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Spatial patterns of leaf shape variation in provenances of European beech (*Fagus sylvatica* L.). Scientific work of category M21

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Spatial and environmental patterns of European beech (*Fagus sylvatica* L.) leaf size and shape variations were studied using landmark-based geometric morphometrics. The study involved eight provenances originating from three biogeographic regions (i.e., Alpine, Continental, and Pannonian), spanning across six European countries (Bosnia and Herzegovina, Croatia, Germany, Hungary, Romania and Serbia). All specimens were cultivated in a common garden experiment. The symmetric component of leaf shape variation was analyzed by Procrustes ANOVA and multi-variate analyses [principal component analysis and canonical variate analysis (CVA)], whereas MANOVA was used to examine asymmetry. Partial least square (PLS) analysis was used to assess the covariation between leaf shape and size, and geographical position and environmental variables at the sites of provenance origin, respectively. A highly observed phenotypic variation for the shape and size of leaf both within and among provenances, indicates a strong local adaptation of provenances within the species natural range. CVA revealed the existence of two clusters of provenances based on the leaf shape, i.e., the first group included provenances originating from Balkan Peninsula and Central Europe, while the second group consisted of two Romanian provenances and the northernmost provenance from Germany. Likewise, PLS evidenced that leaf shape was spatially structured along latitudinal (-0.64) and longitudinal (0.60) gradients, with southern provenances having longer and narrower (ovate) lamina compared to the northern ones. In contrast, no correlation was found between centroid size and spatial and environmental variables. Results suggest the presence of direct selection favoring a leaf shape that likely safeguards trees from heat and water losses under less favorable growing conditions.

