

# Combining growth chamber simulations and field experiments to study temperature adaptation in *Arabidopsis thaliana*

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Interreg  
Austria-Czech Republic  
European Regional Development Fund

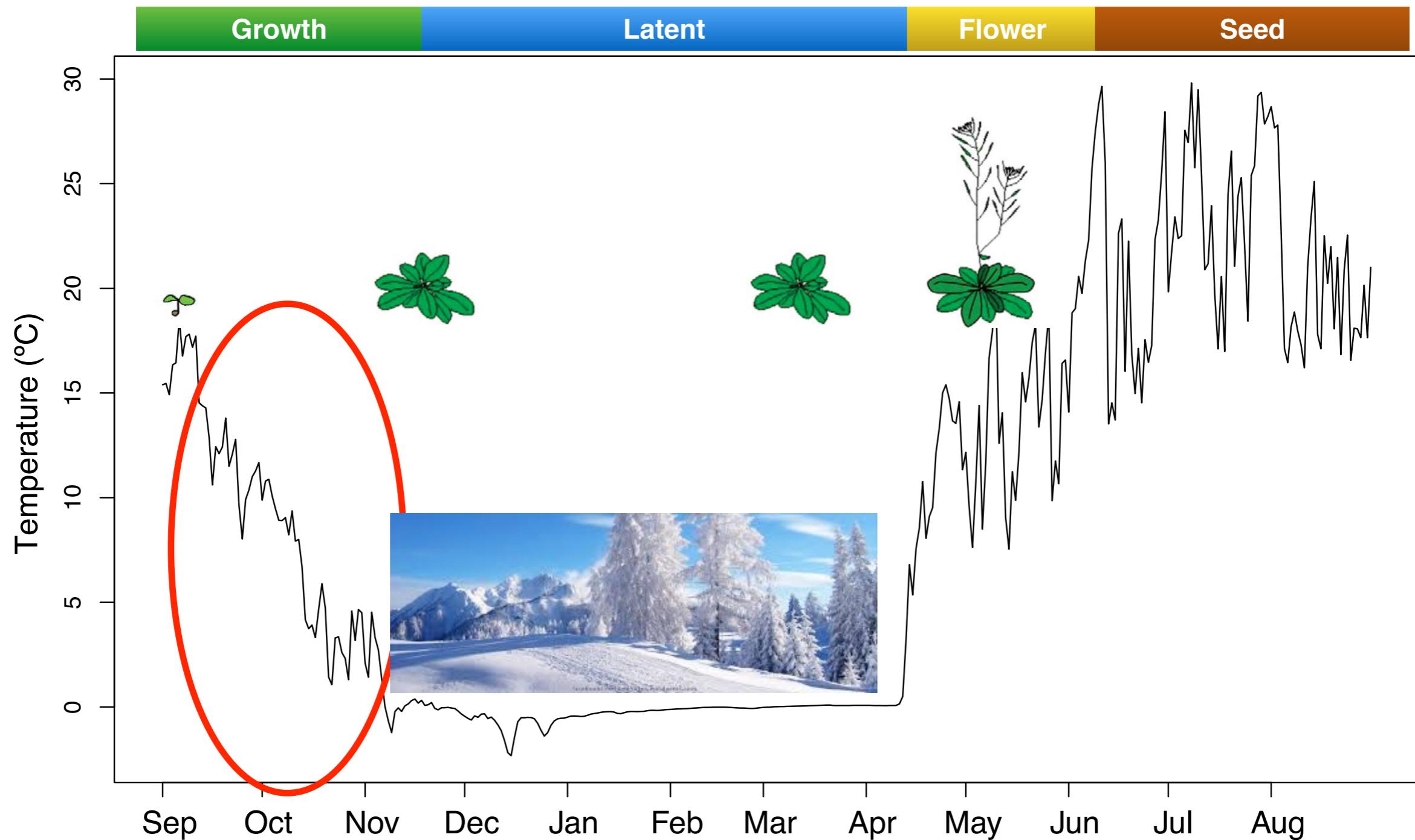




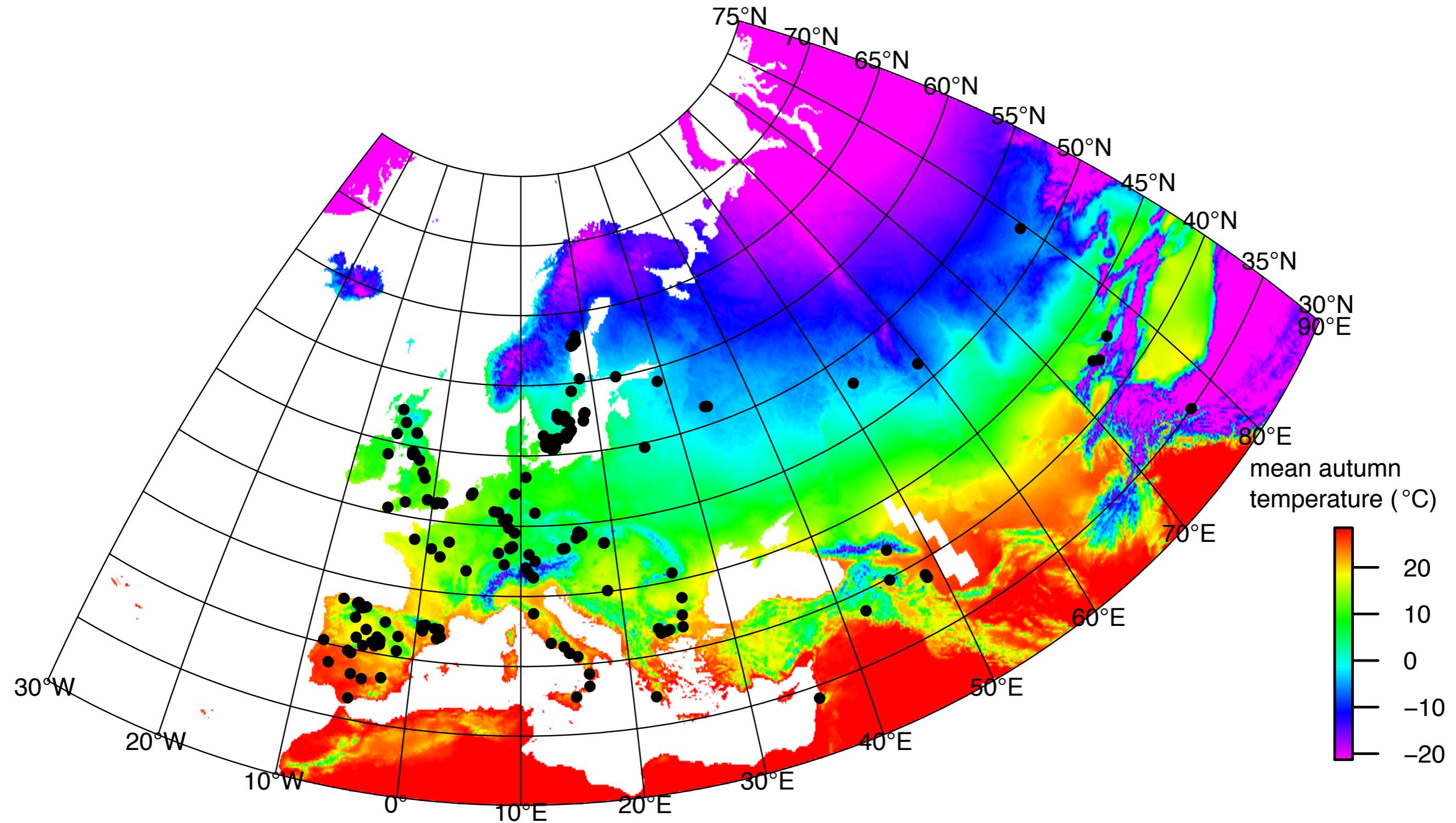
2nd December 2015  
Sweden



# **Arabidopsis' life history in Sweden**



# Arabidopsis accessions in different climate zones



- **Temporal variation in temperature**  
How are cellular and metabolic processes maintained?
- **Geographic variation in temperature**  
Is there local adaptation?

## Growth responses

Natural variation in rosette growth  
at different temperatures?

What are the underlying genetics?

Signs of local adaptation?

## Physiological responses

Temperature response  
of gene expression and metabolism?

Natural variation?

Link with growth responses?

Potential role in temperature adaptation?

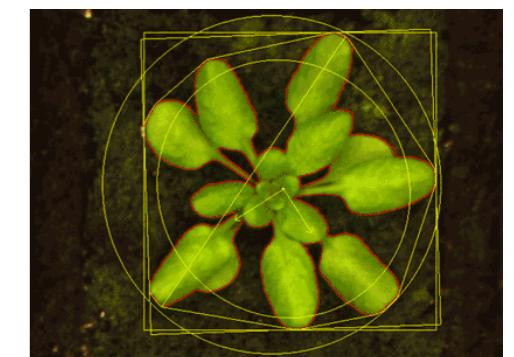
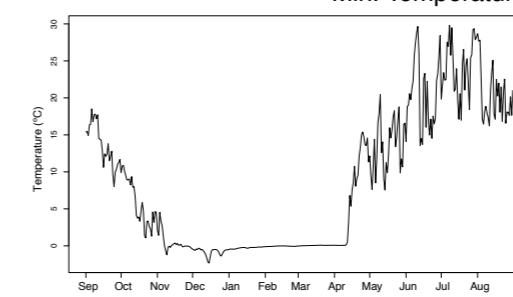
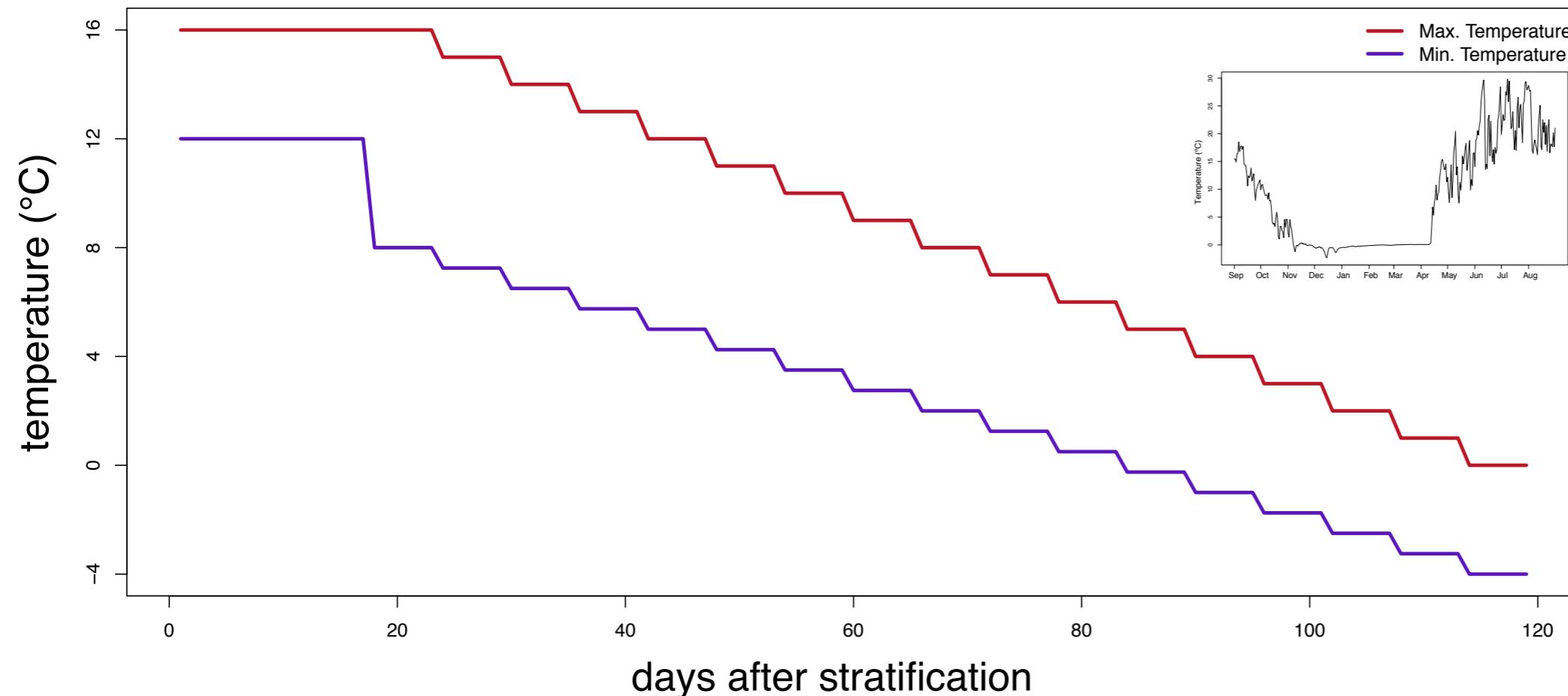
## Field observations

Effect of seasonal temperature variation?

(dis)similarities of growth and gene expression  
with growth chamber experiments?



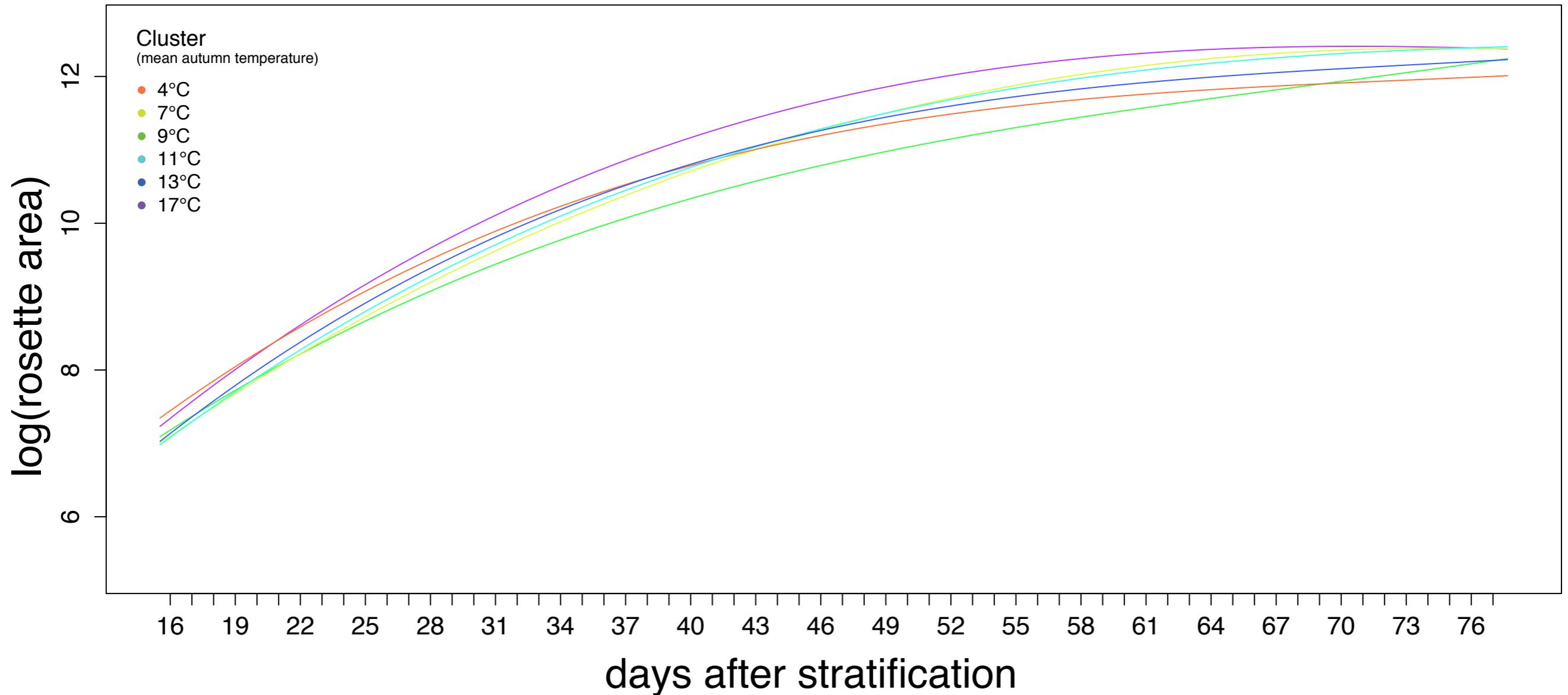
# Simulating North-Swedish autumn



- realistic temperature scenario - North Sweden
- growth chamber - focus on temperature only (9hrs day)
- rosette size measurements - automatic phenotyping
- growth dynamics of 350 accessions - genetic diversity

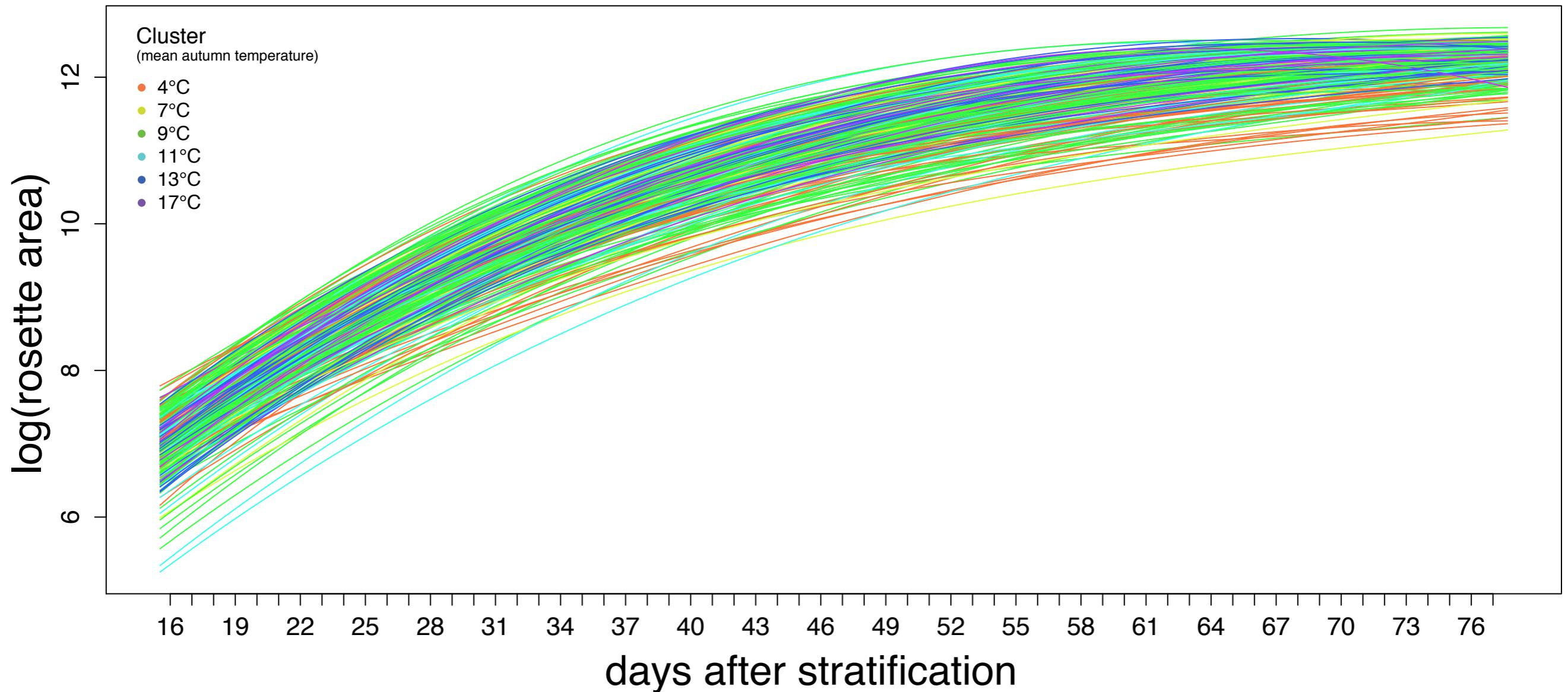
# Variation in rosette areas over time

Per accession log(rosette area) over time

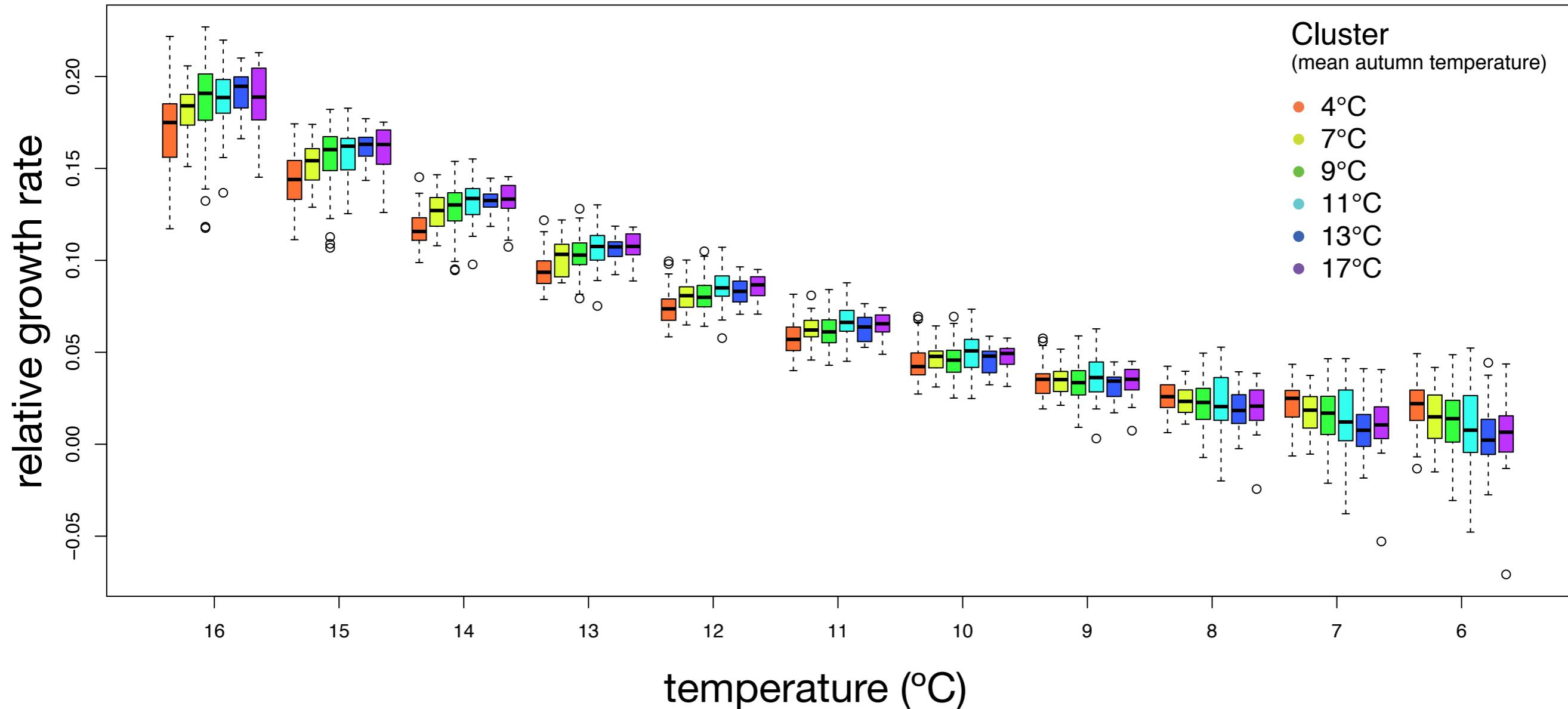


# Variation in rosette areas over time

Per accession log(rosette area) over time

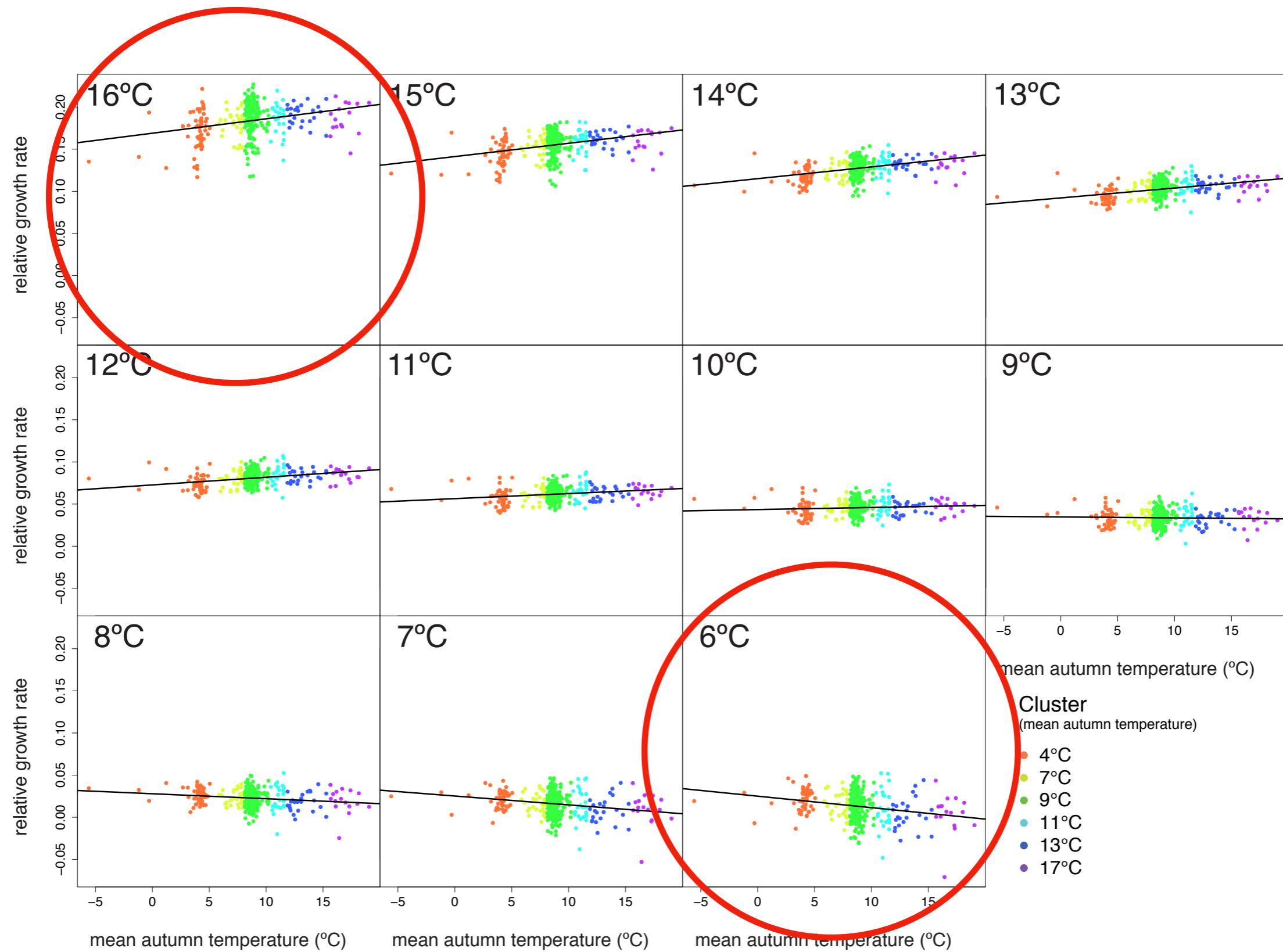


# Temperature clusters are differently affected by temperature

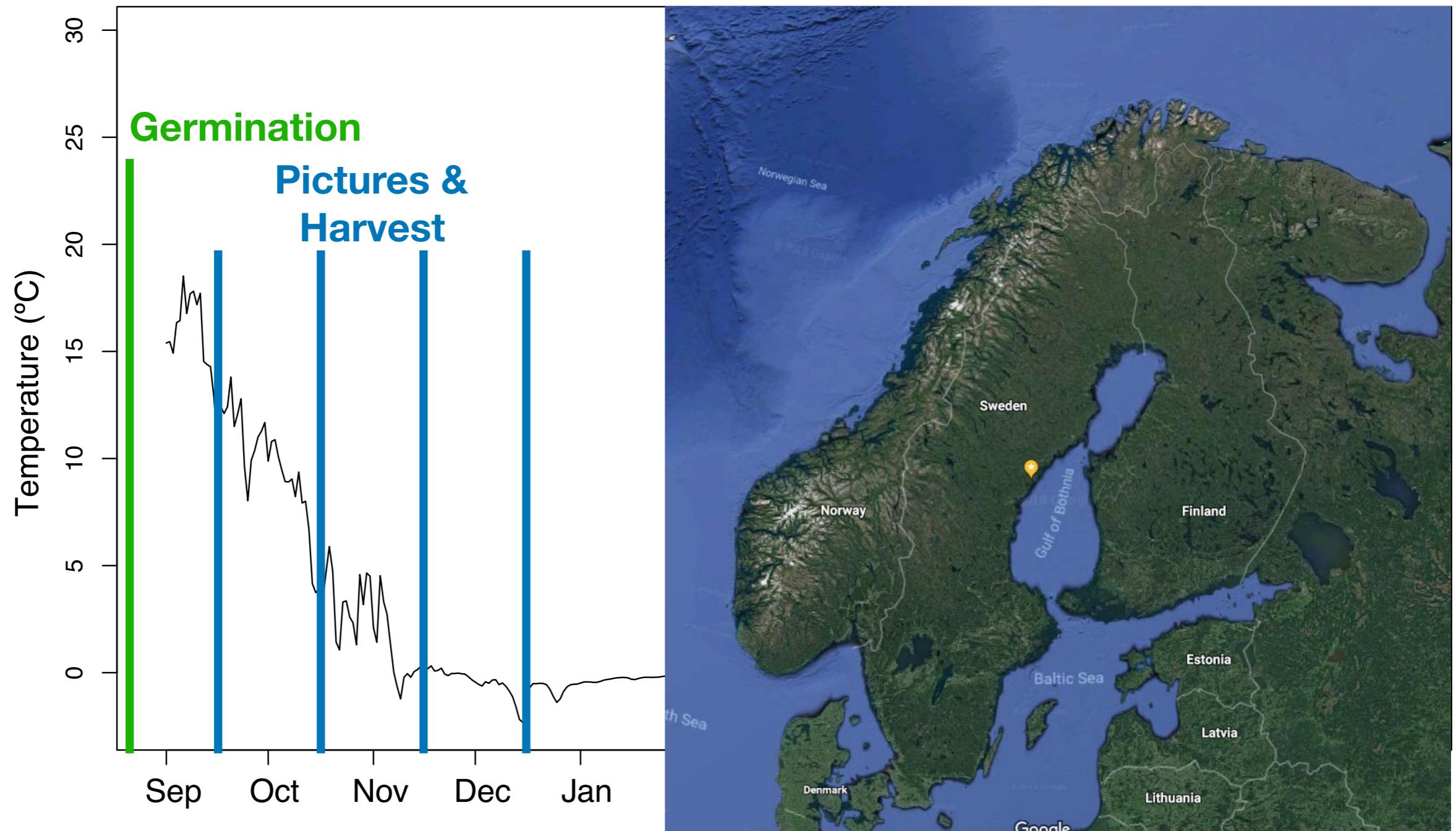


Correlation with local autumn temperature?

# Growth at specific temperatures correlates with local autumn temperature



# Actual North-Swedish autumn



Growth and Transcriptome response to seasonal temperature changes  
(dis)similarities between field and growth chamber



**26 August**



**17 September**

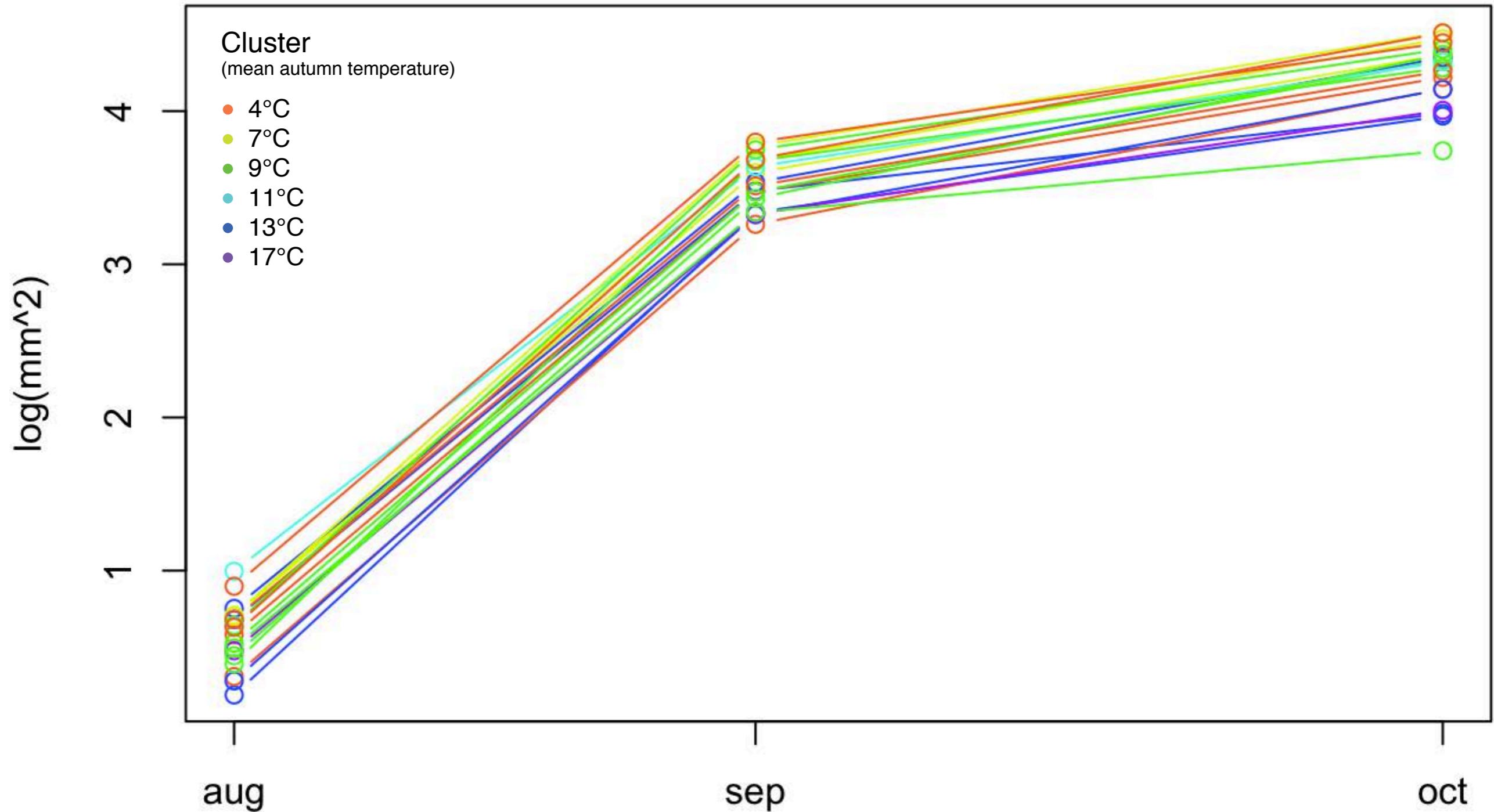


**16 October**



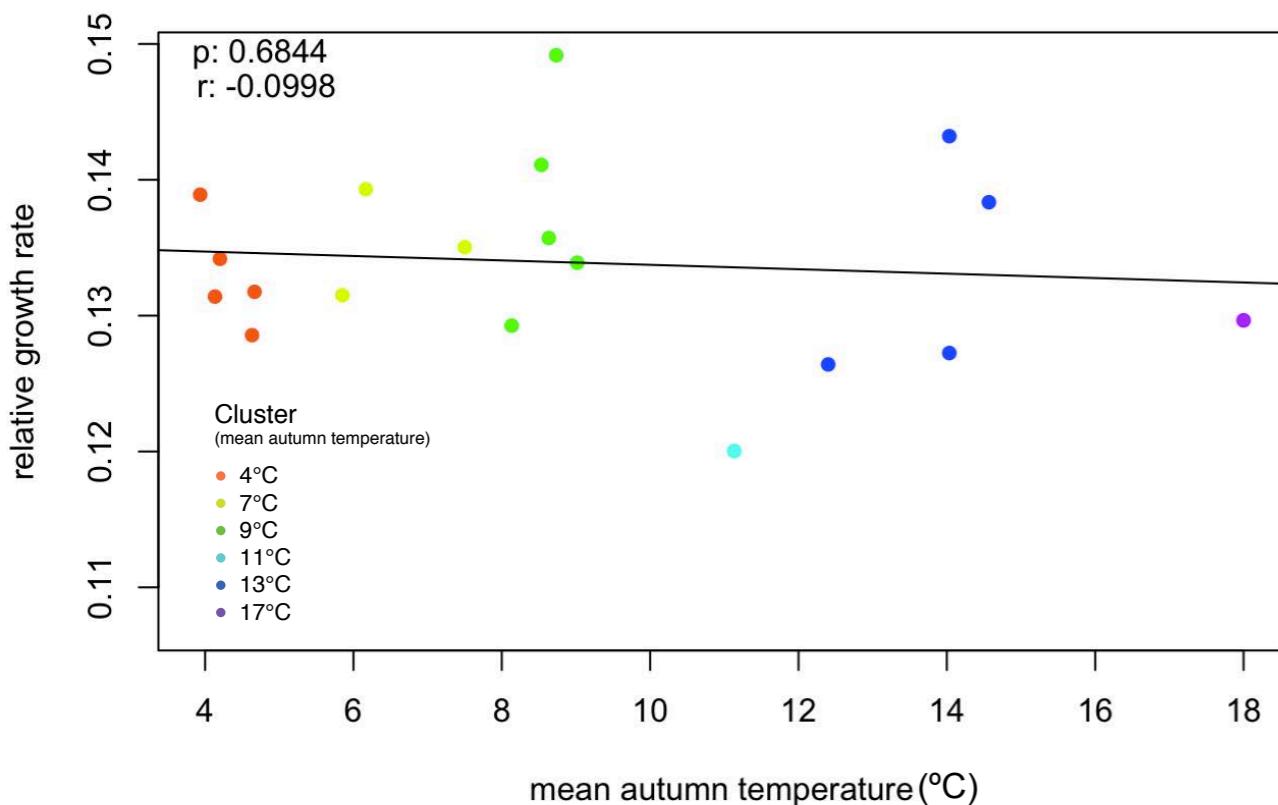
- SLR camera on tripod
- ruler converting pixels to mm<sup>2</sup>
- Lemnatec image analysis (VBCF - plantS)
- 23 accessions

# Strongest growth at start

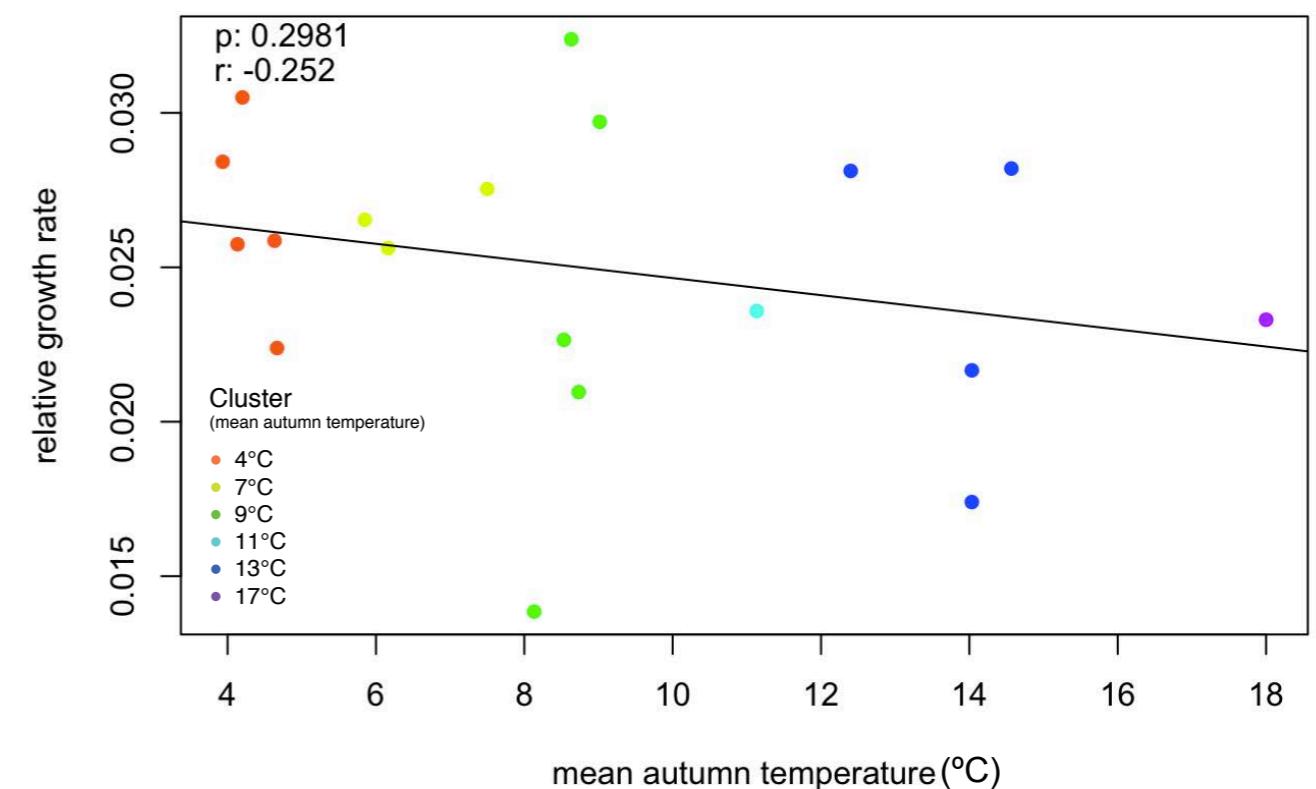


# Correlation with local autumn temperature

August - September



September - October



Non-significant, weak negative correlation with growth between September and October

# Conclusions

- Clear growth differences between accessions
  - Both in growth chamber and field
- Growth differences are related to local temperature conditions
  - clear in growth chamber
  - non-significant in field
- Field setup is challenging
  - much lower temporal resolution
  - unforeseen circumstances (beetle damage, snow mould ...)
  - possible with basic/cheap setup
  - fun
- Field studies as validation of biological/ecological/evolutionary importance of lab-findings

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