UDC 582.5:632.5
Original scientific paper

CONTRIBUTION TO STUDIES OF THE RUDERAL VEGETATION OF EASTERN SREM (II)

Momčilo KOJIĆ[1], Radmila STANKOVIĆ-KALEZIĆ[2] i Ljiljana RADIVOJEVIĆ[2]

[1]Faculty of Agriculture, Belgrade, Serbia and Montenegro
[2]Agicultural Research Institute SERBIA - Pesticide and Environmental Research Centre, Belgrade, Serbia and Montenegro

Kojić Momčilo, Radmila Stanković-Kalezić and Ljiljana Radivojević: *Contribution to studies of the ruderal vegetation of eastern Srem (II).* - Acta herbologica, Vol. 13, No. 1, 75-82, Beograd.

Four ruderal associations have been identified on set-aside grounds and roadsides, in areas between cropped fields around Novi Beograd (Belgrade's Srem side) and Zemun, and along the Sava River embankment. Two of them, presented in this article, belong to the following higher syntaxonomic ranks:

Class *ARTEMISIETEA VULGARIS* Lohm. apud Tx. 1947.
Order *Artemisietalia vulgaris* Lohm. apud Tx. 1947.
Alliance *Arction lappae* Tx. (1937) 1942 em. Gütte 1972.
Ass. *Sambucetum ebuli* Felf. 1942.
Ass. *Asclepietum syriacae* ass. nova

The paper provides full symmorphological, synecological and syntaxonomic description of the two associations.

Corresponding author: Momcilo Kojić, Poljoprivredni fakultet, Nemanjina 6, 11080 Zemun, Serbia and Montenegro

Key words: Eastern Srem, ruderal vegetation, symmorphology, synecology, syntaxonomy, floristic composition, life-forms, floristic elements

INTRODUCTION

Unlike grasses, which have been investigated by a number of researchers so far (reviewed by KOJIĆ *et al.*, 2003), the issue of ruderal flora and vegetation was for the first time analysed in detail in Serbia in the 1950s (SLAVNIĆ, 1951). Research continued also in other parts of the former Yugoslavia (HORVATIĆ, 1963; MARKOVIĆ, 1064; MATVEJEVA, 1982).

An invaluable contribution and a most detailed study of the ruderal flora and vegetation of Belgrade's wider area was made by JOVANOVIĆ (1994). Proceeding in the same direction, we have approached to investigate the ruderal flora and vegetation and this is a follow-up to the results published by KOJIĆ *et al.* (2003).

AREA AND METHODS OF RESEARCH

The research of the ruderal vegetation of Eastern Srem presented in the paper was conducted around the urban areas of Zemun and Novi Beograd.

Data on the climatic and edaphic conditions in the region, chorographic and other characteristics, and the method of research and data processing are given in KOJIĆ *et al.* (2003).

RESULTS AND DISCUSSION

Four ruderal associations have formed in Eastern Srem under the influence of various edaphic, microrelief, anthropogenic and other factors, the initial two of which were described by KOJIĆ *et al.* (2003), while this article deals with the remaining two. All four of the studies associations were found to have a comparatively heterogenous syntaxonomic status:

I) Class *Chenopodietea* Br.- Bl.1952.
Order *Chenopodietalia* Br.-Bl. (1931) 1936.
Alliance *Chenopodion muralis* Br.-Bl. (1931) 1936.
Ass. *Urtico- Sambucetum ebuli* Br.-Bl. (1936) 1952.

II) Class *Agropyretea repentis* Ober., Mull. et Görs 1967.
Order *Agropyretalia repentis* Ober., Mull. et Görs 1967.
Alliance *Convolvulo- Agropyrion repentis* Görs 1966.
Ass. *Convolvulo-Agropyretum repentis* Felf. 1943.

III) Class *Artemisietea vulgaris* Lohm. apud Tx. 1947.
Order *Artemisietalia vulgaris* Lohm. apud Tx. 1947.
Alliance *Arction lappae* Tx. (1937) 1942 em. Gütte 1972.
Ass. *Sambucetum ebuli* Felf. 1942.
Ass. *Asclepietum syriacae* ass. nova

The syntaxa included show a considerable phytocoenological, i.e. syntaxonomic diversity (four associations aligned into three distinctive alliances, three orders and three classes). Such a high diversity of ruderal flora and vegetation mostly results from the specific and considerably diverse conditions in which they occur (OBEDORFER, 1954; FELFÖLDY, 1942; TÜXEN ed., 1966; MARKOVIĆ, 1964; MATVEJEVA, 1982, etc.).

The data included in phytocoenological Tables 1 and 2 give us an insight into the main characteristics of the ruderal associations of Eastern Srem: floristic composition, abundance, cover, association of different species (i.e. coenobionts), and the degree of presence.

The association *Sambucetum ebuli* Felf. 1942 was for the first time described in Hungary (FELFÖLDY, 1942), while MARKOVIĆ (1964) found the same phytocoenosis present in Croatia. Stands of this association are well developed on the slopes of river embankments, neglected grounds along roads and cultivated fields, etc. The association comprises 33 species in the area of Eastern Srem. Over half of them form a characteristic grouping: *Sambucus ebulus, Cichorium intybus, Rubus caesius, Asclepias syriaca, Amorpha fruticosa, Equisetum telmateia, Poa trivialis, Cynanchum vincetoxicum, Convolvulus arvensis, Urtica dioica, Cirsium arvense, Glycyrrhiza echinata, Daucus carota, Erigeron canadensis, Cynodon dactylon, Crepis setosa, Ballota nigra.*

The association *Asclepietum syriacae* is a new ruderal phytocoenosis, identified for the first time in Eastern Srem. Its main characteristic comes from *Asclepias syriaca,* which appears regularly in all stands. The species having presence degrees IV and V and forming the characteristic grouping are: *Asclepias syriaca, Calystegia sepium, Glechoma hederacea* and *Aristolochia clematits.* A large number of species (42) comprise its overall floristic composition. Stands of this phytocoenosis were found in their optimal development on the slopes of river embankments and in underbrush formed by various *Salix* species, *Amorpha fruticosa*, etc.

Table 1. - Ass. Sambucetum ebuli Felf. 1942.

Life forms	No. of species	Evaluation according to Br.-Bl. 1	2	3	Degree of rezence	Ecological index V	R	N	S	T	Floristic element
g	*Sambucus ebulus*	4.5	4.5	2.3	V	3	4	4	4	4	pont-subm.
h	*Cichorium intybus*	+	+.1	+	V	2	4	3	5	4	subevr.
np	*Rubus caesius*	3.3	2.2.	+	V	4	3	5	3	4	subj-sib.
g	*Asclepias syriaca*	+	-	+	IV	2	4	2	3	3	adv.
np	*Amorpha fruticosa*	+.1	-	+	IV	4	3	3	3	4	adv.
g	*Equisetum telmateia*	2.3	+	-	IV	4	3	2	3	3	cirk.
h	*Poa trivialis*	+.1	-	+.1	IV	3	3	4	3	2	subevr.
h	*Cynanchum vincetoxicum*	+	-	+.1	IV	2	4	2	3	3	pont-ca.
g	*Convolvulus arvensis*	-	+.1	+.1	IV	2	4	3	4	3	kosm.
h	*Urtica dioica*	-	+.1	+	IV	3	3	5	3	3	evr.
g	*Cirsium arvense*	-	+.1	+.1	IV	3	3	4	4	4	subevr.
h	*Glycyrrhiza echinata*	-	+	+	IV	3	3	2	4	4	pont-subm.
th	*Daucus carota*	-	1.1	+.1	IV	2	3	2	4	3	subevr.
th	*Erigeron canadensis*	-	+.1	+.1	IV	2	3	3	4	4	adv.
g	*Cynodon dactylon*	-	+.1	1.2	IV	2	3	3	4	5	kosm.
t	*Crepis setosa*	-	+.1	+.1	IV	2	3	3	4	5	subm.
g	*Ballota nigra*	-	+	+	IV	3	3	4	4	4	pont.
g	*Calystegia sepium*	-	+.1	-	II	4	4	4	3	3	evvr.
h	*Carduus acanthoides*	-	+	-	II	2	3	4	4	4	subse.
th	*Silene alba*	-	+	-	II	2	3	4	4	3	subevr.
h	*Linaria vulgaris*	-	+.1	-	II	3	3	4	4	3	subse.
h	*Artemisia vulgaris*	-	+.1	-	II	3	3	4	4	3	cirk.
th	*Lactuca serriola*	+	1.1	+	II	2	3	3	5	4	pont-subm.
t	*Galium aparine*	-	1.2	-	II	3	3	5	4	3	evr.
h	*Heracleum sphondylium*	-	2.3	-	II	3	3	4	3	2	evr.
th	*Matricaria inodora*	-	+	-	II	3	3	3	3	3	evr.
th	*Dipsacus silvestris*	-	+.1	-	II	3	4	3	4	4	subse.
h	*Verbascum nigrum*	-	+	-	II	2	3	4	3	3	evr.
h	*Lythrum salicaria*	-	+	-	II	4	3	3	3	3	pont-subm.
t	*Atriplex patula*	-	+	-	II	3	4	4	3	3	cirk.
t	*Chenopodium album*	-	+	-	II	2	3	4	3	3	kosm.
t	*Stachys annua*	-	+	-	II	2	4	2	4	3	pont-subm.
h	*Epilobium hirsutum*	-	+.1	-	II	4	4	4	3	4	subevr.

Table 2. - Ass. Asciepietum syriacae ass. nova

Life forms	No. of species	Evaluation according to Br.-Bl. 1	2	3	4	5	Degree of prezence	Ecological index V	R	N	S	T	Floristic element
G	*Asclepias syriaca*	1.1	1.1	1.2	1.1	1.1	V	2	4	2	3	3	adv.
G	*Calystegia sepium*	1.1	1.1	+	+	+.1	V	4	4	4	3	3	evr.
H	*Glechoma hederacea*	1.1	1.1	+	-	+.1	IV	3	3	3	3	3	evr.
g	*Aristolochia clematitis*	2.2	2.2	2.2	-	1.1	IV	3	4	4	3	4	subm.
h	*Carduus acanthoides*	+.1	+.1	+	-	-	III	2	3	4	4	4	subse.
h	*Rumex crispus*	1.1	-	+	-	+	III	3	3	3	4	3	evr.
th	*Silene alba*	+	-	+.1	-	+.1	III	2	3	4	4	3	subevr.
h	*Galium mollugo*	1.1	2.2	-	-	1.2	III	3	3	3	3	3	subse.
th	*Stellaria media*	1.1	2.2	-	-	2.2	III	3	3	4	3	3	kosm.
g	*Convolvulus arvensis*	-	1.1	1.2	-	1.1	III	2	4	3	4	3	kosm.
np	*Amorpha fruticosa*	+.1	+.1	-	-	-	II	4	3	3	3	4	adv.
h	*Potentilla reptans*	1.1	-	-	-	+.1	II	3	3	2	3	3	evr.
t	*Geranium dissectum*	1.1	+.1	-	-	-	II	2	3	3	4	4	evr.
g	*Sorghum halepense*	-	1.2	-	-	3.3	II	2	2	3	4	5	kosm.
g	*Aster tradescantii*	-	+	-	-	+.1	II	3	4	4	3	4	avr.
g	*Cirsium arvense*	-	+	-	+.1	-	II	3	3	3	4	4	subevr.
t	*Setaria viridis*	-	+.1	-	-	+.2	II	2	3	4	4	4	subevr.
zc	*Lysimachia nummularia*	+.1	-	-	-	-	I	4	3	3	2	3	subse.
h	*Cichorium intybus*	-	1.1	-	-	-	I	2	4	3	5	4	subevr.
np	*Rubus caesius*	-	+.1	-	-	-	I	4	3	5	3	4	subj-sib.
h	*Silene vulgaris*	-	+.1	-	-	-	I	2	3	2	4	3	subevr.

t	*Polygonum aviculare*	-	1.1	-	-	-	I	3	3	4	4	3	kosm.
h	*Taraxacum officinale*	-	+.1	-	-	-	I	3	3	4	4	3	evr.
th	*Verbena officinalis*	-	+.1	-	-	-	I	2	3	4	4	3	kosm.
h	*Plantago lanceolata*	-	+.1	-	-	-	I	3	3	3	3	3	evr.
h	*Dactylis glomerata*	-	+.1	-	-	-	I	3	3	4	3	3	subevr.
h	*Arctium lappa*	-	+	-	-	-	I	3	3	5	4	4	evr.
h	*Urtica dioica*	-	-	3.4	-	-	I	3	3	5	3	3	evr.
g	*Sambucus ebulus*	-	-	+	-	-	I	3	4	4	4	4	pont-subm.
t	*Bromus sterilis*	-	-	3.3	-	-	I	2	3	4	3	3	subevr.
t	*Echinocystis echinata*	-	-	+	-	-	I	4	3	3	3	3	adv.
h	*Poa trivialis*	-	-	+.1	-	-	I	3	3	4	3	2	subevr.
th	*Lamium purpureum*	-	-	1.2	-	-	I	3	4	4	4	3	subse.
g	*Stachys palustris*	-	-	-	1.2	-	I	4	3	3	3	3	subse.
h	*Calamagostris epigeios*	-	-	-	1.1	-	I	3	3	3	3	3	evr.
h	*Lythrum salicaria*	-	-	-	1.2	-	I	4	3	3	3	3	pont-subm.
h	*Vicia sativa*	-	-	-	1.1	-	I	3	3	3	3	3	pont-subm.
t	*Crepis setosa*	-	-	-	5.5	-	I	2	3	3	4	5	subm.
g	*Lathyrus tuberosus*	-	-	-	+.1	-	I	2	4	2	4	4	subj-sib.
t	*Ambrosia artemisifolia*	-	-	-	-	+	I	2	3	3	4	4	adv.
t	*Xanthium strumarium*	-	-	-	-	-	I	3	3	4	4	5	adv.
t	*Mentha arvensis*	-	-	-	-	+	I	4	3	3	4	4	cirk.

The most important characteristics (life-forms, ecological indexes and floristic elements) of the coenobionts forming the ruderal associations of Eastern Srem are summarized and presented comparatively in Tables 3, 4 and 5.

Table 3. - Biological spectrum of ruderal plant communities of Eastern Srem

Life forms	No. of species 1	%	No. of species 2	%
H	12	36,3	16	38,1
G	8	24,2	11	26,2
T	5	15,1	8	19,0
Th	6	18,1	4	9,5
Np	6	18,1	4	9,5
Zc	-	-	1	2,4

Table 4. - Average ecological index values for ruderal communities of Eastern Srem

Ecological indices	1	2
V	2,76	2,86
R	3,30	3,00
N	3,33	3,46
S	3,57	3,50
T	3,45	3,46

Table 5. - Floristic elements in the ruderal communities of Eastern Srem

Floristic element	1	2	Abbreviation
Evroaziski / Euroasian	6	10	evr.
Subevroaziski / Sub-Euroasian	6	8	subevr.
Kosmopolitski / Cosmopolitan	3	5	kosm.
Subsrednjoevropski / Sub-Mid-European	3	4	subse.
Cirkumpolarni / Circumpolar	3	2	cirk.
Adventivni / Adventive	3	6	adv.
Pontsko-submediteranski / Pontic-Sub-Mediterranean	5	3	pont-subm.
Submediteranski / Sub-Mediterranean	1	2	subm.
Subjužnosibirski / Sub-South-Siberian	1	2	subj-sib.
Pontski / Pontic	1	-	pont.
Subpontski / Sub-Pontic	1	-	subpont.

Synecological characteristics of the ruderal communities of Eastern Srem may be considered based on the average ecological index values and life-form spectrum (Tables 3 and 4). Looking at these results, as well as those reported by KOJIĆ *et al.* (2003), we can see that the ruderal communities studied here occupy flat grounds and slopes around embankments (mostly along Sava River), so that differences occur only as a result of some minor microrelief features.

The data presented in Table 3 shows the life-form spectrum of the ruderal communities of Eastern Srem to be dominated by hemicryptophytes and geophytes, with a considerable participation of therophytes, therophyte-hemicryptophytes and nanophanerophytes.

The average ecological index values for humidity (Table 4) are 2.76 and 2.86, which indicates that, regarding water status, the coenobionts of those communities are close to submesophytes. Soil pH (R) is mostly neutral as the average values are 3.00 and 3.30. The degree of soil nitrophilia is somewhat pronounced, being 3.33 and 3.46. Regarding light regime (S), the average values are 3.50 and 3.57, indicating that members of this phytocoenosis are predominantly semi-sciophilous, tending toward heliophilia. Temperature regime for the ruderal plant community of the investigated region is favourable with mesothermal to thermophilous character predominating (T = 3.45 and 3.46).

Considering the general character of ruderal vegetation, its genesis, chorology and syntaxonomic status, it is understandable that the investigated ruderal associations are predominated by floristic elements of broad distribution (Euroasian, Sub-Euroasian, Cosmopolitan, Circumpolar). The data prove that the Srem ruderal communities fully fit into the geographic and syntaxonomic body of the European ruderal vegetation.

All data put together give us a comprehensive overview of the plant communities making the ruderal habitats of Eastern Srem. They are invaluable not only in scientific terms but practical as well, having in mind that such coenobionts may potentially infiltrate the agrestal communities of neighbouring field ecosystems.

CONCLUSION

Four ruderal associations were identified on neglected grounds, along roadsides and in areas between cropped fields around Novi Beograd and Zemun in Eastern Srem, as well as along the Sava River embankment. Two of them were studied and identified as belonging to the following higher syntaxonomic ranks:

Class *ARTEMISIETEA VULGARIS* Lohm. apud Tx. 1947.
Order *Artemisietalia vulgaris* Lohm. apud Tx. 1947.
Alliance *Arction lappae* Tx. (1937) 1942 em. Gütte 1972.
Ass. *Sambucetum ebuli* Felf. 1942.
Ass. *Asclepietum syriacae* ass. nova

Full phytocoenological tables are given for the two associations, including their floristic composition and a combined assessment of abundance, cover, affiliation of species and their degree of presence. The life-form spectrum is shown, as well as the ecological index average values and participation of floristic elements in the communities. The said parameters have given us the general outlines of the investigated associations.

The life-form spectrum of the ruderal communities of Eastern Srem is dominated by hemicryptophytes, geophytes and therophytes, with a considerable participation of therophyte-hemicryptophytes.

The average ecological index values provide a clear picture of the synecological characteristics of the investigated ruderal communities. Regarding water regime, those indicators show that their coenobionts are sub-mesophilous in character. Soil pH is mostly neutral, with pronounced nitrofilous character.

Temperature and light regimes are favourable, as the investigated communities belong to an open type.

The differences between values for different ecological factors are not highly expressed, indicating that the main cause for the synecological difference is the specificity of anthropogenous and zoogenous influence and microrelief characteristics.

Apart from providing scientific insight into the issue, the results presented here also contribute to solving the problem of weed control as many ruderal species are a potential source of additional diversity of agrestal phytocoenoses surrounding the field ecosystems.

REFERENCES

FELFÖLDY, L. (1942): Szociologiai vizagalatok a pannoniai florateluret gyomvegataciojan. Acta Geobotan. Hung., 5, 87-138, Budapest.

HORVATIĆ, B. (1963): Vegetaciska karta otoka Paga sa opštim pregledom vegetaciskih jedinica hrvatskog Primorja. Prirodoslovna istraživanja JAZU, 33, Acta biologica, 4, Zagreb.

JOVANOVIĆ, S. (1994): Ekološka studija ruderalne flore i vegetacije Beograda. Diss., Biološki fakultet, Beograd.

KOJIĆ, M., STANKOVIĆ-KALEZIĆ, R., RADIVOJEVIĆ, LJ., VRBNIČANIN, S. (2003): Prilog proučavanju ruderalne vegetacije istočnog Srema. Acta herbologica,

MARKOVIĆ, LJ. (1964): Fitocenološka istraživanja ruderalne vegetacije u Hrvackoj. Diss., Prirodno-matematički fakultet, Zagreb.

MATVEJEVA, J. (1982): Ruderalna vegetacija na SR Makedonija, Diss., Monografija, Skopje.

OBERDORFER, E. (1954): Über Unkrautgesellachaften der Balkanhalbinsel. Vegetatio, 4(6), 379-411, Den Haag.

SLAVNIĆ, Ž. (1951): Pregled nitrofilne vegetacije Vojvodine. Nučni zbornik, Matica srpska, Serija prirodnih nauka, 1, 84-169, Novi Sad.

TÜXEN, R. ed. (1966): Anthropogene Vegetation. Bericht über das Internationale Symposium in Stolzenau/Weser, Verlag W. Junk, Den Haag.

Received March 1, 2004
Accepted March 27, 2004

PRILOG POZNAVANJU RUDERALNE VEGETACIJE ISTOČNOG SREMA (II)

Momčilo KOJIĆ[1], Radmila STANKOVIĆ-KALEZIĆ[2] and Ljiljana RADIVOJEVIĆ[2]

[1]Poljoprivredni fakultet, Zemun
[2]Institut SRBIJA - Centar za pesticide i zaštitu životne sredine, Zemun

Izvod

U istočnom Sremu, nedaleko od Novog Beograda i Zemuna, na zapuštenim mestima, pored puteva i na prostorima između njiva, kao i na padinama nasipa pored Save, utvrđene su četiri ruderalne asocijacije, od kojih su proučene dve u ovom radu i pripadaju sledećim višim sintansonomskin jedinicama:

Klasa *Artemisietea vulgaris* Lohm. apud Tx. 1947.
Red *Artemisietalia vulgaris* Lohm. apud Tx. 1947.
Sveza *Arction lappae* Tx. (1937) 1942 em. Gütte 1972.
Ass. *Sambucetum ebuli* Felf. 1942.
Ass. *Asclepietum syriacae* ass. nova

U radu su date komletne fiocenološke tabele koje obuhvataju floristički sastav ruderalnih asocijacija.

U biološkom spektru ruderalnih zajednica istočnog Srema preovladuju hemikriptofite, geofite i terofita, sa značajnim učešcem terofito/hemikriptofita.

Prosečne vrednosti ekoloških indeksa pružaju jasnu sliku sinekološkim karakteristikama proučenih ruderalnih zajednica. U odnosu na vodni režim ovi pokazatelji ukazuju da su cenobionti ovih ruderalnih zajednica submezofilnog karaktera. Hemijska reakcija zemljišta je uglavnom neutralna sa izraženim nitrofilnim obeležjem. Temperaturni i svetlosni režim su povoljni, što je posledica činjenice da se radi o zajednicama otvorenog tipa.

Razlika pomenutim ekološkim ciniocima nisu tako izražene, što ukazuje da glavni uzrok sinekoloških razlika proizilazi iz specifičnosti antropogeno-zoogenih uticaja i mikroreljefnih karakteristika.

Rezultati ovih istraživanja pored velikih naučnih saznanja imaju i dragocen praktični doprinos rešavanju problema kontrole korova.

Primljeno 1. marta 2004.
Odobreno 27. marta 2004.