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Forests with Greek maple (*Acer heldreichii* Orph. ex Boiss.) on Mt. Golija (Serbia)

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SUMMARY. Greek maple (*Acer heldereichii* Orph. ex Boiss.) is an endemorelic species confined to the mountains of the central Balkan Peninsula, where it can be found in various forest communities. Its optimal habitat is in the subalpine zone, where, together with beech, it constitutes the forest community *Aceri heldreichii–Fagetum* Jovanović 1957. In addition, it is a member of diverse mixed broadleaf – coniferous forest communities, mainly predominated by beech and fir, beech, fir and spruce, and spruce, Scots pine and Balkan pine. Rarely, it is also a member of spruce and gray alder communities found along streams and rivers; however, this represents the ecological limits of its distribution and Greek maple can only be found in the shrub layer. Forests containing *A. heldereichii* on Mt. Golija are most developed in refugial habitats between Jankov kamen and Golijska reka, at an altitude from 1400 to 1750 m. A great number of communities are present here, including forests of spruce and grey alder (*Piceo – Alnetum incanae* Jovanović et Gajić 1972), beech – spruce forests (*Aceri heldreichii–Fagetum* Jovanović 1957), subalpine beech forests (*Aceri heldreichii–Fagetum* Janković et Stevanović 1983), beech – spruce forests (*Piceo–Fagetum aceretosum heldreichii* Gajić 1989) and spruce forests (*Aceri heldreichii–Piceetum abietis* Mišić et Panić 1990).

Key words: endemorelic species, forest communities, Golija, Greek maple, Serbia.

INTRODUCTION

Greek maple (*Acer heldreichii* Orph. ex Boiss.) is a Tertiary relic species endemic to the mountains of the Balkan Peninsula, and occurs in Greece, Bulgaria, Serbia, Macedonia, Albania, Montenegro and Bosnia and Herzegovina (Fig. 1). In Serbia, it is distributed from Mt. Rudnik to the Šar Mts. and from Mt. Zvijezda to Mt. Stara planina, with the greatest number of records in southwestern Serbia (Lakušić 1964; Walters 1968; Jovanović 1973; Pavlović et al. 2004; Perović 2007). Usually it grows above the beech and silver fir forest zone between 1000 – 2000 m. In Serbia, the tree is strictly protected by national law (Anonymous 2010).

Golija is the highest mountain in southwestern Serbia (1833 m), and belongs to the interior Dinaric Alps system. Mt. Golija is protected as a Nature Park with a total area of 75183.96 ha and as the Biosphere Reserve "Golija–Studenica" with an area of 53804 ha. The geographical area under study (Golijska reka–Jankov kamen) is strictly protected (level 1 protection regime) in Nature Park Golija as a refugium of *A. heldreichii*.

According to Fukarek (1948), Greek maple was recorded for the first time on Mt. Golija by the famous Serbian botanist Josif Pančić.

The aim of the present study was to obtain an indication of the localities along the transect Golijska reka–Jankov kamen as a refugial center of Greek maple based on phytocoenological relevés sampled in different forest habitats.

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MATERIALS AND METHODS

Phytosociological relevés were sampled according to the Zürich–Montpellier approach (Braun–Blanquet 1964) along the transect Jankov kamen – Golija river from June to October 1997. In order to better evaluate the state, diversity and mutual relationships of the studied plant communities, relevés were taken in stands along forest border habitats with different degrees of prograded/degraded development in forest stadia, rather than within the most representative stands. Nomenclature of vascular plants follows Tutin et al. (1968–1980, 1993).

RESULTS AND DISCUSSION

Forests with Greek maple on Mt. Golija are best developed in the valley of Golija river and from Golija river to Jankov kamen, predominantly on slopes (15–20˚) exposed to the north, northeast and northwest from altitudes between 1400–1750 m.

The geological substrate in these localities consists of different metamorphic rocks, such as fine grained slates and phyllites, as well as various broken metamorphic blocks on the surface. Pedological sustrate is represented by acidic brown soil. In contrast with other areas of Golija, mesoclimate in the studied localities is colder and more humid. This combination of environmental factors makes these localities very suitable for the development of Greek maple in stable forest communities and their prograded/degraded stadia.

The Greek maple was found in all strata with different cover values and was the only species present in the shrub layer in all analyzed groups (Table 1).

Subalpine spruce forests (ass. *Aceri heldreichii–Piceetum abietis* Mišić et Panić 1990) are in the highest forest zone of Golija (1750 m). Greek maple occurs in all layers with cover value up to 20%. It reaches a height of 10 to 12 m (relevé 1).

Scots pine stands are intermingled with previous communities and represent a progradation stadia which is developed after forest fires. Due to this change in habitat, characteristic Greek maple occur here in the shrub layer (relevé 2).

Greek maple display optimum development in mixed decidious coniferous forest zones, where it has numerical superiority, covering an area up to 40%, with individual trees reaching heights of up to 20 m. It occurs in all layers in communities with beech and spruce (ass. *Piceo–Fagetum aceretosum heldreichii* Gajić 1989, relevé 4); and beech, fir and spruce (ass. *Piceo abieti–Fagetum aceretosum heldreichii* Mišić et Panić 1990, relevés 5, 8, 9). In the community *Abieti–Fagetum aceretosum visiani* Stanković–Tomić 1974 (relevés 6, 7), as well as in degraded stadia of mixed broadleaf – coniferous forests (relevés 3, 10), *A. heldreichii* occurs in shrub and canopy layers. Together with beech, common ash and red elderberry, it is the first element of progradation toward forest vegetation.

On more or less significant plateau areas along the Golija river, communities of grey alder with spruce and Greek maple (ass. *Piceo–Alnetum incanae aceretosum heldreichii* prov., relevés 11, 12) have developed.

In the studied localities, communities of Greek maple and subalpine beech *Aceri heldreichii–Fagetum* Janković et Stevanović 1983 were found to cover small areas.

Forests with Greek maple and beech (ass. *Aceri hel-*

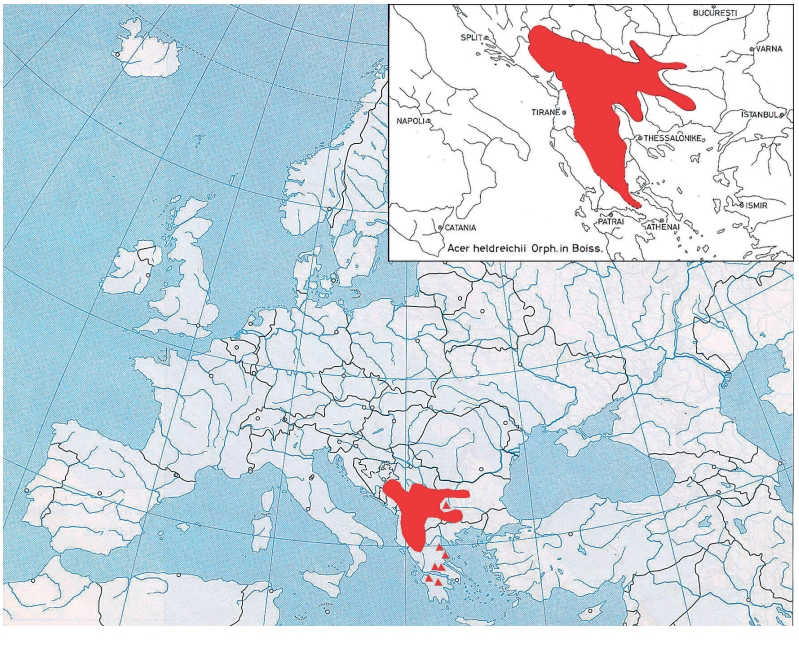

Fig. 1. Areal of the Greek maple (*Acer heldreichii* Orph. ex Boiss.) (modified after Lakušić 1964 and Horvat et al. 1974).

dreichii–Fagetum typicum Mišić et Panić 1990) are characterized with a species poor herbaceous layer and negative differentiation in relation to mixed forests. Greek maple in these forests are found at the lowest altitudes in the whole area (1400–1450 m).

Greek maple can be found in all floristic combinations of mixed deciduous – coniferous forests in the study area; although its ecological optimum is mixed deciduous – coniferous forests, and as a species its optimum is in subalpine beech forests. This fact emphasizes the importance of Golija as refugial habitat, as one of the centers of distribution of Greek maples in the Balkan Peninsula.

During valorization of natural values of Mt. Golija conducted between 1996 and 1997, as can be seen from phytosociological relevés, the greatest quantitative presence and altitude continuity of *A. heldreichii* appears along the transect Golijska reka–Jankov kamen. This indicates that the studyed locality is a distribution center of *A. heldreichii* on Mt. Golija.

Results of this study form the basis for legal protection of Mt. Golija.

Table 1. Forests with Greek maple along the transect Jankov kamen – Golijska reka (relevés location: 1. *Aceri heldreichii–Piceetum abietis* Mišić et Panić 1990; 2. *Pinetum sylvestris* s.l.; 3. contact zone between communities *Aceri heldreichii–Piceetum abietis* Mišić et Panić 1990 and *Piceo abieti–Fagetum aceretosum heldreichii* Mišić et Panić 1990; 4. *Piceo–Fagetum aceretosum heldreichii* Gajić 1989; 5, 8, 9. *Piceo abieti–Fagetum aceretosum heldreichii* Mišić et Panić 1990; 6, 7. *Abieti–Fagetum aceretosum visiani* Stanković–Tomić 1974; 10. contact zone between *Piceo–Fagetum aceretosum heldreichii* Gajić 1989 and *Piceo–Alnetum incanae aceretosum heldreichii* prov.; 11, 12. *Piceo–Alnetum incanae aceretosum heldreichii* prov.).

GOLIJA / Transect Jankov kamen – Golijska reka												
Number of locality	1	2	3	4	5	6	7	8	9	10	11	12
Height above sea level	1700	1670	1630	1600	1500	1500	1500	1550	1620	1420	1420	1420
Exposition	W-NW	W-NW	NW	NW	NW	N-NE	N-NE	N-NE	N	0	0	0
Slope	5	5	10	15	10	15	5	15	10	0	0	0
Geological substrate	phyllites											
Type of soil	acidic brown earth											
Surface (m^2)	1000	500	1000	1000	1000	1000	200	1000	1000	1000	1000	1000
Covering (%)	70	80	90	95	90	95	100	80	90	100	100	100
Height of vegetation (m)	12	15	15 (17)	20	25	25	0,5	35	25	20	7	12 (15)
Floristic composition												
High trees layer												
Picea abies	2.2		2.2	1.1	1.1			1.1	2.2	3.3	1.1	1.1
Acer heldreichii	**1.1**		**+.1**	**1.1**	**2.2**			**1.1**	**2.2**	**1.1**		
Fagus moesiaca			+.1	3.3	2.2	2.2		1.1	1.1	1.1		
Abies alba			+.1		1.1	3.3		3.3	2.2			
Pinus sylvestris	1.1.	4.4.	3.3									
Sorbus aucuparia	1.1		1.1							+.1		
Salix caprea	+.1		1.1									
Alnus incana												5.5
Low trees layer												
Picea abies	+.1		1.1	1.1	1.1				1.1	2.2	+.1	+.1
Acer heldreichii	**+.1**		**+.1**	**+.1**	**1.1**			**+.1**	**1.1**	**+.1**		**+.1**
Fagus moesiaca			+.1	1.1	2.2	1.1		1.1	1.1	+.1		
Abies alba					1.1	1.1		+.1	1.1			
Sorbus aucuparia	+.1		1.1							+.1		
Alnus incana										1.1	4.4	1.1
Pinus sylvestris	+.1		+.1									
Shrub layer												
Acer heldreichii	**+.1**	**+.1**	**1.1**	**+.1**	**1.1**	**1.1**	**+.1**	**1.1**	**1.1**	**+.1**	**+.1**	**+.1**
Sorbus aucuparia	+.1	+.1	+.1	+.1	+.1	+.1	+.1		+.1	+.1		
Picea abies	1.1	1.1	1.1	1.1	+.1				+.1	1.1	+.1	1.1
Fagus moesiaca				+.1	2.2	1.1	+.1	+.1	+.1	+.1		

Daphne mezereum	+.1	+.1		+.1	1.1			+.1				
Ribes petraeum		+.1			+.1					+.1		+.1
Sambucus racemosa				+.1	1.1	+.1	+.1					
Abies alba					1.1	1.1		+.1	+.1			
Lonicera nigra	+.1		+.1							+.1		
Rubus idaeus		1.1			+.1					+.2		
Rubus hirtus						1.2		+.1	+.1			
Alnus incana										2.2	1.2	1.2
Vaccinium myrtillus	+.2									+.2		
Acer pseudoplatanus	+.1											
Salix caprea											+.1	
Herbaceous plants layer												
Stellaria nemorum	1.2	2.2		+.2	1.2	+.1	3.3	2.2		+.2	2.3	3.3
Senecio nemorensis subsp. *fuchsii*	+.1	+.1		+.1		1.1			+.1	+.1	1.1	1.1
Gentiana asclepiadea	1.1	1.1		+.1				+.2	+.1	1.1	+.1	
Dryopteris filix-mas	+.1	+.1			1.1	1.1	1.1		1.1	+.1		
Luzula sylvatica	1.2	+.2	+.1	+.1					+.1	+.2		
Polygonatum verticillatum		+.1	+.1	+.1		+.1	+.1		1.1			
Athyrium filix-femina		+.2				1.1			+.1	1.1	+.1	+.1
Lamiastrum galeobdolon				2.3	1.2	+.2	1.2	2.2	2.2			
Oxalis acetosella				1.2		+.2	+.2	+.2	+.2	1.2		
Ajuga reptans	1.2	1.2							+.1		1.1	+.1
Anemone nemorosa	+.1	+.1				2.3	1.2		2.3			
Galium odoratum				1.2	1.2	1.2	+.2		+.1			
Luzula luzuloides	+.2	+.2	+.2					+.2				
Milium effusum	+.2			+.1					1.1	+.2		
Fragaria vesca		+.1	+.1			+.1					1.1	
Euphorbia amygdaloides				1.1	1.1	1.1			+.1			
Adenostyles alliariae						+.1	4.4	1.1	+.2			
Veratrum album						+.1	+.1	+.1	1.1			
Veronica officinalis	+.2	1.2	1.2									
Geranium sylvaticum	1.1	+.1		+.1								
Campanula patula	+.1	+.1			+.1							
Doronicum austriacum	1.1	+.1					+.1					
Myosotis sylvatica	1.1			2.2	2.2							
Aconitum burnatii subsp. *pentheri*	1.1			+.1	+.1							
Dactylis glomerata	+.2			+.2	+.2							
Silene dioica	1.1				1.1							
Galium rotundifolium		1.2	+.2						1.2			+.1
Dryopteris carthusiana		1.1	+.1							1.2		
Glechoma hirsuta		+.1		+.1	2.3							
Symphytum tuberosum				1.1		+.1			+.1			
Crocus veluchensis						+.1	1.2		1.1			
Paris quadrifolia							1.1	1.1	+.1			
Geranium robertianaum						+.1						
Luzula luzuloides								+.2	+.1	+.2	1.1	+.1

Deschampsia flexuosa	*2.3*	1.3										
Epilobium montanum	+.1				+.1							
Rumex alpinus	+.1											
Carex digitata		1.2	1.2								1.2	
Galeopsis speciosa		+.1										
Prenanthes purpurea			2.2.	+.1							+.1	
Mycelis muralis				+.1	+.1							
Aremonia agrimonoides				+.1					+.1			
Lilium martagon						+.1		+.1				
Cardamine bulbifera						1.1			1.1			
Acer heldreichii						+.1			+.1			
Doronicum columnae						+.1				1.2		
Cicerbita alpina							+.2	+.1				
Asarum europaeum										+.2		+.2
Ranunculus repens											2.2	1.2
Chrysosplenium alternifolium											1.2	2.2
Prunella vulgaris											1.2	1.2
Senecio nemorensis											1.2	1.1
Utrica dioica											1.2	1.1
Geum urbanum											1.1	1.1
Valeriana officinalis	1.2											
Veronica chamaedrys	+.1											
Silene vulgaris		+.1										
Rumex sp.		+.1										
Melica uniflora			1.2									
Solidago virgaurea			1.1									
Hieracium murorum agg.			+.1									
Aegopodium podagraria				+.1								
Veronica montana						1.2						
Corydalis cava						1.1						
Cardamine enneaphyllos						+.1						
Thalictrum aquilegiifolium						+.1						
Fagus moesiaca						+.1						
Cystopteris fragilis						+.1						
Festuca gigantea							+.1					
Ranunculus *platanifolius*							+.1					
Adoxa moschatellina									1.2			
Actaea spicata									+.1			
Abies alba									+.1			
Polytrichum commune										2.3		
Dicranum scoparium										1.3		
Mnium punctatum											1.3	
Filipendula ulmaria											1.2	
Alchemilla vulgaris											+.1	
Cirsium palustre												1.1
Equisetum sylvaticum												1.1
Cardamine sp.												+.1

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