

MOUNTAIN MAPLE (*ACER HELDREICHII ORPH. EX BOISS.*) IN THE FLORA AND VEGETATION OF MOUNTAIN JAHORINA

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Abstract

Jahorina Mountain is located in the central part of Bosnia and Herzegovina. It is a part of the continental Dinaric Mountain massif, where the largest peak is known as Ogorjelica (1916 meters above sea level).

Jahorina Mountain is very rich in maple (*Acer pseudoplatanus*, *Acer pseudoplatanus* f. *argutum*, *Acer pseudoplatanus* f. *serratum*, *Acer heldreichii* subsp. *visianii*, *Acer intermedium*, *Acer platanoides*, *Acer campestre*). Its presence is significant, and that is why the former name of this mountain was "Javorina" ("javor" is the local word for maple).

Jahorina is the northern border of the mountain maple in the Balkan Peninsula. In this area, maple occurs in mixed deciduous forests. For example, *Acer heldreichii* subsp. *visianii* is common within ass. *Abieto-Fagetum illyricum* and *Piceo – Abieto – Fagetum*, whereas *Aceri visianii – Fagetum* B. Jov. 1957 is frequent in forests.

Significant presence of mountain maple caused the separation in two Nature reserves with stricter regime for protection, to the Gold Valley in subalpine and Small Maple in the mountain belt of Jahorina.

Keywords: *Jahorina, Javorina, mountain maple, flora, vegetation, protection.*

Introduction

Jahorina Mountain represents a fascination for nature admirers (mountain climbers, athletes, hunters, tourists,). The oldest existing information about flora researching of Jahorina Mountain dated back to Fial from 1893, 1895; Beck-Mannagetta 1886-1898, 1903-1923; Maly 1938, 1939; Bjelčić 1964-1965. Herbarium collection that was created as a result of these studies is well-preserved and located in Sarajevo at the National Museum of Bosnia and Herzegovina. After the flora researching process, there comes a period where scientists conduct a detailed study of vegetation from different areas of Bosnia and Herzegovina, including Jahorina Mountain as well. One of the first vegetation researchers of Jahorina was Slavnić (1954). Fukarek and Stefanović explored forest vegetation in 1958, and Bjelčić did the same with meadows and pastures situated in front of mountains. Floristic and vegetation data can be seen in the ecosystem study of Ravna planina moorland, Lakušić et al 1981.

Vegetation of this mountain was analyzed in order to know more about mountain maple distribution on Mt. Jahorina (in the territory of Republic of Srpska) which could be an important prerequisite for possible proclamation of the mountain as protected nature area. The main purpose was to establish the presence and state of the population of Balkan endemic species, the mountain maple *Acer heldreichii*, and its groups that are indigenous for Jahorina Mountain. By protecting this area, there will be additional measures for conservation of the mountain maple as well,.

Methods and materials

All available literature sources concerning mountain maple in Bosnia has been examined. After that, detailed field studies had been conducted during 2004, 2005 and 2006. The studies were performed using the method of transect and recording of number of phytocoenological relevés in different habitats (Braun-Blanquet, 1965).

Identification of species was based on floristic literature (Beck, 1903, 1927; Josifovic et al., 1970-1977; Javorka and Csapody, 1979). Nomenclature is adjusted to (I-V) Flora Europaea. Floral elements and life forms of plants are given by Oberdofer (2001). Ecological indices were analyzed by Kojic and associators (1997).

Maple forests of Jahorina Mountain have been examined at sites such as: Javor, Dvoriste and "Zlatna dolina near Stansko vrelo.

These phytocoenological records are presented within synthetic phytocoenological chart and compared with results obtained for this and other areas of Republic of Srpska, Bosnia and Herzegovina and wider.

Results and discussion

Forests with maple on Mount Jahorina can be seen with in the altitude of 1300 – 1600 m, while some individual specimens can grow at even higher altitudes. Mixed broadleaved-deciduous and conifer forests are well present in this zone, and consisted of mainly beech, fir and spruce trees in various quantitative relations. This zone is much wider, compact and with better preserved forests, in contrast to the subalpine beech forests which are degraded, discontinuous and usually turned into subalpine lawn. Degradation of forest vegetation of Jahorina's highest parts started in a distant past, starting from 1600 meters up to the peaks, where such poor vegetation got its geographical name "Gola" ("Naked") Jahorina.

Forest population and mountain maple communities on Jahorina have been considerably reduced, and the most beautiful representatives of the previously mentioned maple trees have been cut down. Because of these reasons, mountain maple is very rarely seen in form of a tall tree, comparing to more common shrub form. One of the main causes why this happens is the constant cutting for the purpose of formation of the ski pists, lifts, ropeways and transmission lines. These destroyed surfaces are still being naturally or artificially maintained in that disastrous state. Other argument is the obvious effect of the previous war (fires) that happened in this region.

Maple forests have been studied in places such as Javor, Dvorište and in the highest forest belt of vegetation called Zlatna Dolina up to Stansko vrelo (Tab. 1). At high altitudes in the range from 1350 to 1600 meters, in northern and northeast exposures and mild slopes up to 15 degrees, geologic surface is mostly consisted of limestone, quartz sandstone and colluvial deposits. The land is basically in different developmental stages of calcareous soils. Forests are scarce and the general coverage spans from 60% to 80%. Vegetation height is not the same everywhere – in reassembled forests it goes up to 30 meters high, and in degraded is about 8 meters, with individual trees of over than 30 m of height. Age of the vegetation is different, probably from 70 to 150 years.

Table 1. Mixed forests with mountain maple (*Acer heldreichii*) on Jahorina

Locality	J A H O R I N A									
	"Bistica" Hotel, 3 kilometers in the direction of Podgraba	"Bistica" Hotel, to Ravla planina	"Zlatna dolina" Stansko vrelo	"Zlatna dolina"	Dvorišta	Mali Javor	Javor	Javor	Javor	
Altitude (m)	1400	1400	1380	1600	1350	1450	1580	1500	1400	
Exposure	N	N-NO	NO	N	N	NO	NO	N	N	
Slope	2-5	5-10	5	15	10	10-15	15-20	15	15-20	
Geological surface	Quartz sandstones	limestone	sandstone and claystone	Poured lime	Sandstone and claystone	limestone	limestone	limestone	limestone	
Soil Type	Acid brown	Brown limestone	Acid brown	humus	Acid brown	Brown limestone	Humus x lime ilimer	Humus x lime ilimer	Humus x lime ilimer.	
Surface of the recordings (m ²)	1 0 0 0									
General coverage (%)	60	80	80	60	70	80	70	60	70	
Height of vegetation (m) max	34 7	25	35	30	25 20	25	30	25	25	
Pectoral diameter (cm)	50 15	50 10	80 15	70 10	70	50	50	40 20	40	
Age of vegetation (years)	70	80	150	100	80	70	80	70	70	
Date	12.08.	12.08. 2 0 0 4	10.10.	19.06.	20.06.	20.06. 2 0 0 5	15.09.	15.09.	15.09.	
Number of localities	1	2	3	4	5	6	7	8	9	
FLORISTIC COMPOSITION										
I Level of high trees										
<i>Abies alba</i>	2.2	4.4	1.1	1.1	2.2	2.2	1.1	2.2	1.1	
<i>Picea abies</i>	3.3	2.2	1.1	.	2.2	1.2	3.3	1.1	2.2	
<i>Fagus sylvatica</i>	1.1	1.1	1.1	3.3	+1	2.2	.	1.1	2.2	
<i>Acer heldreichii</i>	+1	+1	1.1	+1	.	.	1.1	.	.	
<i>Acer pseudoplatanus</i>	.	.	1.1	.	+1	.	+1	.	.	
<i>Sorbus aucuparia</i>	.	.	.	.	.	.	+1	+1	.
<i>Fraxinus excelsior</i>	.	+1	.	.	.	.	.	.	.
II Level of low trees										
<i>Abies alba</i>	1.1	1.1	1.1	+1	2.2	1.1	1.1	+1	+1	
<i>Picea abies</i>	1.1	+1	1.1	+1	1.1	1.1	1.1	+1	+1	
<i>Fagus sylvatica</i>	+1	1.1	3.3	.	+1	1.1	+1	+1	+1	
<i>Acer heldreichii</i>	.	.	1.1	+1	.	.	+1	.	.	
<i>Acer pseudoplatanus</i>	.	.	.	+1	+1	.	+1	.	.	
<i>Sorbus aucuparia</i>	.	.	.	.	+1	.	+1	.	.
III Level of shrubs										
<i>Abies alba</i>	+1	+1	2.2	+1	1.1	+1	1.1	1.1	1.1	
<i>Picea abies</i>	+1	+1	2.2	+1	1.1	+1	+1	1.1	1.1	
<i>Fagus sylvatica</i>	+1	+1	1.1	3.3	2.2	+1	2.2	+1	1.2	
<i>Acer heldreichii</i>	+1	+1	.	+1	+1	.	1.1	+1	+1	
<i>Sorbus aucuparia</i>	+1	+1	.	.	+1	.	+1	+1	+1	

<i>Rubus idaeus</i>	+1	.	+1	.	.	.	2.2	+1	+2
<i>Acer pseudoplatanus</i>	+1	.	.	.	+1	.	+1	.	+1
<i>Vaccinium myrtillus</i>	.	.	.	.	2.3	.	+1	1.2	+3
<i>Rosa pendulina</i>	+1	.	.	.	.	.	+1	.	.
<i>Lonicera xylosteum</i>	+1	.	.	.	.	.	.	.	+1
<i>Rubus hirtus</i>	+1	.	.	.	.	.	.	.	+1
<i>Ulmus glabra</i>	.	+1	1.1	.	.	.	.	.	.
<i>Daphne mezereum</i>	.	.	.	.	+1	.	+1	.	.
<i>Rosa pendulina</i>	.	.	+1	.	.	.	.	.	.
<i>Sambucus racemosa</i>	.	.	.	+1	.	.	.	.	.
<i>Lonicera nigra</i>	.	.	.	.	.	.	+1	.	.
<i>Lonicera alpigena</i>	.	.	.	.	.	.	+1	.	.
IV Level of herbaceous plants									
<i>Oxalis acetosella</i>	1.2	+1	1.2	+2	+2	.	1.2	1.2	1.2
<i>Fragaria vesca</i>	+1	+1	+1	.	+1	+1	1.1	+1	1.1
<i>Galium odoratum</i>	.	2.2	1.1	1.1	+1	1.1	1.1	1.1	+1
<i>Athyrium filix-femina</i>	1.1	+1	1.1	+1	+1	+1	.	+1	.
<i>Viola reichenbachiana</i>	1.1	1.1	+1	+1	+1	+1	.	.	+1
<i>Aremonia agrimonoides</i>	1.1	+1	+1	.	+1	+1	+1	+1	.
<i>Gentiana asclepiadea</i>	1.1	.	+1	.	+1	+1	+1	1.1	1.1
<i>Asarum europaeum</i>	.	+2	.	+1	+1	+1	+2	1.1	+2
<i>Symphytum tuberosum</i>	+1	+1	.	+1	1.1	+1	.	+1	.
<i>Ajuga reptans</i>	+1	1.1	.	.	+1	+1	1.1	.	+1
<i>Prenanthes purpurea</i>	+1	.	+1	+1	.	+1	+1	+1	.
<i>Euphorbia amygdaloides</i>	.	+1	+1	.	1.1	.	+1	+1	1.1
<i>Lamium galeobdolon</i>	.	.	.	1.2	1.1	+2	1.2	1.2	1.2
<i>Acer pseudoplatanus</i>	+1	+1	.	+1	+1	+1	.	.	.
<i>Abies alba</i>	+1	+1	.	.	+1	+1	+1	.	.
<i>Dryopteris filix - mas</i>	.	.	1.1	1.1	1.1	+1	1.1	.	.
<i>Adenostyles alliariae</i>	.	.	1.1	+1	.	+1	+1	.	+1
<i>Hypnum cupressiformae</i>	2.3	1.3	1.3	.	.	1.3	.	.	.
<i>Mycelis muralis</i>	+1	+1	.	+1	.	+1	.	.	.
<i>Carex sylvatica</i>	1.1	+1	.	.	.	+2	.	.	+2
<i>Doronicum austriacum</i>	+1	.	+1	.	.	+1	+1	.	.
<i>Polygonatum verticillatum</i>	1.1	.	.	+1	+1	.	+1	.	.
<i>Dactylorhiza maculata</i>	+1	.	.	.	+1	+1	+1	.	.
<i>Saxifraga rotundifolia</i>	.	.	.	+1	.	+1	+1	+2	.
<i>Hieracium murorum</i>	1.1	.	+1	.	+1	.	.	.	.
<i>Euphorbia carniolica</i>	+1	.	.	+1	+1	.	.	.	.
<i>Anemone nemorosa</i>	+1	.	.	.	1.1	1.1	.	.	.
<i>Luzula sylvatica</i>	1.2	.	.	.	.	.	1.2	2.2	.
<i>Picea abies</i>	.	+1	.	.	+1	.	+1	.	.
<i>Acer heldreichii</i>	.	+1	.	+1	.	+1	.	.	.
<i>Sorbus aucuparia</i>	.	+1	.	.	.	+1	+1	.	.
<i>Hordelymus europaeus</i>	.	+1	.	.	.	.	.	+1	3.3
<i>Veronica urticifolia</i>	.	.	1.1	+1	.	.	.	1.1	.
<i>Sanicula europaea</i>	.	.	2.2	.	+1	.	.	.	+1
<i>Thalictrum aquilegifolium</i>	.	.	.	+1	.	+1	.	+1	.
<i>Rosa pendulina</i>	.	.	.	+1	.	.	+1	+1	.
<i>Pulmonaria officinalis</i>	.	.	.	+1	.	.	1.2	.	+1
<i>Aegopodium podagraria</i>	.	.	.	.	+1	.	+1	.	+1
<i>Aposeris foetida</i>	2.2	.	+1	.	.	.	.	.	.
<i>Myosotis sylvatica</i>	+1	.	.	.	1.1	.	.	.	.
<i>Melampyrum hoermannianum</i>	1.2	.	.	.	1.1	.	.	.	.
<i>Hypericum tetrapterum</i>	+1	.	.	.	+1	.	.	.	.
<i>Hylocomium loreum</i>	1.3	.	.	.	1.3	.	.	.	.
<i>Epilobium montanum</i>	+1	.	.	.	.	+1	.	.	.
<i>Fagus sylvatica</i>	+1	.	.	.	.	+1	.	.	.
<i>Actaea spicata</i>	.	+1	.	2.1	+	+	+	+	+

<i>Luzula pilosa</i>	.	1.2	.	.	+1	.	.	.	.
<i>Cardamine waldsteinii</i>	.	.	+1	.	1.1	.	.	.	.
<i>Cardamine enneaphyllos</i>	.	.	.	+1	.	1.1	.	.	.
<i>Polystichum aculeatum</i>	.	.	.	1.1	.	+1	.	.	.
<i>Milium effusum</i>	.	.	.	+1	.	.	+1	.	.
<i>Geranium robertianum</i>	.	.	.	1.1	.	.	.	.	+1
<i>Veratrum album</i>	.	.	.	.	+1	+1	.	.	.
<i>Phegopteris robertianum</i>	.	.	.	.	+1	.	.	+1	.
<i>Lilium martagon</i>	.	.	.	.	.	+1	.	+1	.
<i>Caltha palustris</i>	3.3	.	.	.	.	.	.	.	.
<i>Carex brizoides</i>	1.3	.	.	.	.	.	.	.	.
<i>Dicranum scoparium</i>	1.3	.	.	.	.	.	.	.	.
<i>Thuidium tamariscinum</i>	1.3	.	.	.	.	.	.	.	.
<i>Equisetum sylvaticum</i>	1.1	.	.	.	.	.	.	.	.
<i>Melica nutans</i>	+2	.	.	.	.	.	.	.	.
<i>Allium ursinum</i>	+2	.	.	.	.	.	.	.	.
<i>Deschampsia cespitosa</i>	+2	.	.	.	.	.	.	.	.
<i>Melica uniflora</i>	.	1.2	.	.	.	.	.	.	.
<i>Mercurialis perennis</i>	.	.	.	1.1	.	.	.	.	.
<i>Chrysosplenium alternifolium</i>	.	.	.	.	+2	.	.	.	.
<i>Polytrichum commune</i>	.	.	.	.	+2	.	.	.	.
<i>Festuca drymeja</i>	.	.	.	.	.	.	.	3.3	.
<i>Laserpitium marginatum</i>	.	.	.	.	.	.	.	1.1	.
<i>Rubus hirtus</i>	.	.	.	.	.	.	.	.	+2

In the first of 1-8, with a value of +1, represented the following species:

- 1: *Prunella vulgaris*, *Tussilago farfara*, *Filipendula ulmaria*, *Ranunculus platanifolius*, *Geranium sylvaticum*, *Veronica officinalis*, *Senecio subalpinus*, *Astrantia major*
- 2: *Lathyrus venetus*, *Galeopsis speciosa*, *Moehringia trinervia* i *Epipactis helleborine*
3. *Salvia glutinosa*, *Potentilla micrantha* i *Cardamine bulbifera*
- 4: *Lunaria rediviva*, *Urtica dioica*, *Scrophularia nodosa*, *Rubus idaeus*
- 5: *Viola biflora*, *Usnea barbata*, *Cladonia rangiferina*
- 6: *Cicerbita pancicii*, *Paris quadrifolia*:
- 7: *Aconitum* sp.
- 8: *Phyteuma spicatum*, *Senecio nemorensis* subsp. *fuchsii*

The floristic composition of these forests consists of 107 species. Levels of high and low trees are made of seven species, but only beech, fir and spruce are in all levels, with considerable number and coverage. The level of shrubs creates 17 species, including the ones from the group of low trees. In the group of herbaceous plants, there has been a recording of 89 species, where nine are seedling of woody plants. Not even one species is seen in these stands. The most often species are: *Oxalis acetosella*, *Fragaria vesca*, *Galium odoratum*, *Aremonia agrimonoides*, *Viola reichenbachiana*, *Athyrium filix-femina*, *Asarum europaeum*, *Gentiana asclepiadea*, *Ajuga reptans*, *Symphytum tuberosum*, *Lamium galeobdolon*. Some of them are significantly placed in individual stands: *Caltha palustris*, *Aposeris foetida*, *Sanicula europaea*, *Festuca drymeja* and *Hordelymus europaeus* and they induce environmental conditions in them. Great diversity of different stands can be seen; which is also an indicator that a number of species (41) is only in one recording each. Mountain maple is relatively little represented in these forests (from +1 to 1.1). There are 5 stands concluded out of 9 analyzed; but only in level of shrubs in four stands and in level of herbaceous plants in one stand.

Analysis of the biological spectrum of the association completes the picture of the environmental conditions and the character of the habitat. Biological spectrum builds 5 groups of life forms. According to biological spectrum the highest percentage is with

hemikryptophytes with 60% of all species but with small covering values. On the second place by percentage of the forms are phanerophytes with 16.85% of the species. but that make the greatest cover values. In building of biological spectrum there is a slight percentage of geophytes (15.78%), chamaephyta (5.26) and therophyte (2.11%).

Based on the analysis of areal spectra the presence of 10 groups of floral elements is revealed. The most significant percentage of the types have pre-Alps (22.34%), boreal (21.27) and sub-Atlantic (18.08%) and Eurasian (15.96%) group of floral elements. The presence of these species from the group of floral elements is in accordance with the environmental conditions in which this type of vegetation develops. Low percentage of participation in the construction of areal spectra is reached by moderate continental, sub-Mediterranean, endemic, European and adventitious group of floral elements.

More complete picture of the ecological habitat specificities is obtained by the analysis of environmental indices for basic environmental factors (soil moisture, soil acidity, mineral content in the soil, light and temperature conditions. According to soil moisture community is mesophilic, because the typical mesophytes accounted for 78.82% of total number of species. In accordance with the requirements for soil acidity community is neutrophilic because these species are 62.35% of all the species, and the transitional group between the neutrophil and basophil makes 28.23% of the species. In relation to the amount of nitrogen in the soil it is dominated by mesotrophic plant species with 58.82% of all the species. Most types of community building belong to the transitional group between sciophytes and semi-sciophytes with 45.88% and semi-sciophytes with 38.83% of total number of species, semi-sciophytes and heliophytes (S₄). Mesothermic types participate in community building with 67.05%, while the transitional group between frigorophilic and mesothermic plants is ranged with 25.88% of species.

Flora of Jahorina Mountain consists of 1.159 taxa including es endemic species of Balkan Peninsula-the mountain maple (*Acer heldreichii* Orph. ex Boiss.). It belongs to the central-Balkan floral element. This species was for the first time recorded for Balkans by Fiala in Klek village in 1895. Karlo Maly later established that this mountain maple is more frequent on Mount Jahorina. He described a subgroup *A. h.* subsp. *visiani*, which is distributed in Bosnia and Herzegovina and Serbia.

Beech-maple forest *Acer heldreichii* subsp. *visianii* forms more families in illyrian-moesian area, which is populated with limestone, smaller silicates, and in subalpine belt it creates colluvial drift with even deeper luvic land. They are situated in cooler humic habitats mostly around 1 300 – 1 600 meters above sea level, places where snow stays longer.

Many beech and forest maple plant associations have been described as: *Aceri heldreichii* - *Fagetum* B. Jov. 1957 (Serbia); *Aceri visiani* – *Fagetum* Fuk. et Stef. 1958 (Bosnia and Herzegovina); *Fago - Aceretum visianii* Bleč. et Lkšć. 1970 (Montenegro); *Aceri heldreichii* – *Fagetum subalpinum* Jank. et Stev. 1983. (Kosovo); *Fagetum subalpinum inferiorum* (= *Fagetum altimontanum*); Mišić and Popović 1954 (Kopaonik), and also on Mount Golija, around the river area we have *Aceri heldreichii* – *Fagetum montanum* Jov., and *Aceri heldreichii* – *Picetum abietis*. They are all rounded up into a widely understood family by the name of *Aceri heldreichii* – *Fagetum* B. Jov. 1957 (Jovanović, 1986). Kovičljka Stanković Tomić marked beech-fir forests in Mokra Gora (which grow around 1 200 – 1 500 meters above sea level) as *Abieto - Fagetum aceretosum visianii* in the year of 1974.

In the area of Mountain Jahorina there is a presence of sub-alpine forests of beech and maple (*Aceri-Fagetum subalpinum*). This community on Jahorina occupies less area because sub-alpine belt is significantly degraded. In sub-alpine forests of spruce (*Piceetum subalpinum*) mountain maple (*Acer heldreichii* subsp. *visianii*) is present individually. Below this belt there are mixed forests of beech, fir, spruce (*Piceo-Abieti-Fagetum*) where Greek

maple trees are encountered with small degree of presence and small covering value. In the mixed forests of the study area Greek or mountain maple has optimum.

In Serbia, this type builds woods, almost always with sub-alpine beech (*Aceri heldreichii -Fagetum*). On Mountain Rudnik in Serbia, Greece maple occupies the extreme northern point of distribution in the world. Perovic and Cvjeticanin (2009) describe the community of mountain maple with beech and hornbeam (*Acer heldreichii-Fagetum* subass. *carpinetosum betuli*) which represents a new sub-association within the community *Aceri heldreichii-Fagetum*.

Conclusion

In the flora of Jahorina there is an endemic Balkan species called forest maple (*Acer heldreichii* Orph. ex Boiss. subsp. *visianii* K. Maly), located on northwestern border of this area.

The forest maple occurs within broadleaved-deciduous and coniferous forests (ass. *Piceo - Abieto - Fagetum*). Comparing to the dominant species, beech, fir and spruce, it is less abundant and distributed at many sites of studied area. Subalpine forests of beech and forest maple are not that widespread on Mount Jahorina because the subalpine belt is degraded and turned into mountain lawns.

Community where there is a mountain maple has phanerophytic- hemikryptohpytic character. In relation to humidity community it is very mesophilic, in relation to soil acidity it is neutrophilic, in relation to nitrogen it is mesotrophic, in relation to light it is sciophytic to semi-sciophytic, and in relation to the temperature it is frigorific to mesothermic. Areal spectra is dominated by sub-mountain, boreal and sub-Atlantic group of floral elements.

Forests of Mount Jahorina are considerably depleted, and the most beautiful populations of mountain maple are being cut down. Mountain maple is rarely seen as a tree, and more common form was the shrub.

Preservation of Jahorina Mountain area will allow continuous survival of forest vegetation and with it also survival and regeneration of forest maple.

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