SHORT COMMUNICATIONS

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PHOTOSYNTHETIC ACTIVITY OF *FAGUS SYLVATICA* L. AND *QUERCUS PETRAEA* (MATT.) LIEBL. IN A MIXED STAND AT MALJEN MOUNTAIN.

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Estimation of the photosynthetic performance of co-existing tree species with pronounced differences in ecophysiological context (A r a n d a *et al.* 1996; L e u s c h n e r *et al.* 2001) could provide insight into their vitality and competitive abilities at a particular site. Gas exchange, composition of photosynthetic pigments, and the water status of beech (*Fagus sylvatica* L.) and sessile oak (*Quercus petraea* (Matt.) Liebl.) were studied in the present work. The investigation was performed on Mt. Maljen (Western Serbia, near the town of Mionica) at an altitude of 950 m, in an ecotope within the confines of the mountain's beech forest belt. Co-dominant samplings [three of each species, 30-years old (n=6), 10-12 m high] were selected for the measurements, which were conducted on fully developed leaves from the outermost branches and from the innermost canopy. Photosynthetic measurements were performed using an LI-6200 closed photosynthesis system (LI-Cor. Inc, Lincoln, NE, USA), while irradiance was detected with a selenium cell mounted on the leaf chamber. Parameters of gas exchange are expressed on the basis of leaf area, using the AREAMETER software (K a r a d ž i ć *et al.* 1999). Chlorophyll content was spectrophotometrically determined, based on light absorption of the solution obtained after extraction with DMSO (H i s c o x and I s r a e l s t a m , 1979). The mid-day water saturation deficit was determined according to T u r n e r (1981). For data analysis, we used the Statistica for Windows program package. The ANOVA one-way breakdown was applied to compare differences within (leaves inside *vs*. leaves outside the surface of the tree canopy) and between species for all investigated parameters at the 0.05 level of significance.

Net photosynthesis and the chlorophyll a/b ratio had similar values in the innermost and outermost leaves of beech, whereas sessile oak showed significant differences at the intra-species level with respect to all investigated parameters. Photosynthetic activity, expressed as the maximum CO_2 assimilation rate, was greater in sunny leaves of sessile oak throughout most of the growing season. This significant difference in A_{max} between outermost leaves of the investigated species began simultaneously with an increase of drought conditions. More shaded leaves from the innermost canopies of both species, showed a similar photosynthetic capacity, even though their water saturation deficit was different. Leaf chlorophyll content was significantly differ-

Table 1. Inter- and intraspecific outside/inside leaf photosynthetic parameters and water status of *Q. petraea* and *F. sylvatica* leaves. (Mean values ± SD, *n*=12): maximal CO_2 assimilation A_{max}, total chlorophyll content in leaves Chl_{tot}, chlorophyll *a* to *b* ratio Chl a/b, leaf water saturation deficit WSD. The letter (o) is for leaves outside the canopy, while (i) is for leaves inside the canopy. Significant differences (α=0.05) between outside and inside leaves for each species are marked with *. Different letters symbolize significant differences between analyzed species (capital letters for outside leaves, and small letters for inside leaves).

	spring				summer				autumn			
A_{max} (μmol m^{-2} s^{-1})												
Q.petraea (o)	13.40±1.84	*	A		18.55±2.05	*	A		16.55±2.56	*	A	
Q.petraea (i)	11.58±1.46			a	11.26±1.92			a	11.86±1.66			a
F.sylvatica (o)	12.77±1.57	ns	A		15.67±1.63	*	B		14.87±1.82	ns	B	
F.sylvatica (i)	10.64±1.77			a	12.69±1.96			a	12.89±1.86			a
Chl_{tot} (mg g^{-1})												
Q.petraea (o)	11.91±1.02	*	A		13.32±1.65	*	A		12.08±1.33	*	A	
Q.petraea (i)	6.04±0.69			a	6.01±0.70			a	5.99±0.65			a
F.sylvatica (o)	12.32±1.40	*	B		11.88±1.34	*	B		10.36±1.14	*	B	
F.sylvatica (i)	8.40±0.71			b	6.68±0.69			a	5.41±0.38			a
Chl a/b												
Q.petraea (o)	2.66±0.24	*	A		2.38±0.26	*	A		2.35±0.22	*	A	
Q.petraea (i)	1.93±0.19			a	2.03±0.20			a	1.97±0.20			a
F.sylvatica (o)	2.51±0.26	*	A		2.31±0.28	ns	A		2.29±0.28	ns	A	
F.sylvatica (i)	2.27±0.22			b	2.22±0.19			b	2.19±0.20			b
WSD (%)												
Q.petraea (o)	13.23±1.40	*	A		17.68±1.88	*	A		15.37±1.75	*	A	
Q.petraea (i)	12.19±1.06			a	14.10±1.50			a	11.75±1.63			a
F.sylvatica (o)	12.14±1.33	*	A		14.01±1.09	*	B		13.14±1.28	*	B	
F.sylvatica (i)	9.41±0.84			b	12.19±1.01			b	10.41±1.15			b

ent throughout the whole season in outermost leaves, but not in innermost leaves of the investigated species after complete development of the tree canopies. However, pigment composition (which usually reflects the shade acclimatization of leaves), was significantly different (greater volues of the Chl a/b ratio) only in innermost leaves. These differences resulted from the specific canopy structure and leaf orientation, which allow beech to withstand deeper shade than sessile oak.

Photosynthetic activity of beech and sessile oak depends on their capacity for rapid capture of limiting resources in forest ecosystems (i.e., water and light). Since the light-saturated net photosynthesis of both species generally was not limited by drought influence at our study site, and the light interception of leaves changed simultaneously for both species, their species-specific capacities for photosynthesis appear to be the main cause of the observed differences. Ecological requirements of the analyzed species are clearly defined in numerous literature sources (*e.g.*, Epron and Dreyer, 1993; Gratani and Foti, 1998; Corcuera *et al.* 2002; Raftoyannis and Radoglou, 2002), and the same is true of plant communities in which they participate (Kojić *et al.* 1998). Although both species are Middle European floral elements, beech tolerates deep shade tolerant and is a late-successional species adapted to humid maritime and temperate climates. It inhabits highland regions of central Europe at altitudes 600 to 2,100 m, forming monodominant beech forests, mixed deciduous and coniferous forests with mostly sciophyllous taxa, and also forests with more light-demanding oak species. Sessile oak is also adapted to the temperate climate of lowlands and hilly regions with uniform temperature, various shade conditions, and moderate humidity (being somewhat drought-tolerant). At the given study site can ecotope where the investigated species co-exist successfully, *Quercus petraea* maintains a relatively high rate of photosynthesis throghout the whole vegetation season, whereas *Fagus sylvatica* compensates for its lower photosynthetic capacity with similar efficiency of sun and shaded leaves and their appropriate pigment composition.

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