Data Article

Phenotyping and cell wall polysaccharide composition dataset of five arabidopsis ecotypes grown at optimal or sub-optimal temperatures

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ABSTRACT

This article presents experimental data describing the morphology and the cell wall monosaccharide content of rosettes and flower stems of five *Arabidopsis thaliana* ecotypes grown at two contrasted temperatures. Besides, cell wall polysaccharides are reconstructed from data of monosaccharide quantification. The well-described and sequenced Columbia (Col) ecotype and four newly-described Pyrenees ecotypes (Duruflé et al., 2019) have been grown at two different temperatures (15 °C and 22 °C). For macrophenotyping, we provide dataset regarding (i) rosettes such as measurement of diameter and fresh mass as well as number of leaves just before bolting and (ii) floral stems at the first flower stage such as length, number of cauline leaves, mass and diameter at its base. Regarding cell wall composition, we provide data of quantification of seven monosaccharides and the reconstruction three polysaccharides. All these data are markers to differentiate both growth temperatures and the different ecotypes. They constitute a valuable resource for the community to study the adaptation of *A. thaliana* ecotypes to sub-optimal temperature growth conditions.

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Specifications Table

Subject area	Biology
More specific subject area	Macrophenotyping data of Arabidopsis ecotypes and cell wall monosaccharide and polysaccharide compositions
Type of data	Tables
How data was acquired	ImageJ, HPAEC-PAD
Data format	Raw and processed data
Experimental factors	5 ecotypes of *Arabidopsis thaliana* at 2 growth temperatures (15 and 22 °C) 2 organs (rosettes and floral stems) 3 biological replicates
Experimental features	Rosettes and floral stems morphological traits and cell wall monosaccharide quantification
Data source location	[1]
Data accessibility	Data are available in this article as 3 supplementary files
Related research articles	H. Duruflé, P. Ranocha, D.L. Mbadinga Mbadinga, S. Déjean, M. Bonhomme, H. San Clemente, S. Viudes, A. Eljebbawi, V. Delorme-Hinoux, J. Sáez-Vásquez, J.-P. Reichheld, N. Escaravage, M. Burrus, C. Dunand, Phenotypic trait variation as a response to altitude-related constraints in Arabidopsis populations, Front. Plant Sci. (2019) [1]

Value of the data
- The datasets include large sets of rosettes and floral stem morphological description of five A. thaliana ecotypes at two growth temperatures, the quantification of seven monosaccharides and the reconstruction of three polysaccharides of the cell wall.
- The phenotyping data obtained from the four newly identified A. thaliana altitudinal ecotypes from the French Pyrenees mountains will be useful as reference to investigate further local adaptation.
- The data can be used to study the impact of sub-optimal temperature growth conditions on A. thaliana development.
- The data can also be used to study the natural morphological or molecular variations in rosettes or floral stems in responses to changes in growth temperature conditions.

1. Data

We report on several rosettes and floral stems phenotyping datasets of five ecotypes of the model plant *Arabidopsis thaliana* grown at two different temperatures. Four kinds of data are reported: macrophenotyping datasets of rosettes and floral stems (Supplementary file 1), raw data of cell wall monosaccharide quantification (Supplementary file 2), total cell wall monosaccharide quantification using raw data (Supplementary file 3), and cell wall polysaccharide reconstruction using total monosaccharide quantification (Supplementary file 4). Data are provided as Supplementary files and their contents are described in the section "2.5. Data organization".

2. Experimental design, materials, and methods

2.1. Plant material

Datasets from five ecotypes of the annual plant A. thaliana have been obtained: on the one hand, Grip, Hosp, Hern, Roch which are living between 700 m and 1400 m in altitude in the Pyrenees mountains [1]; on the other hand, the already well-described Columbia (Col) originating from Poland where it used to live at 200 m in altitude (EFO_0005147, Versailles Arabidopsis Stock Centre number: 186AV). Seeds were sowed in Jiffy-7® peat pellets (Jiffy International, Kristiansand, Norway). After 48 h of stratification at 4 °C in darkness, plants were grown at two different temperatures, at 22 °C or 15 °C, under a light intensity of 90 μmol photons/m^2/s. They were cultivated under a long-day condition (16 h light/8 h dark) with 70% humidity.

Rosettes were collected just before bolting (stage 5.10 [2]) from four or six week-old plants grown at 22 °C or 15 °C, respectively. Floral stems were collected at the first-flower stage of development (stage 6 [2]): 6 weeks for Col; 7 weeks for Grip and Roch; 8 weeks for Hosp and Hern. They were collected two

weeks later for all the ecotypes grown at 15 °C. In total, 15–22 rosettes and 10–20 floral stems from three independent biological replicates have been pooled for the molecular analyses.

2.2. Macrophenotyping

Rosettes and floral stems phenotyping datasets were collected at the time of sampling. Diameter and fresh mass of rosettes were measured and the number of leaves was counted. Before freezing, pictures were taken to measure the rosette areas with the ImageJ software [3]. Regarding floral stems phenotyping datasets, the length, the number of cauline leaves, the mass and the diameter at the base of the floral stem were measured. All the samples were frozen at −80 °C.

2.3. Cell wall purification and sequential cell wall polysaccharide extraction and identification

Cell wall purification was performed using the three independent pools of rosettes or floral stems for each experiment and each ecotype as described [4].

The sequential extraction of cell wall polysaccharides was performed as detailed in [5]. In summary, 100 mg of a deproteinized cell wall fraction were used. Four successive extractions were carried out to obtain two extracts enriched in pectins (E1 and E2) and two extracts enriched in hemicelluloses (E3 and E4). Each extract was hydrolysed in 2 N TFA for 1 h at 120 °C. After 10X dilution in UHQ water, monosaccharides were analysed by High-Performance Anion-Exchange Chromatography coupled to Pulsed Amperometric Detection (HPAEC-PAD; Dionex, Sunnyvale, CA, USA) using a CarboPac PA1 column (Dionex). L-Ara (L-Arabinose), D-Gal (D-Galactose), L-Fuc (L-Fucose), L-Rha (L-Rhamnose), and GalA (Galacturonic acid, Sigma-Aldrich, Saint-Quentin Fallavier, France); D-Glc (D-Glucose, Merck, Darmstadt, Germany); D-Xyl (D-Xylose, Roche, Mannheim, Germany) were used as standard monosaccharides for identification and quantification.

2.4. Cell wall polysaccharide reconstruction

Cell wall polysaccharide reconstruction was performed using formula adapted from [5,6] and described in Table 1.

2.5. Data organization

The data are provided in four Supplementary files including:

- Supplementary file 1: Macrophenotyping data of the five ecotypes at two growth temperatures

Table 1
Polysaccharide reconstruction based on monosaccharide analysis data. Arabinose (Ara), Fucose (Fuc), Galactose (Gal), Galacturonic Acid (GalA), Glucose (Glc), Rhamnose (Rha), Xylose (Xyl), molecular mass of GalA (MGalA: 194.139 g/mol), molecular mass of Rha (MRha: 164.156 g/mol). Quantitative values are in μg/mg fresh mass. RG stands for total Rhamnogalacturonan I and II.

Description	Formula
Rhamnogalacturonan I (RGI)	$(\text{Rha} \times (1 + \frac{MGalA}{MRha})) + \text{Ara} + \text{Gal}$
Homogalacturonan (HG)	$\text{GalA} - (\text{Rha} \times (1 + \frac{MGalA}{MRha}))$
Xyloglucan (XG)	$\text{Fuc} + \text{Glc} + \text{Xyl}$
Linearity of pectin	$(\text{GalA} - \text{Rha})/((\text{Rha} \times (1 + \frac{MGalA}{MRha})) + \text{Ara} + \text{Gal})$
Contribution of RG to pectin population	$(\text{Rha} \times (1 + \frac{MGalA}{MRha}))/(\text{GalA} - \text{Rha})$
Branching of RGI	$(\text{Ara} + \text{Gal})/(\text{Rha} \times (1 + \frac{MGalA}{MRha}))$

- Supplementary file 2: Raw data of cell wall monosaccharide quantification after HPAEC-PAD analysis
- Supplementary file 3: Cell wall monosaccharide quantification data after HPAEC-PAD analysis
- Supplementary file 4: Cell wall polysaccharide reconstruction

Acknowledgments

Conflict of 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.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dib.2019.104318.

References

[1] H. Duruflé, P. Ranocha, D.L. Mbadinga Mbadinga, S. Déjean, M. Bonhomme, H. San Clemente, S. Viudes, A. Eljebbawi, V. Delorme-Hinoux, J. Sáez-Vásquez, J.-P. Reichheld, N. Escaravage, M. Burrus, C. Dunand, Phenotypic trait variation as a response to altitude-related constraints in Arabidopsis populations, Front. Plant Sci. (2019), https://doi.org/10.3389/fpls.2019.00430.
[2] D.C. Boyes, A.M. Zayed, R. Ascenzi, A.J. McCaskill, N.E. Hoffman, K.R. Davis, J. Görlach, Growth stage-based phenotypic analysis of Arabidopsis: a model for high throughput functional genomics in plants, Plant Cell 13 (2001) 1499−1510, https://doi.org/10.1105/TPC.010011.
[3] C.A. Schneider, W.S. Rasband, K.W. Eliceiri, NIH Image to ImageJ: 25 years of image analysis, Nat. Methods 9 (2012) 671−675, https://doi.org/10.1038/nmeth.2089.
[4] L. Feiz, M. Irshad, R.F. Pont-Lezica, H. Canut, E. Jamet, Evaluation of cell wall preparations for proteomics: a new procedure for purifying cell walls from Arabidopsis hypocotyls, Plant Methods 2 (2006) 10, https://doi.org/10.1186/1746-4811-2-10.
[5] H. Duruflé, V. Hervé, P. Ranocha, T. Balliau, M. Zivy, J. Chourré, H. San Clemente, V. Burlat, C. Albenne, S. Déjean, E. Jamet, C. Dunand, Cell wall modifications of two *Arabidopsis thaliana* ecotypes, Col and Sha, in response to sub-optimal growth conditions: an integrative study, Plant Sci. 263 (2017), https://doi.org/10.1016/j.plantsci.2017.07.015.
[6] K. Houben, R.P. Jolie, I. Fraeye, A.M. Van Loey, M.E. Hendrickx, Comparative study of the cell wall composition of broccoli, carrot, and tomato: structural characterization of the extractable pectins and hemicelluloses, Carbohydr. Res. 346 (2011) 1105−1111, https://doi.org/10.1016/j.carres.2011.04.014.