ANNUAL RING WIDTH IN THE MEDITERRANEAN-ALPINE SHRUB SPECIES *CYTISUS GALIANOI* - DATASET FROM LONG-TERM ALPINE ECOSYSTEM RESEARCH IN THE SIERRA NEVADA, SPAIN (LTAER-ES)

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With 3 figures and 1 data supplement
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Summary: This is a datapaper including microscopically measured data of annual ring widths from the Mediterranean-alpine shrub species *Cytisus galianoi* (Sierra Nevada, Spain). The dataset will be updated with future measurements.

Zusammenfassung: Dies ist eine Datenpublikation mikroskopischer Jahrringbreitenmessungen der mediterran-alpinen Strauchart *Cytisus galianoi* (Sierra Nevada, Spanien). Der Datensatz wird mit zukünftigen Messungen aktualisiert.

Keywords: Dendrochronology, wood anatomy, intra-plant growth patterns

1 Background, aims, and objectives

Here, we present annual ring width data of the Mediterranean-alpine shrub species *Cytisus galianoi*, abundant in the Sierra Nevada (Spain) and potentially affected by future climate change predicted for the Mediterranean-alpine biome, including increased aridification in a warming environment (Giorgi & Lionello 2008, Dobbert et al. 2022). To predict the species´ adaptive capacity and its future spatial distribution, it is thus crucial to increase our knowledge on growth mechanisms and performance (e.g., Cotto et al. 2017, Magaña Ugarte et al. 2019, González-Rodríguez et al. 2021, Tumajer et al. 2021, Wessely et al. 2022).

2 Methods and techniques

Embedded in our long-term alpine ecosystem research program in the Sierra Nevada, Spain (LTAER-ES), established in 2012 (Löffler et al. 2022), we collected entire *C. galianoi* specimens for intra-annual and intra-plant ring width measurements. The first specimens were collected in November 2012 and further specimens were added to the dataset in 2014 and 2015. We collected two specimens along a steep elevation gradient, and at different topographical positions above the local treeline (Löffler et al. 2022).

In order to detect the oldest plant parts, assumed to be close to the root collar (Gazol & Camarero 2012), we performed serial sectioning (Kolishchuk 1990). To assess intra-plant growth patterns (cf., Buchwal et al. 2013) and differences in climate sensitivity along the main sprout axis (cf., Ropars et al. 2017), we cross-cut all collected specimens at three intra-plant segments (stem, base, and root) (Fig. 1). To obtain permanent histological preparations, we cut thin sections of 10 to 15 µm from all our samples. Following the standardized protocols (Schweingruber & Poschlod 2005, Gärtner & Schweingruber 2013), the sections were stained with Safranin and Astra Blue and permanently embedded in Euparal. We captured images of each section with a Keyence optical microscope (VHX-5000), using 100 x magnification.

The xylem of *C. galianoi* is semi-ring porous and annual rings showed abrupt boundaries of thick-walled latewood fibres, merging into thin-walled earlywood fibres. The concentrically arranged earlywood vessels and the intra-annual vessels, which occurred in clumps and irregular bands, helped to identify and distinguish the annual rings. Vessels were surrounded by small parenchyma cells and the xylem contained narrow radial rays, mostly ranging from the round-shaped pith, and from the root stele, respectively, to the outer xylem boundary (Fig. 2 and Fig. 3).

We measured annual ring widths along five radii up to the pith and to the root stele, respectively (cf., Dee & Palmer 2019), evenly distributed across each entire section (Fig. 3). As such, we obtained individ-

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ual time series along the five radii, which we visually cross-dated. For detected missing rings and wedging rings, we inserted 8.00001 µm into the time series, which was the smallest measured value of the entire dataset (Buchwal et al. 2013).

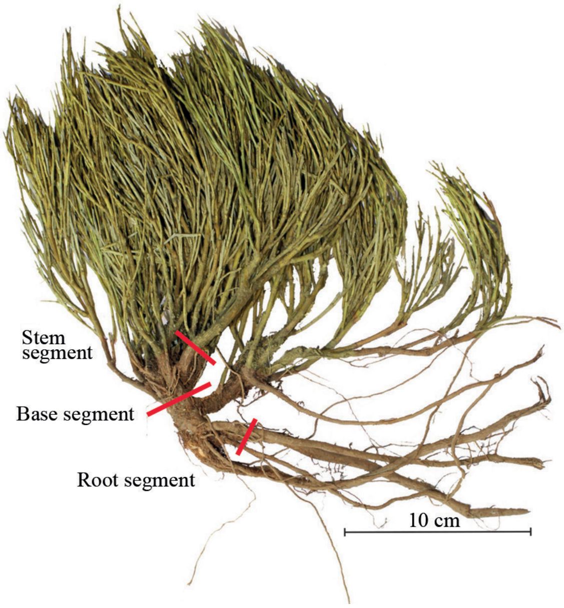

Fig. 1: Stem, base, and root segments along the main sprout axis of a *C. galianoi* specimen collected at 2326 m a.s.l.

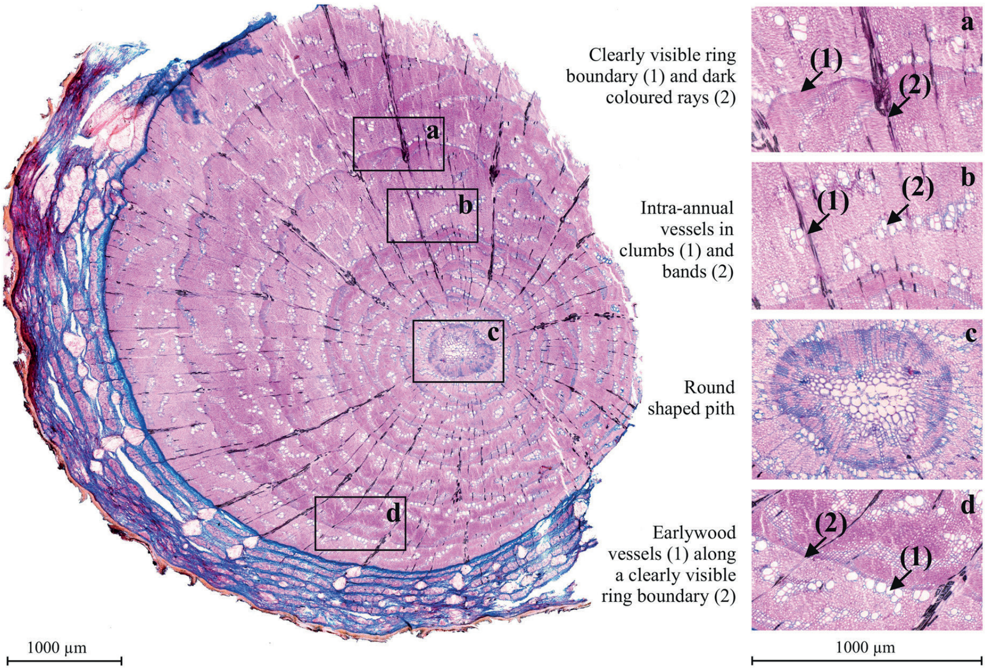

Fig. 2: Anatomical features in a base section of *C. galianoi*. The semi-ring porous xylem is characterized by a) clearly visible boundaries between thick-walled latewood and thin-walled eralywood fibres. Narrow, dark coloured rays occur regularly and mostly range from the pith to the outer xylem boundary. b) Large-lumened intra-annual vessels occur in clumps and bands and are surrounded by small parenchyma cells. c) The pith is round shaped and d) the large-lumened eralywood vessels are arranged along the ring boundaries.

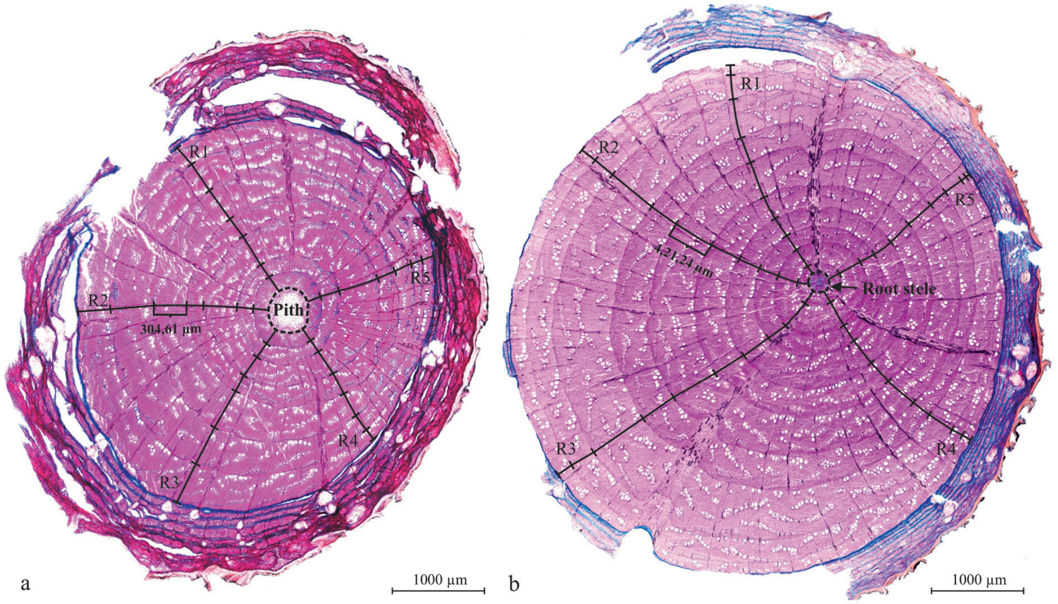

Fig. 3: a) Cross-section of a 7-year-old shoot segment with measurements of five radii (R 1,2,3,4,5) and marked pith which was excluded from the dataset before analysis. Bases were treated the same. b) Cross-section of the respective 10-year-old root segment with measurements of five radii (R 1,2,3,4,5) and marked root stele.

3 Data structure

Our dataset is organised according to the following attributes:

id
Unique identifier given to each monitored specimen. Form: Elevation [m a.s.l.], abbreviation for position, intra-plant segment (stem, base, root).

elevation
Elevation in meters above sea level [m a.s.l.].

species
Monitored shrub species: *Cytisus galianoi* (Talavera & P.E. Gibbs).

position
For description of topographical positions see Löffler et al. (2022).

segment
Intra-plant segment (stem, base, root).

year
Year of ring formation (after visual cross dating).

ring width
Ring width, measured along five radii and subsequently averaged [µm].

4 Dataset

Here, we publish a current dataset as part of an ongoing long-term project. This dataset will be updated, and is available online as a dataset supplement via: https://doi.org/10.3112/erdkunde.2023.ds.01

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