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Data Article

New data of plant leaf traits from Central Europe

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ABSTRACT

Trait-based ecology is gaining ground nowadays on species-based ecology: the number of research and publication focusing on the ecological role of taxa instead of the species themselves increased significantly in the last two decades. One great advantage of this approach is that communities with different species composition due to great geographical distances (e.g., different continents) or different environmental conditions (e.g., loess, sand, and alkaline grasslands) become comparable. Obtaining trait values is, however, labour and time consuming even in the case of so-called soft traits. It is therefore reasonable and desirable for scientists to share their data as widely as possible. Demand for such data induced the publication of data papers and the establishment of databases, which support both theoretical ecological research and practical restoration ecological projects.

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Although several international databases (e.g., TRY, LEDA, CLO-PLA, BiolFLOR) are available nowadays, Central and Eastern European species are either missing or underrepresented in them. Consequently, measurement and publication of the traits of species typical in the above region is necessary. This paper presents leaf trait (leaf fresh and dry weight, leaf area, specific leaf area and leaf dry matter content) data for more than 1100 species of the Central European flora.

Specifications Table

Subject	Environmental sciences: Ecology
Specific subject area	Plant Ecology, Functional Ecology
Type of data	Table [1] Figure (map)
How the data were acquired	The collected leaves were transported to the laboratory. The fresh weight of the leaves was measured there as soon as possible after rehydration using analytical scales (d = 0.001 g and d = 0.0001 g). To determine the leaf area, we used two different methods: 1) after scanning the leaves we measured their area by a software (ImageJ or Lafore); 2) we measured leaf area directly using an Li-3000 C Leaf Area Meter. The leaves were then placed in paper bags, air-dried, and their dry weight was measured using analytical scales. Based on these measured data (fresh weight, dry weight and leaf area) we can calculate specific leaf area (SLA) and leaf dry matter content (LDMC). The data capture and measurements followed the protocols of Cornelissen et al. [2] and Pérez-Harguindeguy et al. [3].
Data format	Raw (measured and calculated)
Description of data collection	The leaves were collected mostly in the Pannonian Ecoregion during field works. We collected one leaf per 2–10 individuals or three leaves per 3–10 individuals (if it was possible) per species. The samples were kept cool in sealable plastic bags until processing. (The different methods of leaf collection are indicated in the data table.)
Data source location	• *City/Town/Region:* the location of each sample is indicated in the data table and the number of sampled taxa per site is presented on a map (Fig. 1) • *Country:* Hungary, Slovakia, Romania
Data accessibility	Repository name: Figshare Data identification number: 34,294,232 Direct URL to data: https://figshare.com/articles/dataset/Leaf_trait_dataset/19308023

Value of the Data

- The floristic-taxonomic approach used for characterizing communities has been gradually replaced by a functional approach, i.e., communities are characterized by not the classification of their species but their ecological role. This makes the comparison of communities with different species pools possible. The ecological role of the species is determined by their functional traits, therefore, it is essential to have data on these traits.
- As functional ecology is gaining ground, the number of databases has increased, but these typically include Northern and Western European species [4]. The traits of species with a wider range can also be different under different climates. The data presented here [1] include the leaf traits of species of the Pannonian flora, therefore it can promote Central and Eastern European plant ecological research.

- The reported data [1] are easily measurable soft traits, but their measurement is time and labour consuming. Thus, presenting these trait data can save time for researchers, making ecological research faster, providing results earlier.
- The reported data [1] can be used for a great diversity of trait-based analyses and may support practical restoration projects in Central Europe.

1. Data Description

Fig. 1: The sampling locations are presented on a map in Fig. 1. The size of the dots indicating settlements depends on the number of the collected species (see the legend).

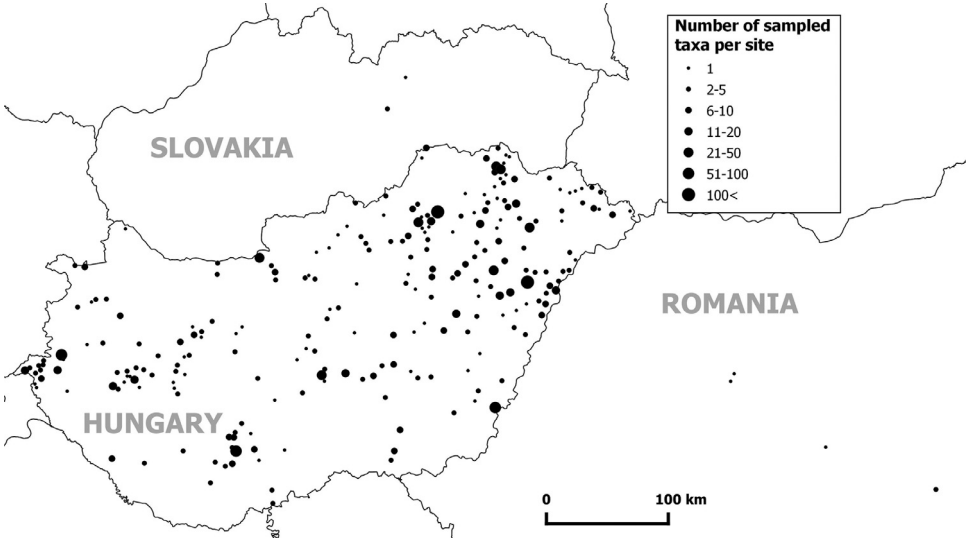

Fig. 1. Location and number of the collected species.

Data table [1]: The data table contains the collected species with the date and location of sampling, the measured part of the plants, the sample size and the measured and calculated data. There is some space for comments (e.g., correction with $\pi/2$). Detailed description of the columns in the dataset [1] you can find in Table 1.

Table 1
Structure of the dataset.

Column	Description
MC	Method Code (A1, A2, B1 or B2): see Table 2 for the explanations.
Species	Name of the species – the taxonomic nomenclature is based on Király [5] modified and supplemented according to subsequently published taxonomic works and floristic papers (e.g., [6–8]).
Date	Date of sampling
Location	The name of the settlement to which the sampling location belongs (in the language of the country). If the settlement is not located in Hungary its Hungarian name and the abbreviation of the country is given in brackets (SK – Slovakia, RO – Romania).
Measured part of the plants	The measured part of the plants (e.g., leaf, stem, last unbranched shoot).

(*continued on next page*)

Table 1 (*continued*)

Column	Description
Fresh weight (g)	Leaf fresh weight [g]
Dry weight (mg)	Leaf dry weight [mg]
LA (mm2)	Leaf area [mm^2]
SLA (mm2/mg)	Specific leaf area [mm^2/mg]
LDMC (mg/g)	Leaf dry matter content [mg/g]
Sample size	The number of leaves measured
Comment	Important notes

2. Experimental Design, Materials and Methods

Plant leaves were collected from March to October over several years mainly in Hungary, partly in Slovakia and Romania. There were more sampling campaigns with different protocols. They are marked in the dataset as as you can see in Table 2.

Table 2
Summary of differences between sampling and measurement protocols.

	Sampling protocol	Leaf area measurement
A1	One leaf per individual, 2–10 individuals per population (without petiole, rachis, leaf sheath)	Flatbed scanner + software ImageJ v. 1.48 [9]
A2	One leaf per individual, 2–10 individuals per population (without petiole, rachis, leaf sheath)	Li-3000 C Leaf Area Meter
B1	Three leaves (if possible) per individual, 3-10 individuals per population (with petiole, rachis or leaf sheath)	Flatbed scanner + software Lafore v. 1.0 [10]
B2	Three leaves (if possible) per individual, 3-10 individuals per population (without petiole, rachis, leaf sheath)	Li-3000 C Leaf Area Meter

In the course of collection, mature, healthy leaves were preferred. The number of collected leaves is indicated in the column 'Sample size' in the data table. The collected fresh leaves were placed in sealable plastic bags to avoid moisture loss. We measured their fresh weight after the field sampling as soon as possible, but not later than 24–48 h after collection. Until measurement the samples were stored in a fridge at 3–6 °C. Fresh weight was measured using analytical scales ($d = 0.001$ g or $d = 0.0001$ g). After weight measurements we determined the leaf area directly with an Li-3000 C Leaf Area Meter or we scanned the leaves with an HP ScanJet Pro 2500 f1 flatbed scanner at 300 DPI and their area was calculated using the software ImageJ [9] or Lafore [10].

After scanning the leaves, they were dried until weight constancy (e.g., for one month at room temperature or for two days in a drying oven at 70 °C) and their dry weight was measured with analytical scales ($d = 0.001$ g or $d = 0.0001$ g). When several leaves were collected, we calculated the average of the leaves' weight and area per individuals, and we calculated the average of the collected individuals per species. Then we calculated the SLA and LDMC based on the averaged data. Therefore, we present average data of fresh weight, leaf dry weight, LA, SLA and LDMC. Considering LA and SLA measurements, in the case of rolled-up leaves (e.g., certain *Festuca* and *Stipa* species), cylindrical leaves (e.g., *Juncus* species) and shoots (e.g., *Equisetum* species), the projected area was multiplied by $\pi/2$. Such correction is also indicated in the 'Comment' column of the data table [1].

Ethics Statements

The data have no personal information or institutional references that may compromise the privacy of any parties, therefore, no ethical implications should be declared.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data Availability

Leaf trait dataset (Original data) (Figshare).

CRediT Author Statement

Andrea McIntosh-Buday: Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Visualization; **Judit Sonkoly:** Conceptualization, Methodology, Investigation, Resources, Writing – review & editing, Project administration; **Attila Takács:** Methodology, Investigation, Resources, Writing – review & editing, Visualization; **Nóra Balogh:** Investigation; **Gergely Kovacsics-Vári:** Investigation, Resources; **Balázs Teleki:** Resources; **Kristóf Süveges:** Resources; **Katalin Tóth:** Resources; **Alida Anna Hábenczyus:** Investigation, Resources; **Balázs A. Lukács:** Conceptualization, Resources, Project administration, Funding acquisition; **Ádám Lovas-Kiss:** Resources; **Viktor Löki:** Resources; **Alexandra Tomasovszky:** Investigation, Data curation; **Béla Tóthmérész:** Conceptualization, Resources; **Péter Török:** Conceptualization, Methodology, Resources, Writing – review & editing, Supervision, Project administration, Funding acquisition; **Edina Tóth:** Conceptualization, Methodology, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Funding acquisition.

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