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MORPHOMETRIC AND PHYSIOLOGICAL ANALYSIS OF FAGUS SYLVATICA AND CARPINUS BETULUS LEAVES

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Abstract: *This purpose of this study was to assess some morphometric and physiological indices of two woody plant species, European beech (Fagus sylvatica L.) and common hornbeam (Carpinus betulus L.), to describe plant behavior in different forest zones, at different altitudes and light intensities. The samples were collected from a beech forest located in western part of Romania, at an average altitude of 230 a.s.l., in October 2020. Leaves that were intact and healthy were selected. These were scanned and then taken into plant physiology lab for dry weight determination. The analyzed indices were leaves lengths, perimeters and areas with a specific software. Dry weight of each sample was determined using an analytical balance, after the completion of drying process in an oven, at 100 ˚C. After this, specific leaf weight (SLW) was obtained. Regarding the results, in general, beech leaves were longer and with a higher perimeter than common hornbeam ones. The highest values of this indices were obtained for beech samples collected from the forest. Leaf area was higher for beech leaves, when compared with hornbeam leaves. Between gravimetric indices tested in this study, dry weight behavior was similarly with leaf areas one. Leaf area and dry weight of a sample are related with photosynthetic efficiency and plant investments can be noticed through leaves analysis. Also, variations in specific leaf weight values were observed. This index had the lowest mean values for the samples taken from trees located inside the forest. This can be due to a lower light level in that site. Higher values were obtained for the rest of the samples. In general, hornbeam leaves presented a higher specific leaf weight when compared with beech leaves, and the highest value was obtained for the samples taken from trees that grow at the forest edge where light intensity is higher than inside the forest.*

• Introduction

The European beech (*Fagus sylvatica* L.) is a deciduous tree that reaches 30-40 m and it can attain heights up to 50 m in some places. Beech is widely distributed in Central and Western Europe. In the northern part of its range beech grows at low elevations while in the southern part it is found at altitudes above 1000 m a.s.l.

The common hornbeam (*Carpinus betulus* L.) is a small to medium sized deciduous tree, normally reaching heights of 20-25 meters. The hornbeam has a large range of distribution and covers Central Europe, up to southern England, southern Europe (excluding the Iberian Peninsula), and the south part of Sweden. Eastwards it can be found across the Black Sea reaching the Caucasus and northern Iran.

Materials and methods

The analyzed species were European beech, *Fagus sylvatica* (Fagaceae) and common hornbeam - *Carpinus betulus* (Betulaceae). The leaves were harvested from a beech forest, from a medium altitude of 230 m.

Beech and common hornbeam leaves were collected in October 2020. All the samples were intact, with some senescence features.

Sample 1, conventionally noted BLF (beech leaves - forest) consisted of beech leaves, collected from the forest (240 m altitude).

Sample 2 consisted of hornbeam leaves (HLNR – hornbeam leaves near road), collected from a clear cut forest patch near a forest road (239 m altitude).

Sample 3 consisted of beech leaves (BLNR – beech leaves near road), collected from a clear cut forest patch near a forest road (239 m altitude).

Sample 4 consisted of hornbeam leaves (HLFE – hornbeam leaves from forest edge) collected from a forest edge (218 m altitude).

The samples were analyzed with Digimizer software, length (LL – leaf length), perimeter (LP – leaf perimeter) and area (LA – leaf area) being obtained. After this, the samples were placed in an oven (Sauter model) for 6 hours, at 100 ˚C, dry weight (DW) being obtained. Specific leaf weight (SLW) (g m^{-2}) was calculated by dividing dry weight values to leaf area.

Statistical analysis was performed using PAST software v3 (HAMMER et al., 2001). Correlations between indices were performed.

• Aknowledgment

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• Selective references:

APOLO-APOLO O.E., PÉREZ-RUIZ M., MARTÍNEZ-GUANTER J., EGEA G. 2020. A Mixed Data-Based Deep Neural Network to Estimate Leaf Area Index in Wheat Breeding Trials. Agronomy 10: 175.

JOHNSON O., MORE D. 2006. Collins tree guide. HarperCollins Publishers; UK ed. 464 p.

VON WUEHLISCH G. 2008. EUFORGEN Technical Guidelines for genetic conservation and use for European beech (Fagus sylvatica). Bioversity International, Rome, Italy. 6.

• Results and discussions

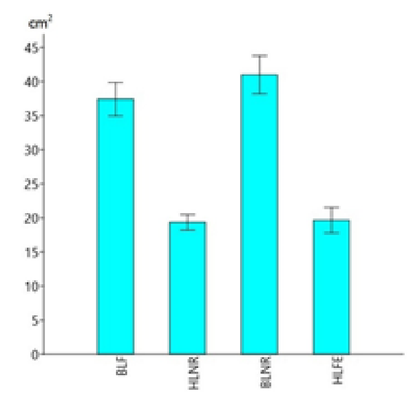

Figure 1. Mean values of LA for the analyzed samples

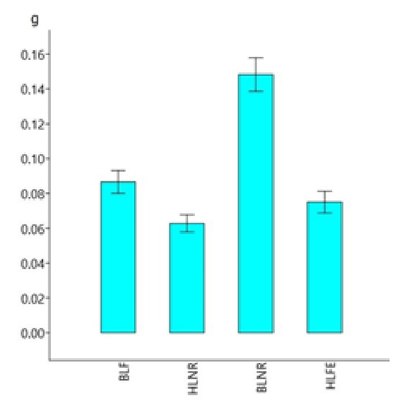

Figure 2. Mean values of DW for the analyzed samples

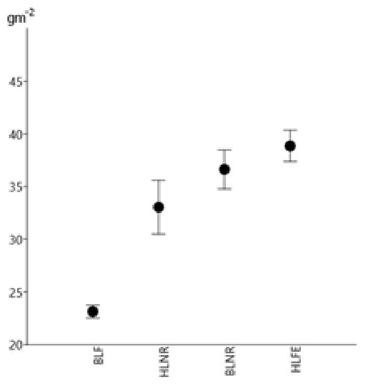

Figure 3. Mean values of SLW (g m^{-2}) for the analyzed samples

Table 1
LL and LP min, max and mean values for all studied samples

Sample		LL (cm)	LP (cm)	Correlation coefficient
BLF	Min	8.8020	23.6550	0.909
	Max	11.4570	37.2710	
	Mean	10.2279	28.9129	
HLNR	Min	6.3400	19.8090	0.651
	Max	8.2690	27.6160	
	Mean	7.3839	23.5391	
BLNR	Min	8.5430	23.8110	0.947
	Max	11.0230	31.6910	
	Mean	10.1011	28.2657	
HLFE	Min	6.3950	19.2700	0.930
	Max	10.0200	32.1750	
	Mean	7.9230	25.3778	

• Conclusions

- This study aimed to assess the **morphometric** and **photosynthetic indices** of two woody plant species, European beech and common hornbeam, and to **describe plant behavior in different forest zones**, at different altitudes and light intensity. The analyzed indices were leaves **lengths, perimeters, areas, dry weight and specific leaf weights**.
- **High positive correlations** were obtained between the first two indices. Generally, the first four indices had bigger values at beech samples. SLW presented variations between the samples, the samples from sunny areas having the highest values. Further research will focus on the interdependence between morphometric and other gravimetric or physiological indices, because light or shade, different altitudes and sites modify numerous traits in leaves, and in trees.