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DATA PAPER

PLANT TRAIT RECORDS OF THE HUNGARIAN AND SERBIAN FLORA AND METHODOLOGICAL DESCRIPTION OF SOME HARD TO MEASURE PLANT SPECIES

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New plant trait measurements collected during the field sampling in Pannonian sandy grasslands in Hungary and Serbia are presented. Selected traits include canopy height, leaf area (LA), specific leaf area (SLA) and leaf dry matter content (LDMC). The leaf area measurement procedures of overlapping, 3-dimensional or otherwise difficult-to-measure leaves and shoots are described in details.

Key words: data paper, plant traits, Pannonian grasslands, leaf dry matter content, specific leaf area, vegetative height

Plant traits are plant characteristics that play a role in adapting to the biotic and abiotic environment and can be measured at the level of individuals (Violle *et al.* 2007). The trait-based approach is an efficient tool in a wide range of research, as it is used in agricultural sciences (e.g. Abalos *et al.* 2019), community ecology (e.g. Schöb *et al.* 2017), evolutionary biology (e.g. Santangelo *et al.* 2019), restoration ecology (e.g. Halassy *et al.* 2019) and the studies dealing with ecosystem services (e.g. Cresswell *et al.* 2019). However, while trait databases are steadily growing, continuous intraspecific variation is underrepresented (Kattge *et al.* 2020), and there is evidence that it should be considered in analyses (e.g. Carmona *et al.* 2019, Read *et al.* 2017).

Hereby, we publish canopy height, leaf area (LA), specific leaf area (SLA) and leaf dry matter content (LDMC) records measured from 2016 to 2019 in Hungary and Serbia. The dataset can be divided into two categories based on the purpose of collection: (1) Ágasegyháza project: data collected for an ongoing project to explore the role of intraspecific variation within communities, covering the spectrum from sandy grasslands to oligotrophic wet meadows;

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(2) Traits of Pannonian grassland species: data of species and/or locations underrepresented in the global trait databases, e.g. TRY (Kattge *et al.* 2020). The Ágasegyháza project involves 93 plots and 217 species from two meadows and sandy grasslands near Ágasegyháza village (Hungary), while the other collection covers 101 species from 15 locations, in Hungary and Serbia.

During the field and the laboratory measurements, we followed the standard protocols of the LEDA database (Kleyer *et al.* 2008, Knevel *et al.* 2003) and the suggestions of Cornelissen *et al.* (2003). We measured the canopy height (i.e. the height of the vegetative part of the plant) of 5 to 30 randomly selected, robust, well-grown individuals of the species per location. To measure the SLA, LA and LDMC, we collected two mature and intact leaves per individual, altogether from at least ten individuals, for laboratory measurements. In the case of leafless plants (*Ephedra distachya*, *Equisetum ramosissimum*) or plants where the photosynthetic activity of the stem is comparable to that of the leaves (*Corispermum leptopterum*, *Eleocharis uniglumis*), a young shoot was collected. The fresh weight of the whole leaves (in most cases, including petiole and rachis; for details, see Appendix 3) were measured after 12-hour-long rehydration. Then we scanned the leaves at 400 DPI and calculated their projected area from the raster image using Lafore analysing software (free software by Veiko Lehsten (s.d.), University of Oldenburg). In the case of rolled-up leaves (e.g. *Festuca pseudovina*) or shoots (e.g. *Equisetum ramosissimum*) we calculated the upper half of the circumference by multiplying the projected area by pi / 2. In case of *Poa pratensis* and *Stipa capillata*, where some leaves were folded in half, we multiplied their area by 2. In case of *Fumana procumbens*, where the leaf shape is approximately half-cylinder, projected areas were multiplied by pi / 4 + 0.5. In the case of *Syrenia cana*, where the leaf shape is closest to a triangular prism, projected areas were multiplied by 1.5.

In the case of *Achillea asplenifolia* and *Achillea collina* – which have a complex, tile-like leaf structure, impossible to project into 2-dimensional space without overlaps –, we approximated real leaf area by calibration. From both species, we selected three different sized leaves, and first scanned and calculated the projected area in the usual way. Then, we severed the leaflets of each leaf from their rachis by forceps, and scanned them again without overlaps to get the whole area of the disassembled leaves. We fitted a function with the intact leaf measures on the x-axis and their disassembled measures on the y-axis; the best fitting model was the linear function with zero intercept. After that, we estimated the real leaf area of the other individuals with this linear equation. We found only a negligible difference between intact and teared up measures in the case of *Achillea asplenifolia;* probably because their leaflets are sparsely placed, preventing overlap. Thus we used the linear equation method only at *A. collina*.

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After the scanning process, leaves were dried in oven at 60°C for 72 hours, and then we measured their dry mass. For calculating SLA, the one-sided area of the fresh leaves (LA) was divided by their oven-dry mass; for calculating LDMC we divided their dry mass by their fresh weight. For more information and the datasets, see the Digital supplements 1–4. The species nomenclature follows Király (2009).

*

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Electronic supplements: Appendix 1, Appendix 2, Appendix 3, and Appendix 4.

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