

# Epigenetic variation in *Populus nigra* cv 'Italica' clones along climatic and geographical gradients

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## Introduction

- Epigenetic mechanisms (e.g., DNA methylation) contribute to complex functional plant traits and phenotypic plasticity <sup>1,3</sup>
- Epigenetic changes can be induced by environmental conditions <sup>1,2</sup>
- Epigenetic variation can potentially lead to plant adaptation <sup>2</sup>
- Species with clonal propagation provide an ideal system for epigenetic studies <sup>3</sup>

*Populus nigra* cv. 'Italica'  
(Lombardy poplar)



- Long-lived species
- Wide distribution
- Clonal reproduction
- Male clone
- Genome ~ 500 Mb

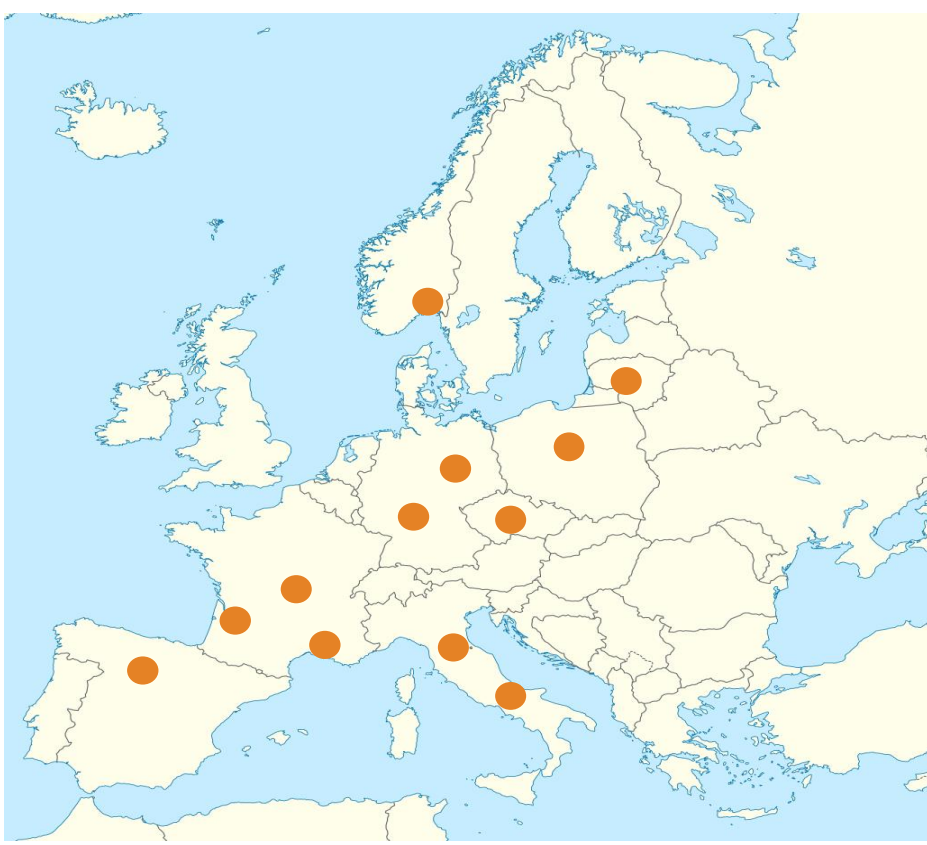
## Aims

- Characterize epigenetic structure of *P. nigra* clones
- Associate methylation variants with ecological and climatic variables
- Assess the contribution of environmental conditions to epigenetic changes relative to stably inherited methylation patterns
- Evaluate the role of epigenetic variance in plant adaptation

## Methods

### 1. Sampling

- Climatic gradient
- Geographical gradient



### 3. Whole Genome Bisulfite Sequencing (WGBS)

```

>A Cm G T T G C C A A>
<T G Cm A A C G G T T<

>A Cm G T T G U U A A>
<T G Cm A A U G G T T<

>A Cm G T T C T T A A>
<T G C A A G A A T T<

<T G Cm A A T A A T T<
>A C G T T A T T A A>
    
```

### THE COMMON GARDEN



- Random block design
- Ca. 400 individuals belong to the same genotype

### 2. Phenotyping

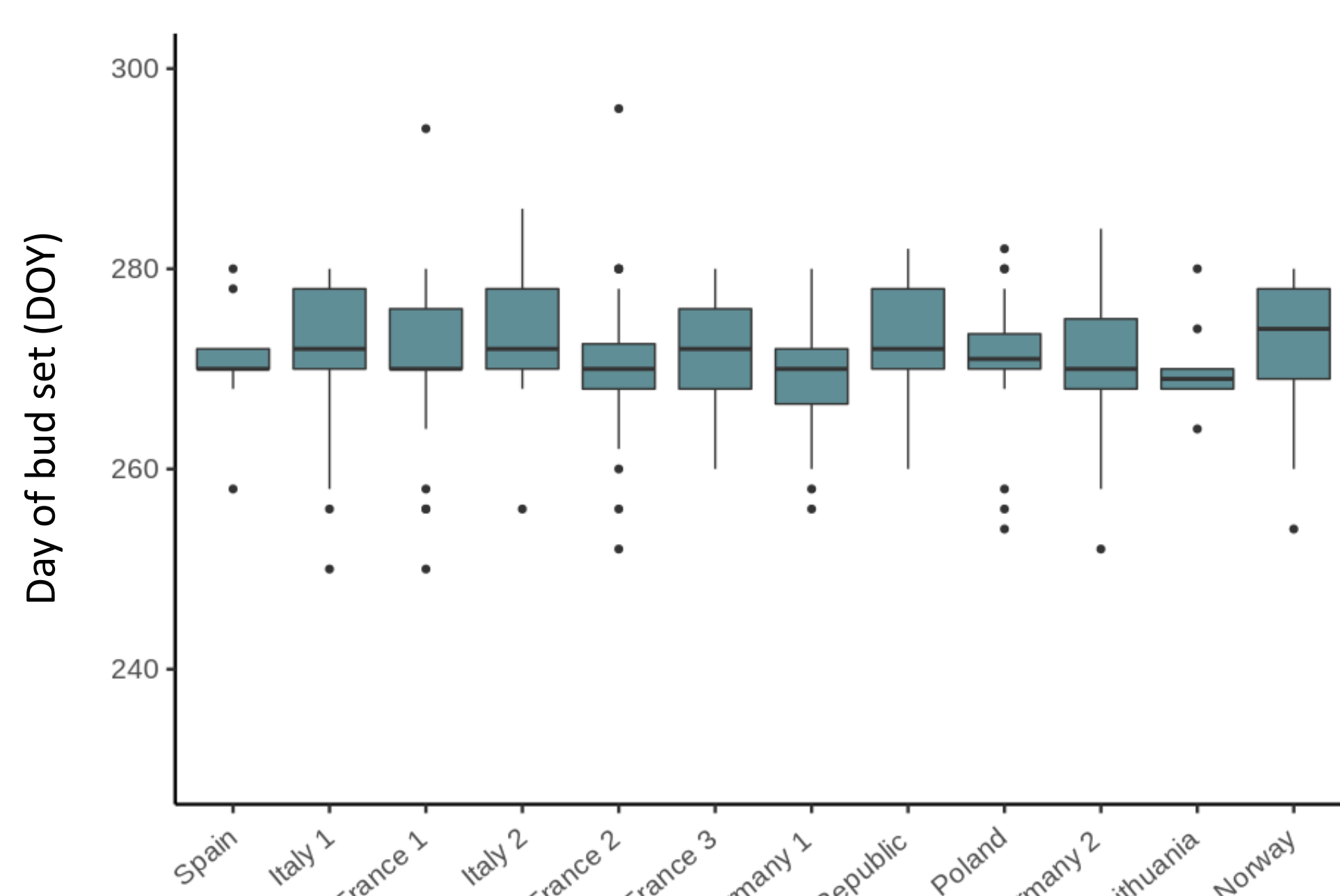


- Phenology
- Growth
- Herbivory

### 4. DMR identification: Link between environment, phenotypic traits and epigenetics

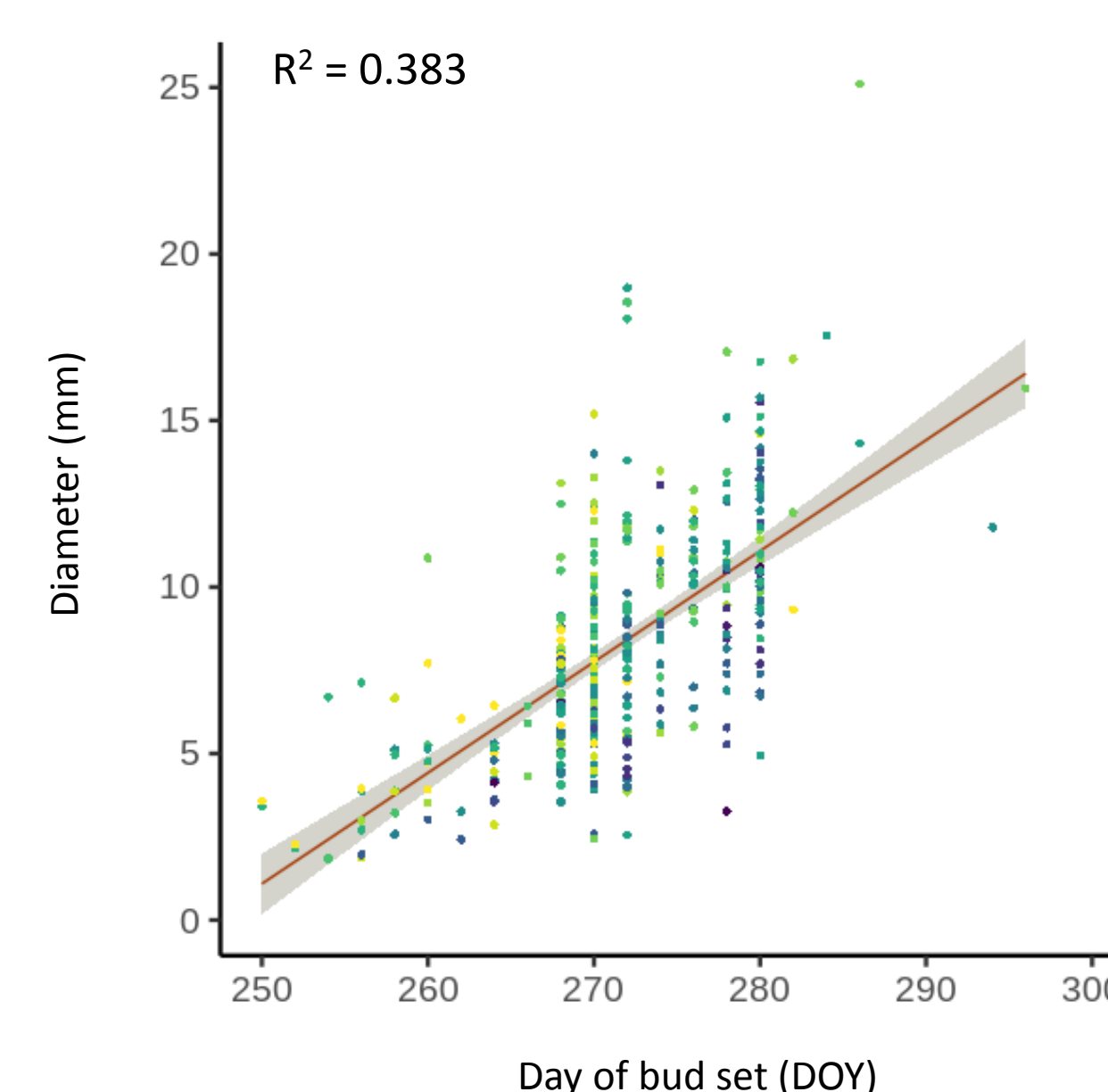
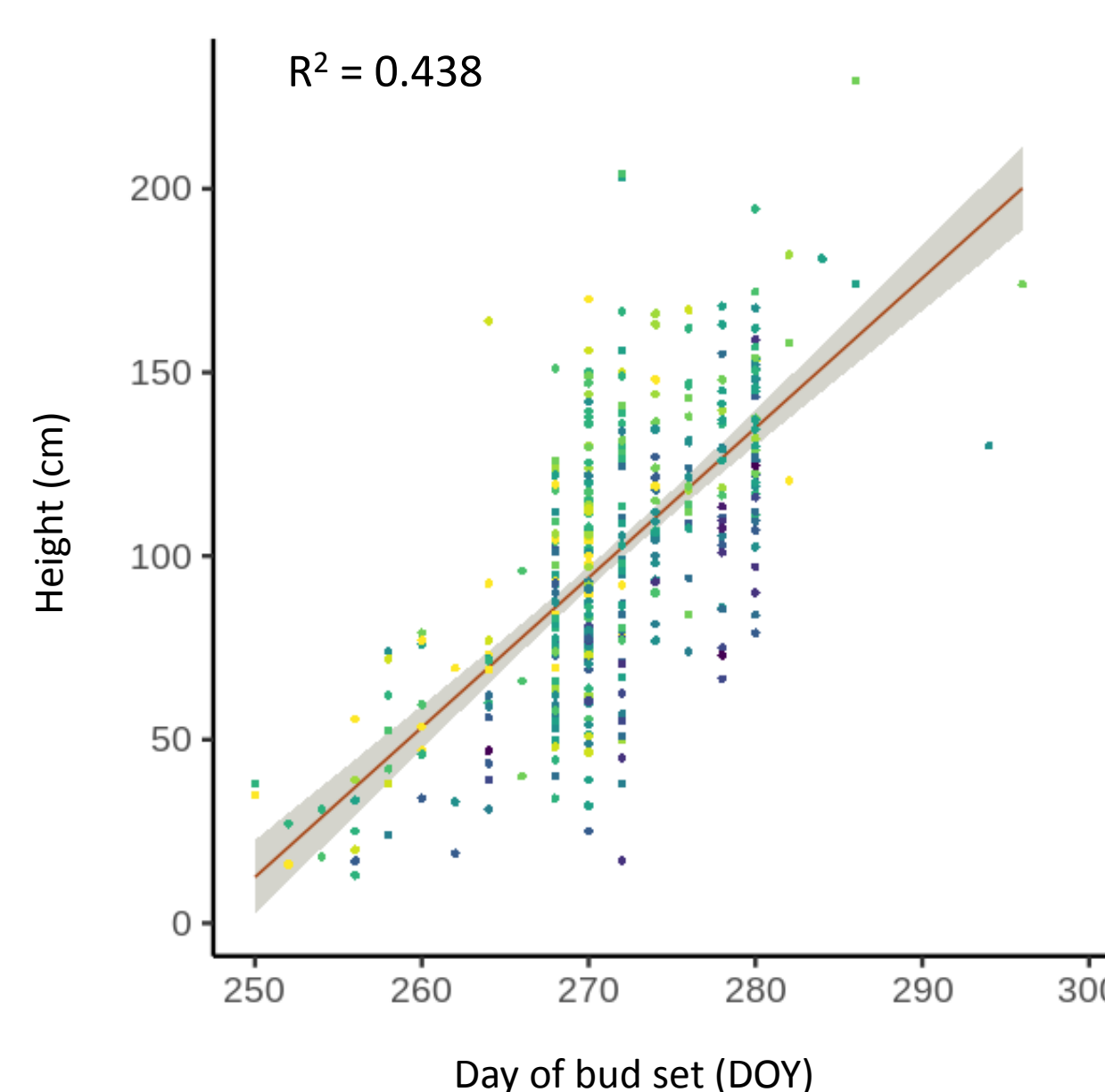
## Preliminary results

### Day of bud set



Day of bud set according to original sampling source. Bud set stage was scored following the chart described in Rohde et al., 2011.

### Correlation between bud set and growth parameters



Relative distance from the center of the common garden

- 1 4 7 10 13
- 2 5 8 11 14
- 3 6 9 12 15

Spatial correlation analysis of tree height (Mantel):  
**R² = 0.15**

Correlation between the day of bud set (DOY) and height (cm) and stem diameter (mm) of the Lombardy poplars grown in the common garden. Regression lines are given with 95% confidence intervals. The colors display the relative distance of an individual to the center of the common garden (1 is the central point, 15 is the farthest position in the garden), where a combination of overwatering and soil composition might have caused flood conditions.

## Acknowledgements



The EpiDiverse project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 764965

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