**	**250**	**400**
Vicia sativa L.	7	.	.	.	.	.	.	.	.	.
Centaurium umbellatum Gilib.	.	3	.	.	.	.	.	.	.	.
Brachypodium sylvaticum (Huds.) P. B.	.	3	.	.	.	.	.	.	.	.
Anagalis arvensis L.	.	3	.	.	.	.	.	.	.	.
Cyperus fuscus L.	.	5	.	.	.	.	.	.	.	.
Kickxia elatine (L.) Dum.	.	3	.	.	.	.	.	.	.	.
Euphorbia helioscopia L.	.	3	.	.	.	.	.	.	.	.
Festuca pratensis Huds.	.	5	.	.	.	.	.	.	.	.
Aristolochia clematitis L.	.	.	5	.	.	.	.	.	.	.
Sonchus arvensis L.	.	.	5	.	.	.	.	.	.	.
Galium mollugo L.	.	.	5	.	.	.	.	.	.	.
Solanum dulcamara L.	.	.	5	.	.	.	.	.	.	.
Rumex hydrolapathum Huds.	.	.	5	.	.	.	.	.	.	.
Verbascum sp.	.	.	3	.	.	.	.	.	.	.
Potentilla supina L.	.	.	2	.	.	.	.	.	.	.
Lathyrus hirsutus L.	.	.	1	.	.	.	.	.	.	.
Hibiscus trionum L.	.	.	3	.	.	.	.	.	.	.
Salvinia natans (L.) All.	.	.	2	.	.	.	.	.	.	.
Cynodon dactylon (L.) Pers.	.	.	7	.	.	.	.	.	.	.
Scutellaria galericulata L.	.	.	1	.	.	.	.	.	.	.
*Cuscuta epithymum*L.	.	.	.	5	.	.	.	.	.	.
Raphanus raphanistrum L.	.	.	.	3	.	.	.	.	.	.
Arrhenatherum elatius L.	.	.	.	.	5	.	.	.	.	.
Datura stramonium L.	.	.	.	.	1	.	.	.	.	.
Petasites hybridus (L.) G.M. Sch.	.	.	.	.	.	3	.	.	.	.
Amaranthus retroflexus L.	.	.	.	.	.	3	.	.	.	.
Alopecurus pratensis L.	.	.	.	.	.	3	.	.	.	.
Tragopogon dubius Scop.	.	.	.	.	.	3	.	.	.	.
Iris pseudacorus L.	.	.	.	.	.	5	.	.	.	.
Rumex sanguineus L.	.	.	.	.	.	.	2	.	.	.
Solanum nigrum L.	.	.	.	.	.	.	3	.	.	.
Melissa officinalis L.	.	.	.	.	.	.	.	3	.	.
Agrimonia eupatoria L.	.	.	.	.	.	.	.	5	.	.
Veronica chamaedris L.	.	.	.	.	.	.	.	1	.	.
Bellis perennis L.	.	.	.	.	.	.	.	1	.	.
Lemna trisulca L.	.	.	.	.	.	.	.	7	.	.
Veronica persica Poir.	.	.	.	.	.	.	.	.	.	2

environmental factor has the most pronounced impact on the ecological differentiation of the investigated vegetation into appropriate syntaxa, which was confirmed by the CCA. The species which have the highest presence and are most significant in terms of quantity and quality in the described ruderal habitats are: *Amorpha fruticosa, Cirsium arvense, Convolvulus arvensis, Medicago lupulina* and *Stenactis annua*, while the extremely significant and highly present xenobionts of the identified associations are: *Asclepias syriaca, Calystegia sepium, Cichorium intybus, Daucus carota, Erigeron canadensis, Galega officinalis, Lolium perenne, Mentha aquatica, Pastinaca sativa, Plantago lanceolata, Rubus caesius, Stachys palustris* and *Trifolium pretense*. These species have the main influence on the physiognomy of the analyzed types of ruderal habitats, which is confirmed by the presence of the corresponding syntaxonomic elements, above all of the predominant vegetation classes Molinio-Arrhenatheretea and Stellarietea mediae.

The significant presence of non-native plant species (22) contributes to the study of the biodiversity of the research area: 14 in ass. *Asclepietum syriacae*, 16 in ass. *Amorpho-Typhaetum* ass. nova, and as many as 21 non-native species in ass. *Chenopodio-Ambrosietum artemisiifoliae* ass. nova. Neophytes predominate in the chronological spectrum (15), and in terms of invasivity status, invasive plant species are dominant (11) (Trinajstić, 1977). The presence of non-native species in the research area is above all the result of continual or temporary anthropogenic intervention which hinders the development of perennial plants and encourages the presence of annuals which prefer open habitats with favorable temperature and light regimes.

The ruderal vegetation of the south Srem region is characterized by a great diversity of plant species, distinctive dynamics, microfragmentation in distribution and the high morphoanatomic variability of its xenobionts. Studying this type of vegetation is not only important from the floristic and phytocoenological aspects, but it is also of great significance for direct plant production, because it is from these ruderal habitats that many species of weed invade cultivated areas and create great competition for crops.

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