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Original Article

Phytogeographical analysis of the flora of Miljkovačka gorge in Eastern Serbia

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***Abstract*:**
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As a result of two-year investigation of the Miljkovacka gorge flora, carried out during the 2010. and 2011., 331 plant taxa belonging to 245 genera and 70 families were recorded and sorted into 112 floristic elements, 15 area groups and 9 area types. Phytogeographical analysis showed that the species of Eurasian area type are the most abundant ones.

Key words: area group, area type, floristic element, Miljkovačka gorge

Introduction

One of the major biodiversity hotspots is Balkan Peninsula (Horvat *et al*., 1974), and the Miljkovacka gorge is situated in Eastern Serbia, SE of Niš, bordered by Mt Kalafat (837 m), Mt Kamenički vis (813 m) from south and hillsides of Mt Devica (1187 m) from north and northeast, which belong to Carpathian-Balkan group of mountains (**Fig. 1**). Bela river that flows beneath Mt Devica and Kopaljkosarska river that flows beneath Mt Kalafat are flowing into each other near Popsica village making Popsica river. During its passage through the village Kravlje, it changes name to Kravljanska river. On its way to South Morava, it changes its name twice more: Miljkovačka river and Toponička river. As Toponička river, it finally flows into South Morava.

The geological structure of the Miljkovačka gorge is represented by Mesozoic limestone. The pedological substrate is predominantly consisted of cambisoil and red soil.

The climate of this area is humid continental with two extremely wet and cold periods (from January to May and from September to December) and one arid period during the summer.

Miljkovačka gorge is not well explored area. The first data concerning this area were collected by Spas Sotirov in 1977, who found the new locality of endemic-relict plant species, *Ramonda serbica* in the valley of Kravljanska river. Martinović *et al.* (1985) published paper which was the first phytogeographical investigation of Miljkovačka gorge. The more significant and widely extended breakthrough in the studies of the flora and vegetation of the Miljkovačka gorge was made during 2010. and 2011. (Miljković, 2011; Miljković *et al*., 2012).

Materials and methods

The study is based on literature data (Sotirov, Stanojević, 2012), herbarium collections (HMD), and continuous field observations carried out during the 2010 and 2011. Herbarium specimens are deposited at the Herbarium Moesiacum (HMN). Identification of the collected plants was performed according to Flora

Europaea (Tutin *et al.*., 1964-1980) and the regional Floras relevant for the investigated area (Jordanov, 1963-1979, Velchev 1982-1995, Josifović, 1970-1977, Micevski, 1985-1995, Sarić, 1986, 1992). The nomenclature follows Med-Checklist (Greuter *et al.*, 1984-1989), Flora Europaea (Tutin *et al.*, 1964-1980), and IOPI – International Organization for Plant Information (http://plantnet.rbgsyd.nsw.gov.au/iopi/iopihome.htm). For the area types classification Meussel *et al.* (1965, 1978), Meussel and Jäger (1992) and Stevanović (1992) were used.

Results

As a result of floristic investigations of the Miljkovačka gorge in Eastern Serbia, region in the central part of the Balkan peninsula, 331 plant taxa belonging to 245 genera and 70 families were recorded (**Tab. 1**).

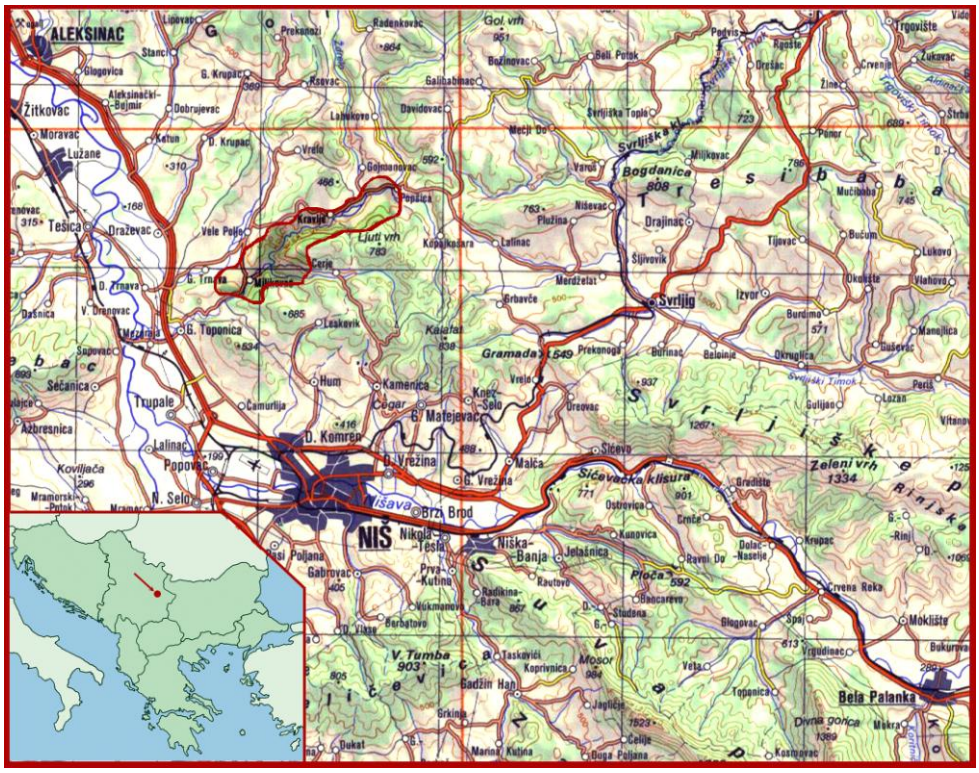

Figure 1. Geographical position of investigated area

Table 1. List of vascular flora with area types, area groups and floristic elements

Taxa	Area type	Area group	Flostic element
EQUISETOPSIDA	-	-	-
Equisetaceae			
Equisetum arvense L.	**Hol**		**Circumcholarct. -(arct-merid)**
Equisetum maximum Lam.	**Hol**		**Europ.-North Amer.-(bor-merid)**
Aspleniaceae			
POLYPODIOPSIDA			
Asplenium ceterach	**EA**		
Asplenium ruta-muraria L.	**Hol**		
Asplenium trichomanes L.	**Cosm**		**Cosm.-amfiatl. origin**
MAGNOLYOPSIDA			
Acanthaceae			
Acanthus balcanicus Heywood & I. B. K. Richardson	**Med-smed**	**Balk**	

Taxa	Area type	Area group	Flostic element
Aceraceae			
Acer monspessulanum L.	**Med-smed**		
Acer tataricum L.	**EA**	**Ce-m-p-or**	
Adoxaceae			
Adoxa moschatelina L.	**Hol**		**Circumcholarkct.-(temp-submer)**
Anacardiaceae			
Cotinus coggygria Scop.	**MSM**		
Apiaceae			
Aegopodium podagraria L.	**EA**		**Eurasian-(bor-merid)**
Berula erecta (Hudson) Coville	**Hol**		**Circumcholarkct.-(bor-merid)**
Carum carvi L.	**EA**		**Eurasian-(temp-submer)**
Danaa cornubiensis (L.) Burnat	**Med-smed**		
Daucus carota L.	**Phol-ptrop**		**Central Europ.-medit.-pont.-orient.-turan.-East African**
Eryngium campestre L.	**EA**		
Falcaria vulgaris Bernh.	**EA**		
Heracleum sphondylium L.	**CE**		**Central European**
Pastinaca sativa L.	**EA**		**Eurasian-(bor-merid)**
Pimpinella saxifraga L.	**EA**		**Eurasian-(temp-mer)**
Seseli rigidum Waldst. & Kit.	**Med-smed**		**SKarp-Balk**
Seseli varium Trev.	**EA**	**Ce-med**	
Torilis arvensis (Hudson) Link	**EA**	**Ce-med**	
Araliaceae			
Hedera helix L.	**EA**	**EA(W)**	
Aristolochiaceae			
Aristolochia clematitis L.	**Med-smed**		
Asarum europaeum L.	**EA**		**Eurasian**
Asclepiadaceae			
Cynanchum vincetoxicum (L.) Pers.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Asteraceae			
Achillea crithmifolia Waldst. & Kit.	**MSM**	**Med-pont**	**Panon.-skard.-pind.-mac.-trak.-moes.-danub.**
Achillea millefolium L.	**EA**		**Eurasian-(bor-submer)**
Achillea millefolium L. forma rubra	**EA**		**Eurasian-(bor-submer)**
Arctium lappa L.	**EA**		**Eurasian-(temp-submer)**
Artemisia absinthium L.	**EA**		**Eurasian-(subbor-mer)**
Artemisia alba L.	**Med-smed**		
Artemisia annua L.	**EA**		
Artemisia scoparia Waldst. & Kit.	**EA**		
Artemisia vulgaris L.	**Hol**		**Circumcholarkct.-(subbor-mer)**
Bellis perennis L.	**EA**	**Ce-med**	**Central European-medit.-submedit.**
Bidens tripartita L.	**EA**		**Eurasian-(bor-temp)**
Bombyciealena erecta (L) Smolj.	**EA**	**Ce-med-pont**	
Carduus acanthoides L.	**CE**		**Central European**
Carduus nutans L.	**EA**		
Carthamus lanatus L.	**EA**	**Ce-med-pont**	

Taxa	Area type	Area group	Flostic element
Centaurea solsticialis L.	**MSM**		**Medit.-submedit.-pont.-South Sibir-orijent.-turan.**
Centaurea stoebe L.	**EA**	**EA(W)**	
Chrysanthemum parthenium L.	**EA**	**EA(W)**	
Cirsium palustre (L.) Scop.	**Bor**		**Eur.-West Asian-(bor-temp)**
Crepis pulchra L.	**EA**	**Ce-m-p-or**	
Crepis setosa Haller fil.	**Med-smed**		**Medit.-submedit.**
Crupina vulgaris Cass.	**MSM**	**Med-pont**	
Echinops sphaerocephalus L.	**EA**		
Erigeron canadensis L.	**Adv**		**North American**
Eupatorium cannabium L.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Galinsoga parviflora Cav.	**Adv**		**South American**
Hieracium pilosella L.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Inula conysa DC.	**EA**	**Ce-m-p-or**	**Sarm.-medit.-smed.-pont.-orijent.**
Inula germanica L.	**EA**	**Ce-m-p-or**	
Inula helenium L.	**EA**	**Ce-m-p-or**	
Inula oculus-christi L.	**EA**	**Ce-med-pont**	
Lactuca perennis L.	**EA**	**Ce-med-pont**	
Matricaria trichophylla (Boiss.) Boiss.	**EA**	**Ce-med**	**Herc.-panon.-East submedit.**
Mycelis muralis (L.) Dumort.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Petasites hybridus (L.) P. Gaertner, B. Meyer & Scherb.	**EA**		**Eurasian-(bor-submer)**
Ptilestemon afer (Jacqu.) Greut.	**Med-smed**		**South Carp.-moes-mac.-trac.-skard. pind.**
Senecio jacobaea L.	**EA**	**Ce-med-pont**	
Senecio vernalis Waldst. & Kit.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Stenactis annua (L.) Less.	**EA**	**Ce-med-pont**	
Taraxacum officinale Weber	**EA**		**Eurasian-(bor-temp)**
Tussilago farfara L.	**EA**		**Central European-medit.-submedit.-pont.-South Sibir.-Central Asian**
Xeranthemum annuum L.	**Med-smed**		**Submedit.**
Xeranthemum cylindraceum Szb. Et Sm.	**MSM**	**Med-pont**	
Berberidaceae			
Berberis vulgaris L.	**EA**	**EA(W)**	
Boraginaceae			
Anchusa officinalis L.	**EA**	**Ce-med-pont**	**Central European-East submedit.-West pont.**
Echium italicum L.	**Med-smed**		
Echium vulgare L.	**EA**		**Eurasian-(bor-merid)**
Symphytum officinale L.	**EA**	**EA(W)**	**Atlant-subatlant.-medit.-submedit.-pont.-south-sibir.**
Symphytum tuberosum L.	**MSM**	**Med-pont**	**Medit.-submedit.-pont.**
Brassicaceae			
Alliaria officinalis Andrz. ex Bieb.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Alyssum alyssoides L.	**EA**	**EA(W)**	
Alyssum murale Waldst. & Kit.	**MSM**	**Med-pont**	
Alyssum saxatile L.	**EA**	**Ce-med-pont**	
Arabis recta Will.	**EA**	**Ce-med-pont**	

Taxa	Area type	Area group	Flostic element
Conringia orientalis (L.) Dumort.	**EA**	**EA(W)**	
Draba aizoides L.	**EA**	**Ce-med**	
Erysimum comatum Pancic	**Med-smed**	**Balk**	**Moesian-skard. pind.**
Erysimum diffusum Ehrh.	**EA**	**Ce-m-p-or**	**East Medit.-pont.-panon.-South Sibir.-turan.**
Hesperis matronalis L.	**EA**	**EA(W)**	
Campanulaceae			
Campanula bononiensis L.	**EA**		
Campanula lingulata Waldst. & Kit.	**EA**	**Ce-med**	**Karp.-panon.-balk.**
Campanula rapunculoides L.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Campanula trachelium L.	**EA**		**Eurasian-(bor-merid)**
Cannabaceae			
Humulus lupulus L.	**EA**		
Caprifoliaceae			
Sambucus ebulus L.	**EA**		**Central European-medit.-submedit.-pont.-South Sibir-orijent.-turan.**
Caryophyllaceae			
Cerastium brachypetalum Pers.	**EA**	**Ce-med**	
Cerastium pumilum Curtis	**EA**	**Ce-med**	
Cucubalus baccifer L.	**EA**		
Dianthus armeria L.	**EA**	**Ce-med**	
Dianthus petraeus Waldst. & Kit.	**EA**	**Ce-med**	**CKarp-Balk**
Dianthus pontederae A. Kerner	**EA**	**Ce-med**	
Herniaria hirsuta L.	**EA**	**Ce-m-p-or**	**Central European-submedit.-West Asian-(temp-merid)**
Holosteum umbellatum L.	**EA**		
Lychnis coronaria (L.) Desr.	**EA**	**Ce-m-p-or**	**Central European-submedit.-kavk.-turan.**
Moehringia muscosa L.	**EAM**	**CSEM**	**Central-South-Europ.-Mont.**
Petrorhagia illyrica (L.) P. W. Ball & Heywood	**Med-smed**		
Petrorhagia saxifraga (L.) Link	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Saponaria officinalis L.	**EA**		**Eurasian-(temp-submer)**
Silene alba (Miller) W. Greuter & Burdet	**EA**		**Eurasian-(bor-merid)**
Silene flavescens Waldst. & Kit.	**EA**	**Ce-med**	
Silene viridiflora L.	**EA**	**Ce-m-p-or**	**Central European-Central Medit.-East Submedit.-orijent.-turan.**
Silene vulgaris (Moench) Garcke	**EA**		**Eurasian-(bor-merid)**
Stellaria holostea L.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Stellaria media (L.) Vill.	**Cosm**		**Cosm-Eurasian origin**
Celastraceae			
Euonymus europaeus L.	**EA**	**Ce-med**	**Europ.-submedit.**
Chenopodiaceae			
Polycnemum arvense L.	**EA**		
Cistaceae			
Helianthemum nummularium (L.) Miller	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Convolvulaceae			
Calystegia sepium (L.) R. Br.	**Cosm**		**Cosm.-europ.-northamer. origin**

Taxa	Area type	Area group	Flostic element
Convolvulus arvensis L.	**Cosm**		**Cosm.- mediter. origin**
Convolvulus cantabricus L.	**EA**	**Ce-med**	
Cornaceae			
Cornus mas L.	**EA**	**Ce-med**	
Cornus sanguinea L.	**CE**		
Corylaceae			
Carpinus orientalis Miller	**EA**	**Ce-med**	
Crassulaceae		**Ce-med**	
Sedum acre L.	**CE**	**Ce-med**	**Atlant.-Central European-submedit.**
Sedum dasyphyllum L.	**Med-smed**		
Sedum hispanicum L.	**Med-smed**	**E smed**	**Submedit.**
Sedum ochroleucum Chaix	**Med-smed**	**E smed**	
Sedum telephium L. ssp. maximum (L.) Krocker	**Med-smed**	**E smed**	
Sempervivum marmoreum Griseb.	**EA**	**Med-pont**	
Cucurbitaceae			
Bryonia alba L.	**EA**	**Ce-m-p-or**	
Cuscutaceae			
Cuscuta epithymum L.	**EA**		**Eur.-med.-smed.-pont.-orijent.-turan.-himal.**
Dipsacaceae			
Cephalaria flava (Sibth. & Sm.) Szabó	**Med-smed**	**Balk**	**Moesian-skard. pind.**
Dipsacus laciniatus L.	**EA**	**EA(W)**	
Knautia drymeia Heuffel	**EAM**	**CSEM**	**Alp.-balk.**
Scabiosa ochroleuca L.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Euphorbiaceae			
Euphorbia amygdaloides L.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Euphorbia cyparissias L.	**EA**		**Eurosib.-(bor-merid)**
Euphorbia polychroma A. Kerner	**Med-smed**		
Euphorbia salicifolia Host	**EA**	**Ce-med-pont**	
Euphorbia taurinensis All.	**Med-smed**		
Mercurialis perennis L.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Fabaceae			
Astragalus cicer L.	**EA**	**Ce-med**	
Galega officinalis L.	**EA**	**Med-pont**	**Pontsko-istočnosubmedit.**
Genista tinctoria L.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Lathyrus venetus (Miller) Wohlf.	**EA**	**Ce-med-pont**	
Lathyrus vernus (L.) Bernh.	**EA**	**Ce-med**	**Europ.-medit.-west-Asian**
Medicago arabica (L.) Hudson	**EA**	**Ce-med-pont**	
Medicago falcata L.	**EA**		
Medicago prostrata Jacq.	**EA**	**Ce-med-pont**	
Melilotus officinalis (L.) Pallas	**EA**		**Eurasian**
Ononis spinosa L.	**EA**	**Ce-med**	**Atlant.-Central European-submedit.**
Trifolium alpestre L.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Trifolium arvense L.	**EA**	**EA(W)**	**Europ.-medit.-southsib.**
Trifolium campestre Schreber	**EA**	**Ce-m-p-or**	**Central European-medit.-submedit.-pont.-orijent.-turan.**

Taxa	Area type	Area group	Flostic element
Trifolium dalmaticum Vis.	**Med-smed**	**E smed**	
Trifolium pratense L.	**EA**	**EA(W)**	**Europ.-submedit.-pont.-south-sibir.**
Trifolium repens L.	**Hol**		**Circumcholarkct.-(arct-submer)**
Vicia lathyroides L.	**EA**	**EA(W)**	
Vicia villosa Roth	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Fagaceae			
Fagus moesiaca K.Maly	**CE**		**Moesian**
Quercus cerris L.	**Med-smed**		
Quercus frainetto Ten.	**EA**	**Ce-med**	
Quercus pubescens Willd.	**EA**	**Ce-med**	
Gentianaceae		**Ce-med**	
Centaurium erythraea Rafin.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Geraniaceae			
Geranium lucidum L.	**EA**		
Geranium molle L.	**EA**		
Geranium robertianum L.	**Cosm**		**Sec. cosm. -Eurasian. origin**
Gesneriaceae			
Ramonda serbica Pančˇ.	**Med-smed**	**Balk**	**Moesian-skard. pind.**
Hypericaceae			
Hypericum boissieri Petrovic	**Med-smed**	**Balk**	
Hypericum perforatum L.	**EA**		**Europ.-medit.-west-Asian**
Hypericum rumeliacum Boiss.	**Med-smed**		**SKarp-Balk**
Lamiaceae			
Acinos arvensis (Lam.) Dandy	**EA**	**Ce-med-pont**	**Central European-submedit.-pont.-South Sibir.**
Acinos hungaricus (Simonkai) [ilic	**EA**	**Ce-med-pont**	**Herc.-panon.-South sarmat.-medit.-submedit.-pont.**
Ajuga reptans L.	**EA**	**Ce-med**	**Central European-submedit.**
Calamintha sylvatica Bromf.	**EA**	**Ce-m-p-or**	**Sublant.-Central European-submedit.-pont.-orijantal.-turan.**
Clinopodium vulgare L.	**EA**	**Ce-med-pont**	**Eurasian-(subbor-submer)**
Glechoma hederacea L.	**EA**		**Eurasian-(subbor-submer)**
Glechoma hirsuta Waldst. & Kit.	**EA**	**Ce-med-pont**	**Subatl.-ce-medit.-pont.**
Hyssopus officinalis L.	**Med-smed**		
Lamium amplexicaule L.	**Hol**	**Phol-ptrop**	**Eurasian-(temp-smer)-East-Afric.**
Lamium galeobdolon L.	**CE**		**Central European**
Lamium garganicum L.	**EA(M)**	**CSEM**	
Lamium maculatum L.	**EA**	**Ce-med-pont**	**Central European-submedit.-pont.**
Leonurus cardiaca L.	**EA**	**Ce-m-p-or**	**Herc.-sarmat.-submedit.-pont.-South Sibir.-orijental.-turan.**
Lycopus europaeus L.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Marrubium peregrinum L.	**EA**	**Ce-med-pont**	
Melissa officinalis L.	**MSM**		**Medit.-East submed.-orijent.-turan.**
Melittis melissophyllum L.	**CE**		
Mentha aquatica L.	**Hol**	**Phol-ptrop**	**Europ.-(subbor-mer)-East.-Afric.-(borsubtro)-afric-(austr)**

Taxa	Area type	Area group	Flostic element
Mentha longifolia (L.) Hudson	**Hol**	**Phol-ptrop**	**Europ.-West-Asian-(temp-mer)-East-Afric.-(borstro)-afric-(austr)**
Mentha pulegium L.	**EA**		
Micromeria cristata (Hampe) Griseb.	**Med-smed**	**Balk**	**Moesian**
Origanum vulgare L.	**EA**		**Eurasian-(temp-mer)**
Prunella laciniata L.	**EA**	**EA(W)**	**Atlant.-Central-Europ.-medit.-orijental**
Prunella vulgaris L.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Salvia nemorosa L.	**EA**	**Ce-m-p-or**	**Central European-submedit.-pont.-orijent.-turan.**
Salvia sclarea L.	**EA**	**Ce-m-p-or**	
Satureja kitaibelii Wierzb.	**Med-smed**		
Scutellaria columnae All.	**Med-smed**		
Sideritis montana L.	**EA**	**Ce-med**	
Stachys germanica L.	**MSM**	**Med-pont**	**Medit.-submedit.-pont.**
Stachys palustris L.	**Hol**		**Circumcholarkct.-(bor-submer)**
Stachys recta L.	**EA**	**EA(W)**	
Stachys sylvatica L.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Teucrium chamaedrys L.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Teucrium montanum L.	**EA(M)**	**CSEM**	
Teucrium polium L.	**Med-smed**		
Thymus marschalianus Willd.	**EA**	**Ce-med**	
Thymus pulegioides L.	**CE**		**Central European**
Lythraceae			
Lythrum salicaria L.	**Cosm**		**Eurasian disjunct-(subbor-mer)-southeastern Austr. (Austr.)**
Malvaceae			
Alcea rosea L.	**Med-smed**		
Althaea officinalis L.	**EA**		
Oenotheraceae			
Circaea lutetiana L.	**Hol**		**Circumcholarkct.-(bor-merid)**
Epilobium hirsutum L.	**Hol**	**Phol-ptrop**	**Euras.-(subbor-mer)-afric-(borsubtro-austrosubtro)**
Epilobium lanceolatum Sebastiani & Mauri	**EA**	**EA(W)**	
Epilobium montanum L.	**EA**		**Eurasian**
Oenothera biennis L.	**Adv**		
Oleaceae			
Fraxinus ornus L.	**EA**	**Ce-med**	
Ligustrum vulgare L.	**EA**	**Ce-med-pont**	
Syringa vulgaris L.	**EA**	**Ce-med-pont**	
Paeoniaceae			
Paeonia decora G. Anderson	**MSM**	**Med-pont**	
Papaveraceae			
Chelidonium majus L.	**EA**	**EA(W)**	**Amfiatlant.-Central-Europ.-medit.-west-Asian-(bor-merid)**

Taxa	Area type	Area group	Flostic element
Corydalis bulbosa (L.) DC	**EA**	**EA(W)**	**European-West Asian**
Papaver rhoeas L.	**EA**		**European-medit.-submedit.-pont.-South Sibir.-orijental.**
Plantaginaceae			
Plantago lanceolata L.	**EA**		**Eurasian-(subbor-temp)**
Plantago major L.	**Cosm**		**Cosm.-europ.-northamer. origin**
Plantago media L.	**EA**		**Eurasian-(temp-submer)**
Polygonaceae			
Bilderdykia convolvulus (L.) Dumort.	**EA**		**Eurasian-(bor-merid)**
Polygonum hydropiper L.	**EA**		**Eurasian-(temp)**
Portulacaceae			
Portulaca oleracea L.	**Adv**		
Primulaceae			
Anagallis arvensis L.	**Cosm**		**Cosm.- mediter. origin**
Lysimachia nummularia L.	**CE**		**Central European**
Lysimachia punctata L.	**EA**	**Ce-pont**	
Lysimachia vulgaris L.	**EA**		**Eurasian-(temp-submer)**
Ranunculaceae			
Anemone ranunculoides L.	**CE**		**Central European**
Clematis vitalba L.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Helleborus odorus Waldst. & Kit.	**CE**		**Central European (temp-submer)**
Hepatica nobilis Schreber	**CE**		
Isopyrum thalictroides L.	**EA**	**Ce-med-pont**	**Herc.-sarmat.-pan.-medit.-submedit.-pont.-southsib.**
Nigella arvensis L.	**EA**	**Ce-med**	
Ranunculus millefoliatus Vahl	**Med-smed**		
Ranunculus repens L.	**EA**		**Eurasian-(bor-merid)**
Ranunculus serbicus Vis.	**EAM**	**SEM**	**Apen.-balk.**
Ranunculus stevenii Andrz. ex Besser	**MSM**	**Med-pont**	**Pont.-submedit.**
Thalictrum lucidum L.	**CE**		**Central European**
Rosaceae			
Agrimonia eupatoria Ledeb.	**EA**		**Evropsko-mediteransko-pontsko-orijentalno-južnosibirsko-turanski**
Aremonia agrimonioides (L.) DC.	**EAM**	**EA(W)M**	**SEM-south-west-Asian-mont.**
Filipendula hexapetala Gilib.	**EA**		
Fragaria vesca L.	**Cosm**		**Sekundarni kosmop. evroaz. porekla**
Geum urbanum L.	**Hol**		**Europ.-West Asian-North Amer.-(bor-temp)**
Potentilla argentea L.	**CE**		**Central European**
Potentilla cinerea Chaix ex Vill.	**EA**	**Ce-med-pont**	
Potentilla detommasii Ten.	**EAM**	**CSEM**	**Apen.-balk.-anatol.**
Potentilla recta var. sulfuraea Lam.	**EA**	**EA(W)**	
Potentilla reptans L.	**EA**		
Prunus spinosa L.	**EA**	**EA(W)**	
Rubus caesius L.	**EA**		**Eurasian-(temp-submer)**
Sanguisorba minor Scop.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Waldsteinia geoides Willd.	**EA**	**Ce-med-pont**	

Taxa	Area type	Area group	Flostic element
Rubiaceae			
Asperula longiflora Waldst. & Kit.	**Med-smed**	**Alp-balk**	
Asperula purpurea (L.) Ehrend.	**Med-smed**		
Asperula taurina L.	**EA**	**Ce-med**	**South Central Europ.-submedit.**
Galium album Miller	**CE**		**Subatlant.-Central European**
Galium aparine L.	**EA**		**Eurasian-(bor-merid)**
Sherardia arvensis L.	**Cosm**		
Rutaceae			
Dictamnus albus L.	**EA**		
Salicaceae			
Salix fragilis L.	**EA**	**EA(W)**	**Europ.-west-Asian-(temp-submer)**
Salix purpurea L.	**EA**		**Eurasian-(bor-merid)**
Santalaceae			
Comandra elegans Roch.	**Med-smed**		**Southkarp.-balk.**
Saxifragaceae			
Saxifraga rotundifolia L.	**EAM**	**EA(W)M**	**SEM-anatol.-kavk.**
Scrophulariaceae			
Digitalis lanata Ehrh.	**CE**		**Panon.-balk.**
Lathraea squamaria L.	**EA**		
Linaria concolor Gris.	**Med-smed**	**Balk**	**Moesian-macedon.-trac.**
Linaria genistifolia (L.) Miller	**EA**	**Ce-med-pont**	**Central European-Cmed.-pont.-south-sibir.**
Linaria vulgaris Miller	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Melampyrum arvense L.	**EA(W)**		
Odontites rubra Besser	**EA**	**Ce-med**	**Central European-medit.-submedit.**
Verbascum phlomoides L.	**EA**	**Ce-med**	**Central European-medit.-submedit.**
Veronica beccabunga L.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Veronica hederifolia L.	**EA**	**Ce-med-pont**	**Central European-submedit.-pont.**
Veronica polita Fries	**EA**	**EA(W)**	
Veronica serpyllifolia L.	**Cosm**		**Cosm-Eurasian origin**
Solanaceae			
Solanum dulcamara L.	**EA**		**Eur.-medit.-pont.-orijent.-turan.**
Urticaceae			
Parietaria officinalis L.	**EA**	**Ce-med**	**Central European-medit.-submedit.**
Parietaria serbica Pancic	**Med-smed**	**Balk**	**Moesian**
Urtica dioica L.	**Hol**		**Circumcholarkct.-(bor-temp)**
Valerianaceae			
Valeriana officinalis L.	**EA**		**Eurasian-(subbor-temp)**
Valerianella carinata Loisel.	**EA**	**Ce-m-p-or**	
Valerianella turgida (Steven) Betcke	**Med-smed**		
Verbenaceae			
Verbena officinalis L.	**Cosm**		**Cosm-Eurasian origin**

Taxa	Area type	Area group	Flostic element
Violaceae			
Viola canina L.	**Hol**		**Circumcholarkct.-(bor-submer)**
Viola kitaibeliana Schultes	**EA**	**Ce-med**	
Viola silvestris Lam. p.p.	**EA**		
LILIOPSIDA			
Alysmataceae			
Alisma plantago-aquatica L.	**Hol**		**Circumcholarkct.-(bor-submer)**
Araceae			
Arum maculatum L.	**EA**	**Ce-med-pont**	**Ce-submedit.-West pont.**
Cyperaceae			
Carex bueckii Wimmer	**EA**	**EA(W)**	
Scirpus sylvaticus L.	**Adv**		**Eurasian-(bor-temp)**
Dioscoreaceae			
Tamus communis L.	**EA**	**EA(W)**	**Atlant.-Central-Europ..-medit.-submedit.-orijental**
Iridaceae			
Iris pseudoacorus L.	**EA**	**EA(W)**	
Lemnaceae			
Lemna minor L.	**Cosm**		**Cosm.**
Liliaceae			
Allium flavum L.	**MSM**	**Med-pont**	**Medit.-submedit.-pont.**
Allium rotundum L.	**EA**	**Ce-m-p-or**	**Sublant.-Central European-submedit.-orijantal.**
Allium saxatile Bieb.	**MSM**	**Med-pont**	
Asparagus tenuifolius Lam.	**MSM**	**Med-pont**	
Colchicum autumnale L.	**EA**	**Ce-med**	**Atlant.-Central European-medit.**
Erythronium dens-canis L.	**EA**		**Eurasian-(bor-merid)**
Lilium martagon L.	**EA**		**Subatlant.-Central European-submedit.-central Sibir.**
Polygonatum odoratum (Miller) Druce	**EA**		**Eurasian-(bor-submer)**
Orchidaceae			
Cephalanthera damasonium (Miller) Druce	**EA**		
Himantoglossum hircinum (L.) Sprengel	**EA**	**Ce-med**	
Poaceae			
Aegilops triaristata Willd. nom. illegit.	**Med-smed**		
Agrostis alba L.	**Hol**		
Agrostis capillaris L.	**Hol**		**Circumcholarkct.-(bor-merid)**
Alopecurus pratensis L.	**EA**		**Eurasian-disjunct.-(bor-submer)**
Anthoxanthum odoratum L.	**EA**		**Eurasian-disjunct.-(bor-submer)**
Brachypodium sylvaticum (Hudson) Beauv.	**EA**		
Chrysopogon gryllus (L.) Trin.	**MSM**	**Med-pont**	
Dasypirum villosum (L.) Cand.	**Med-smed**		
Dichanthium ischaemum (L.) Roberty	**Cosm**		**Cosm.- mediter. origin**
Echinochloa crus-galli (L.) Beauv.	**Cosm**		
Hordeum leporinum (Linc) Arcangeli)	**Hol**		

Taxa	Area type	Area group	Flostic element
Koeleria macrantha (Ledeb.) Schultes	**Hol**		**Circumcholarkct.-(bor-submer)**
Lolium perenne L.	**EA**		**Eurasian-(bor-merid)**
Melica ciliata L.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Orysopsis virescens (Trin.) G. Beck	**MSM**	**Med-pont-or**	
Poa bulbosa L.	**EA**		**Eur.-medit.-submedit.-pont.-South Sibir.-orijent.-turan.-Central Asian**
Poa nemoralis L.	**Hol**		**Circumcholarkct.-(temp)**
Poa pratensis L.	**Cosm**		
Sesleria rigida Heuffel ex Reichenb.	**EA(M)**	**CSEM**	
Setaria viridis (L.) Beauv.	**EA**		**Eurasian-(temp-mer)**
Stipa capillata L.	**EA**		**Eurasian-(temp-mer)**
Sparganiaceae			
Sparganium erectum L.	**EA**	**EA(W)**	**Europ.-medit.-west-Asian**
Typhaceae			
Typha latifolia L.	**Cosm**		**Cosm.- circumcholarct. origin**
Typha laxmanii Lepechin	**EA**	**EA(W)**	

Table 2. Chorological spectrum of the Mijkovačka gorge flora

Areal type (group)	Species	%
Boreal (Bor)	2	0.60
Eurasian mountane (EAM)		0.00
Central South European mountane (EAM/CSEM)	6	1.81
West Eurasian mountainous (EAM/EA(W)M	2	0.60
South European mountainous (EAM/SEM)	1	0.30
Central European (CE)	16	4.83
Meditteranenan-submeditteranean (Med-smed))	26	7.85
Alpine-Balkan (Med-smed/Alp-balk)	1	0.30
Balkan (Med-smed/Balk)	8	2.42
European-submeditteranean (Med-smed/E smed)	4	1.21
Meridional-Submeridional (MSM)		0.00
Mediterranean-Pontic (MSM/Med-pont)	12	3.63
Meditteranean-Pontic-Oriental (MSM/Med-pont-or)	1	0.30
Meditteranean-Pontic-Oriental-Carpathian (MSM/Med-pont-or-ca)	3	0.91
Eurasian (EA)	72	21.75
European-West Asian (EA/EA (W))	53	16.01
Central European-Mediterranean (EA/Ce-med)	33	9.97
Mediterranean-Pontic (EA/Med-pont)	2	0.60
Central European-Mediterranean-Pontic (EA/Ce-med-pont)	27	8.16
Central European-Mediterranean-Pontian-Oriental-Turanian (EA/Ce-m-p-or)	17	5.14
Central European-Pontian (EA/Ce-pont)	1	0.30
Holarctic (Hol)	18	5.44
Paleoholarctic-paleotropic (Hol/Phol-ptrop)	5	1.51
Adventive (Adv)	4	1.21
Cosmopolitan (Cosm)	17	5.14
TOTAL	331	100.00

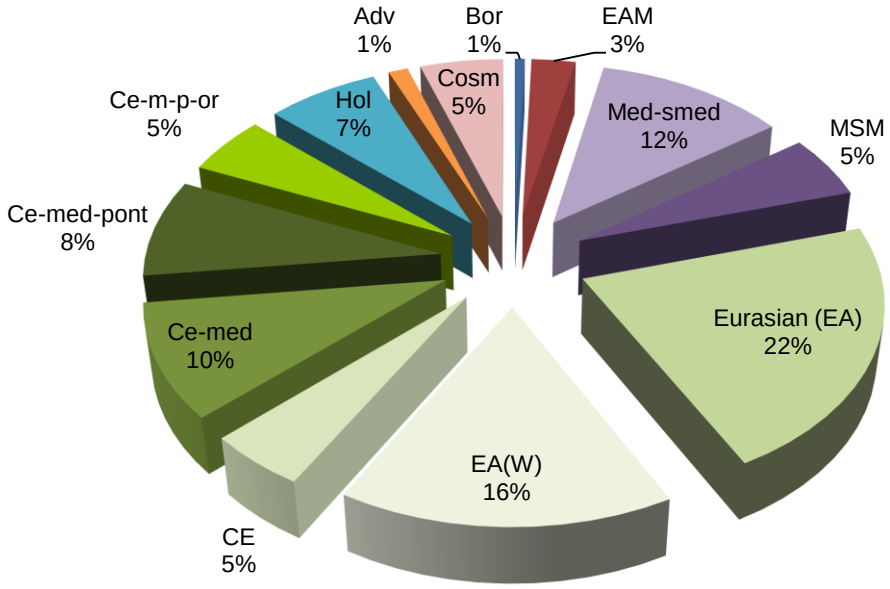

Figure 2. Area spectrum of the flora of the Miljkovacka gorge

Disscusion

For the phytogeographical analysis, all plant taxa were classified into 112 floristic elements, sorted in 15 area groups and 9 areal types (**Tab.2**).

As shown in **Fig.2**, domination of Eurasian area type (EA) with 205 taxa (62%) indicates the accessibility of Miljkovačka gorge for colder influences coming from the northwest through the valley of the South Morava river. From the other side, Svrljiške mountain massif (Kalafat and Kamenički vis) prevent the penetration of warmer effects coming from the Mediterranean by the valleys of Nišava and South Morava rivers. European-West Asian areal group were represented with 53 taxa (16.01%), where 27 taxa belongs to European-Meditteranean-West-Asian floristic elements: *Stellaria holostea*, *Veronica beccabunga*, *Prunella vilgaris*, *Cynanchum vincetoxicum*, *Campanula rapunculoides*, etc.

The high presence of plants which belong to Meditteranenan-submeditteranean area type (Med-smed (12%), or 39 plant taxa) and Meridional-Submeridional area type (MSM (5%), or 16 taxa), can be explained by the ground degradation, presence of limestone that heats easily and more easily colds, and small amount of soil covering. Almost all endemic taxa, *Parietaria serbica*, *Hypericum boissieri*, *Linaria concolor*, *Erysimum comatum*, *Ramonda serbica*, *Acanthus balcanicus*, *Micromeria cristata*, *Cephalaria flava* belong to Med-smed area type, while *Parietaria serbica* and *Micromeria cristata* represent edificatory species of ass. *Micromerio-Pariterietum serbicae* Miljković, M. 2012., and *Ramonda serbica* represents edificatory taxa of ass. *Ceterachi-Ramondietum serbicae* Jovanović, R. 1953 on limestones.

Holarctic area type includes 23 taxa (7%) with 4 boreal- meridional and 4 boreal-submeridional floristic elements, while others have disjunctive distribution area.

Percentage of 5% of species which belong to Central European area type is product of the presence of mesophilous beach forest communities (*Fagetum moesiacae montanum* Blečić et Lakušić 1970. above 700 m,, *Carpinio-Querco-Fagetum mixtum*, prov., located near the stream that flows next to the monastery St. Archangel Gabriel in Popsica) (Đorđević, V. *et al*. 2006).

Low percentage of Eurasian-mountain (3%) and Boreal (0.6%) chorological types point to relatively low altitude of this gorge as well as to weak phytogeographical links with the high mountain region of the Balkan peninsula.

The significant presence in the composition of the Miljkovačka gorge flora has Cosmopolitan (Cosm) area type with many ruderal species: *Plantago major*, *Stellaria media*, *Convolvulus arvensis*, *Verbena officinalis*, etc.

Small number of Adventive area type taxa (4 (1%)) can be explained by the distance of the Miljkovačka gorge valley and the significant migratory routes of adventive flora, which coincides with the nearby road traffic.

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