Does the ability to preform buds determine the phenology of perennial herbs?

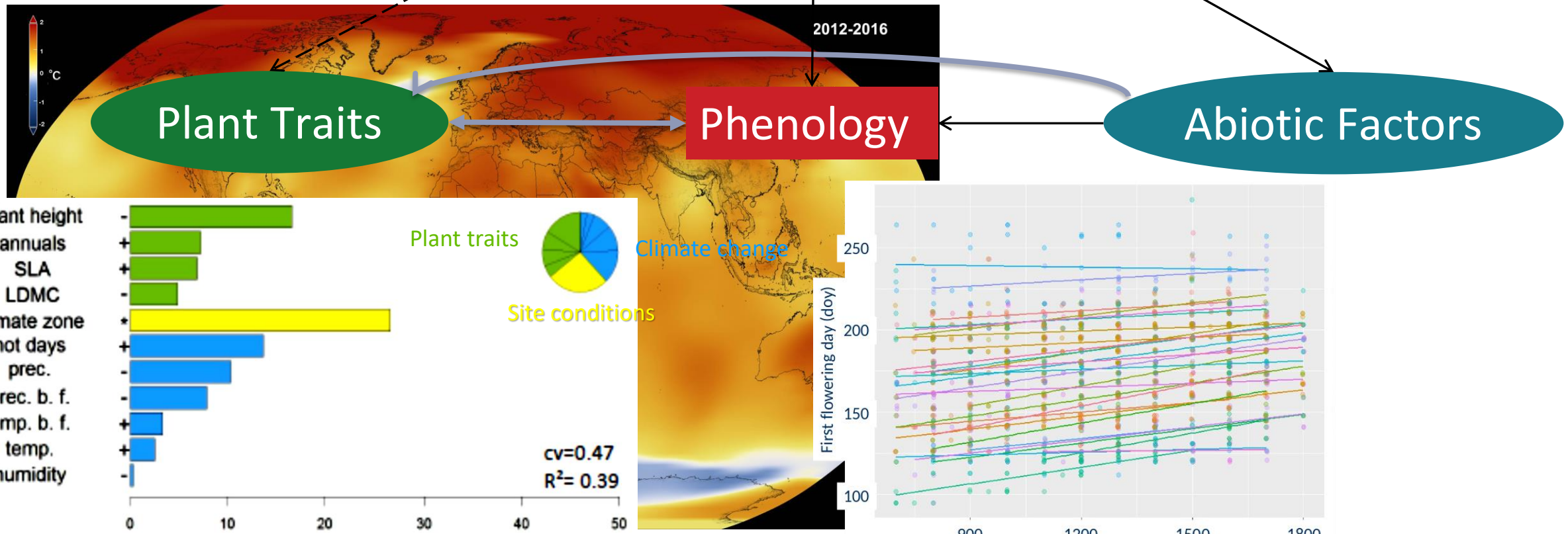
Solveig Franziska Bucher, Renáta Schnablová, Tomáš Herben, Christine Römermann and the PhenObs consortium

Global Change

Plant Traits

Phenology

Abiotic Factors



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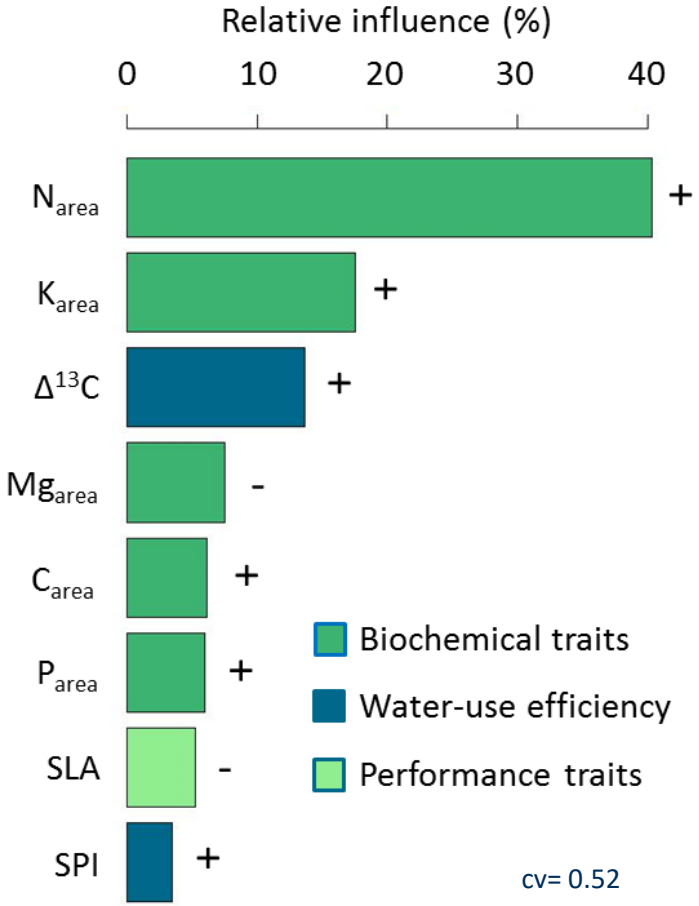
König et al. (2018), Global Ecology and Biogeography

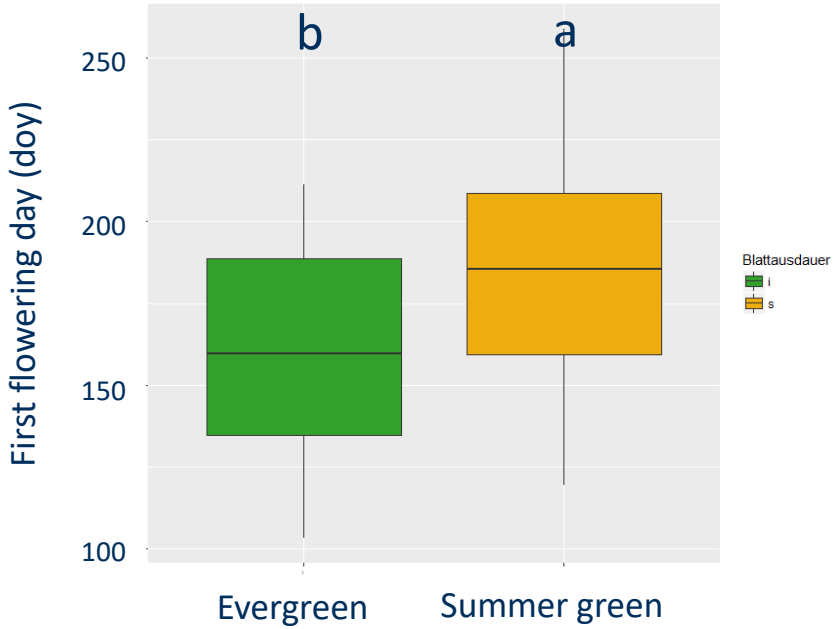
Bucher and Römermann (2020), Alpine Botany

Which traits are important for a species to determine phenology?



Bucher et al. (2018), Ecology and Evolution

N_{area} is most influential on the shift in phenology



Functional traits are more important to explain shifts in phenology than abiotic factors

Bucher and Römermann (2020), Alpine Botany

inflorescence preformation in buds clasified:

0 - only vegetative meristem

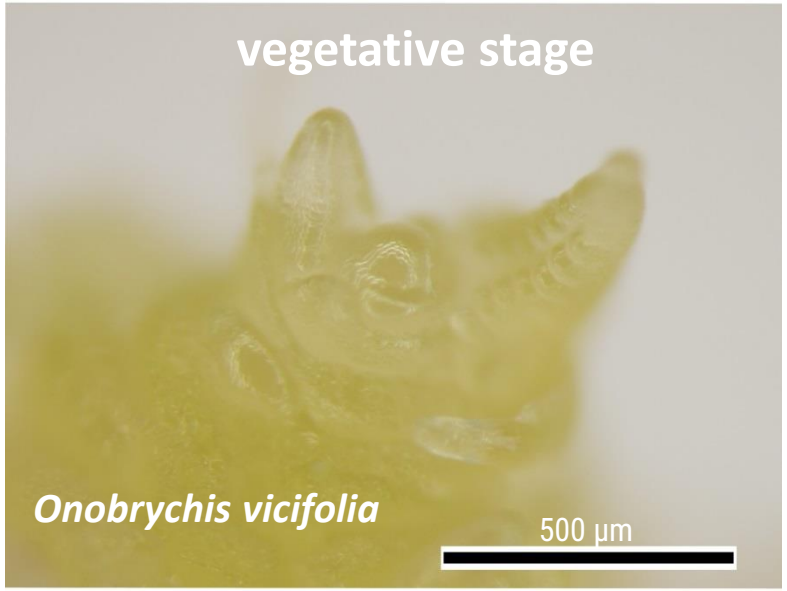
1 - initiatial stage – the meristem undergos the transition to generative stage

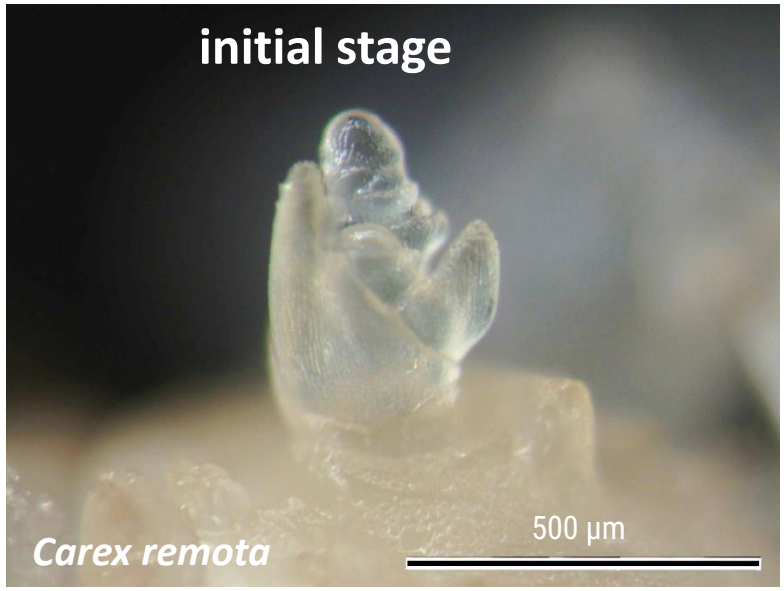
2 - primordial – the first primordia of few flower organs are visible

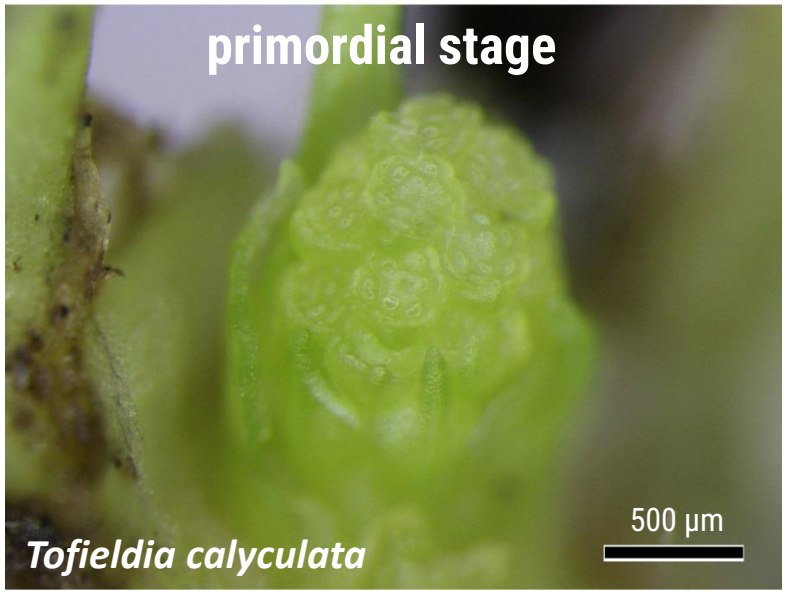
3 - primordial advanced – more primordia visible

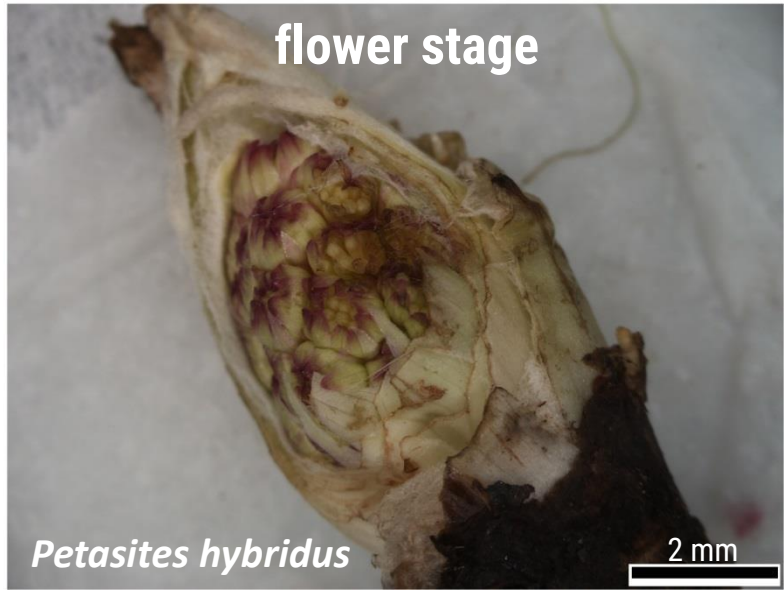
4 - full primordial – all primordia of the flower organs are present

5 - flower stage – all inflorescences developed





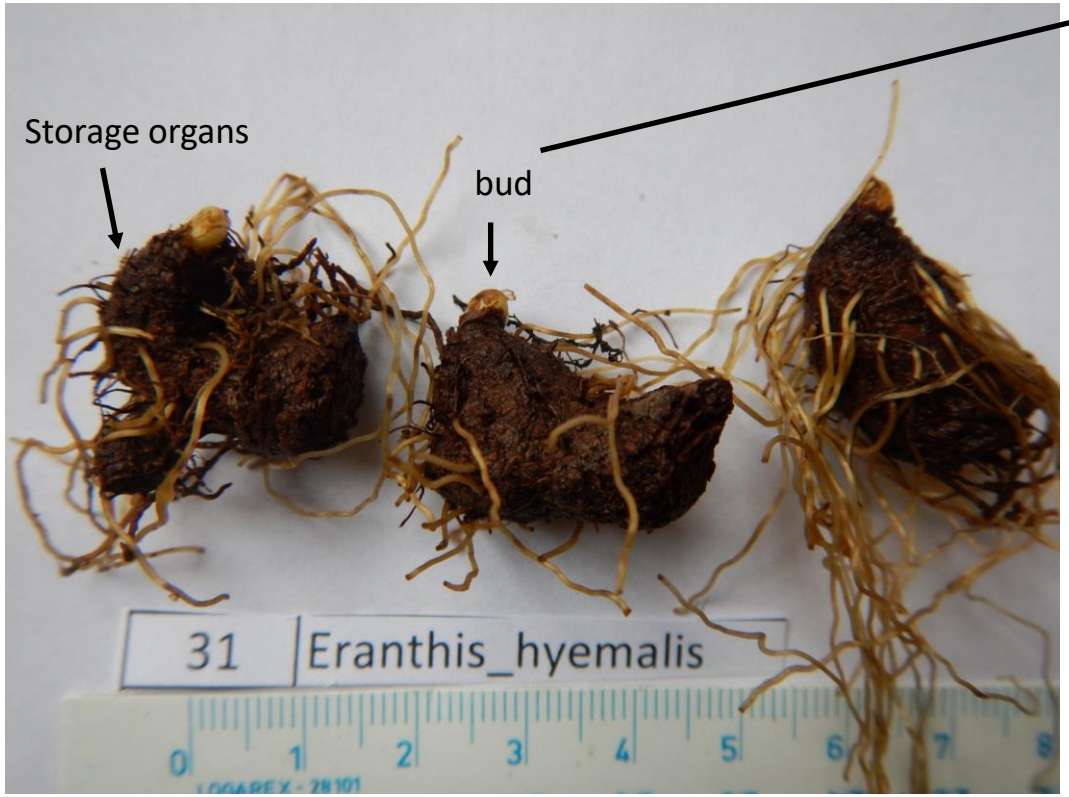


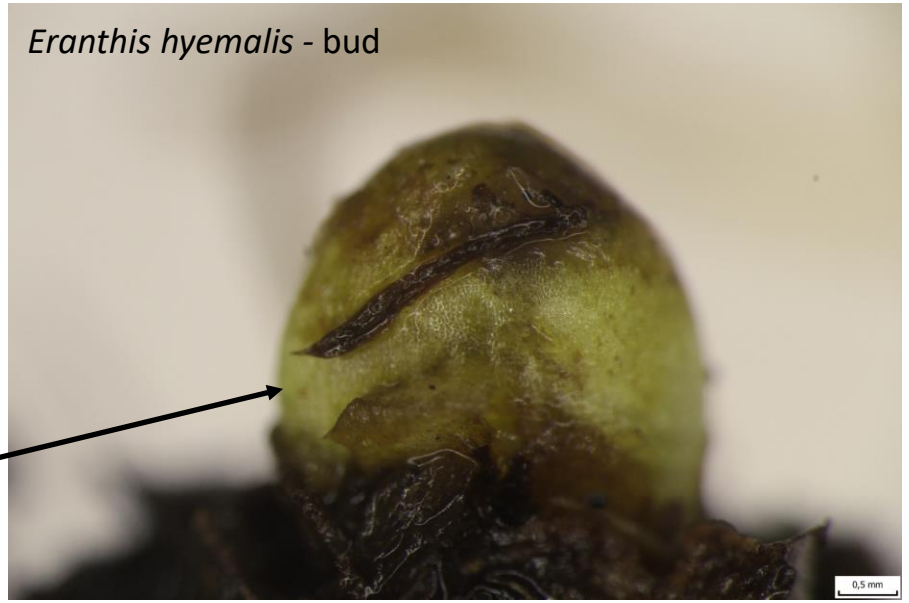


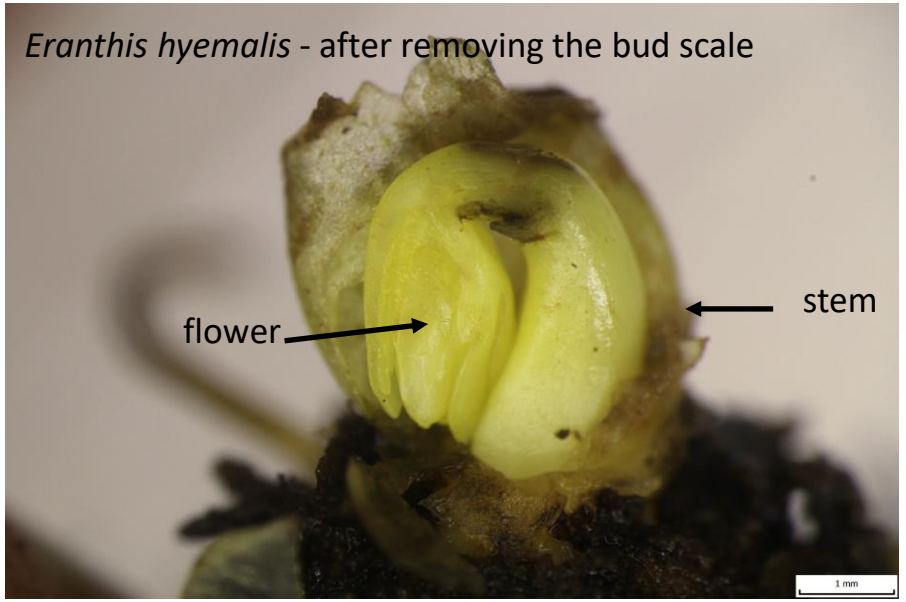
Schnablová et al., 2020, New Phytologist

Inflorescence preformation

Preparation of bud preformation

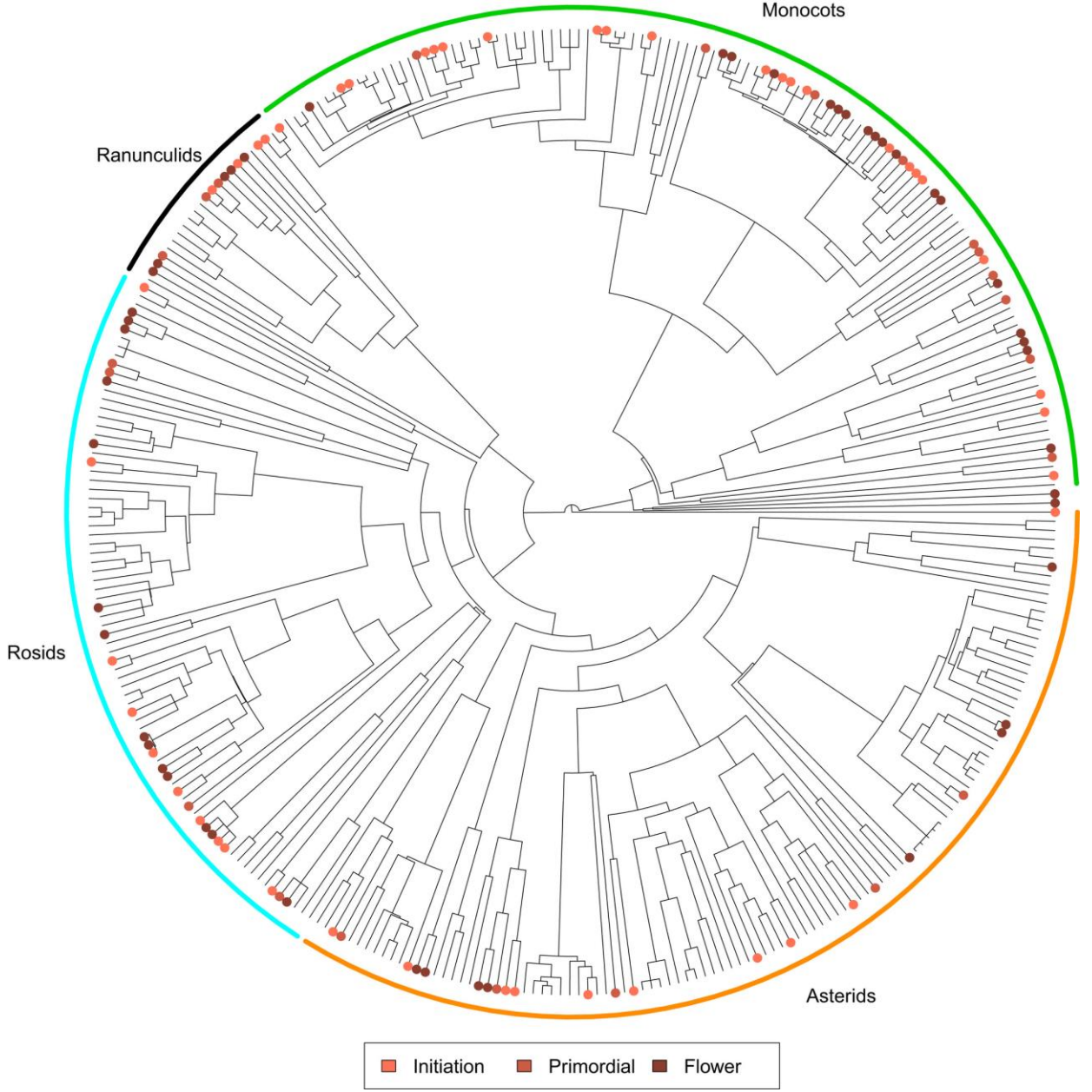






Preformation buds

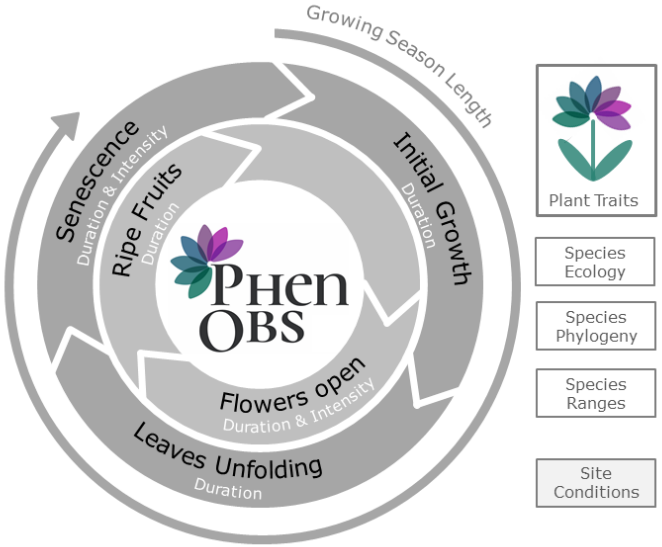
- Widely distributed, but non-randomly between species (phylogenetic signal)
- Is this important for phenology?

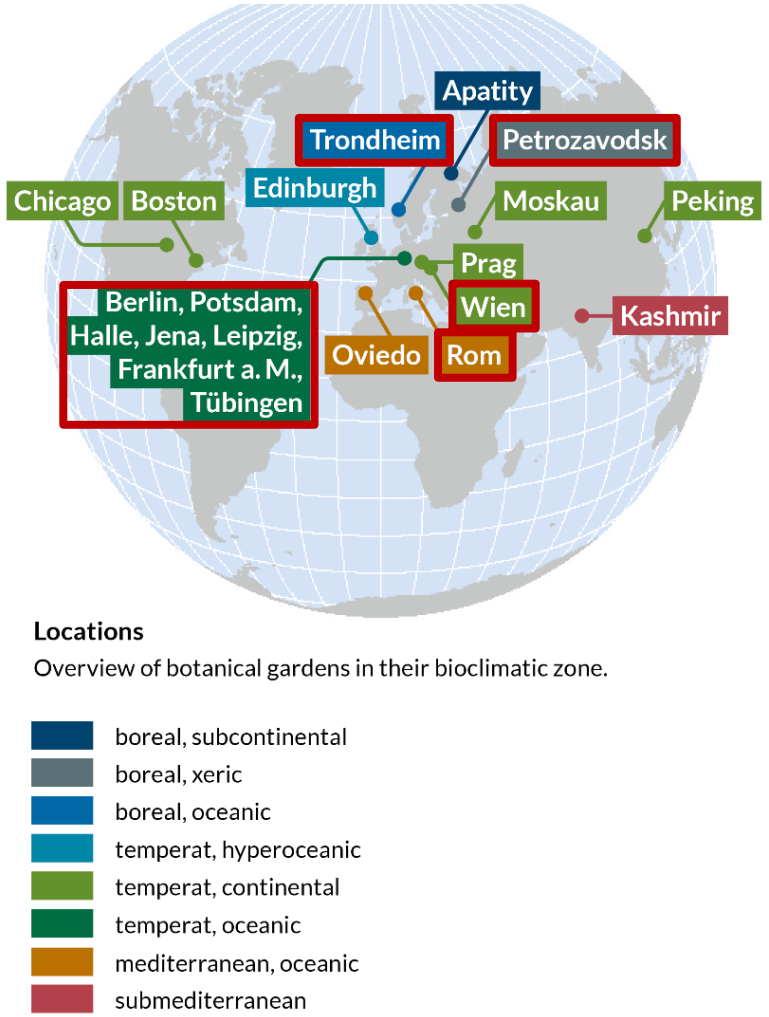


Schnablová et al., 2020, New Phytologist

The Phenobs initiative – monitoring phenology in herbaceous species

Network of 20 botanical gardens on the northern hemisphere





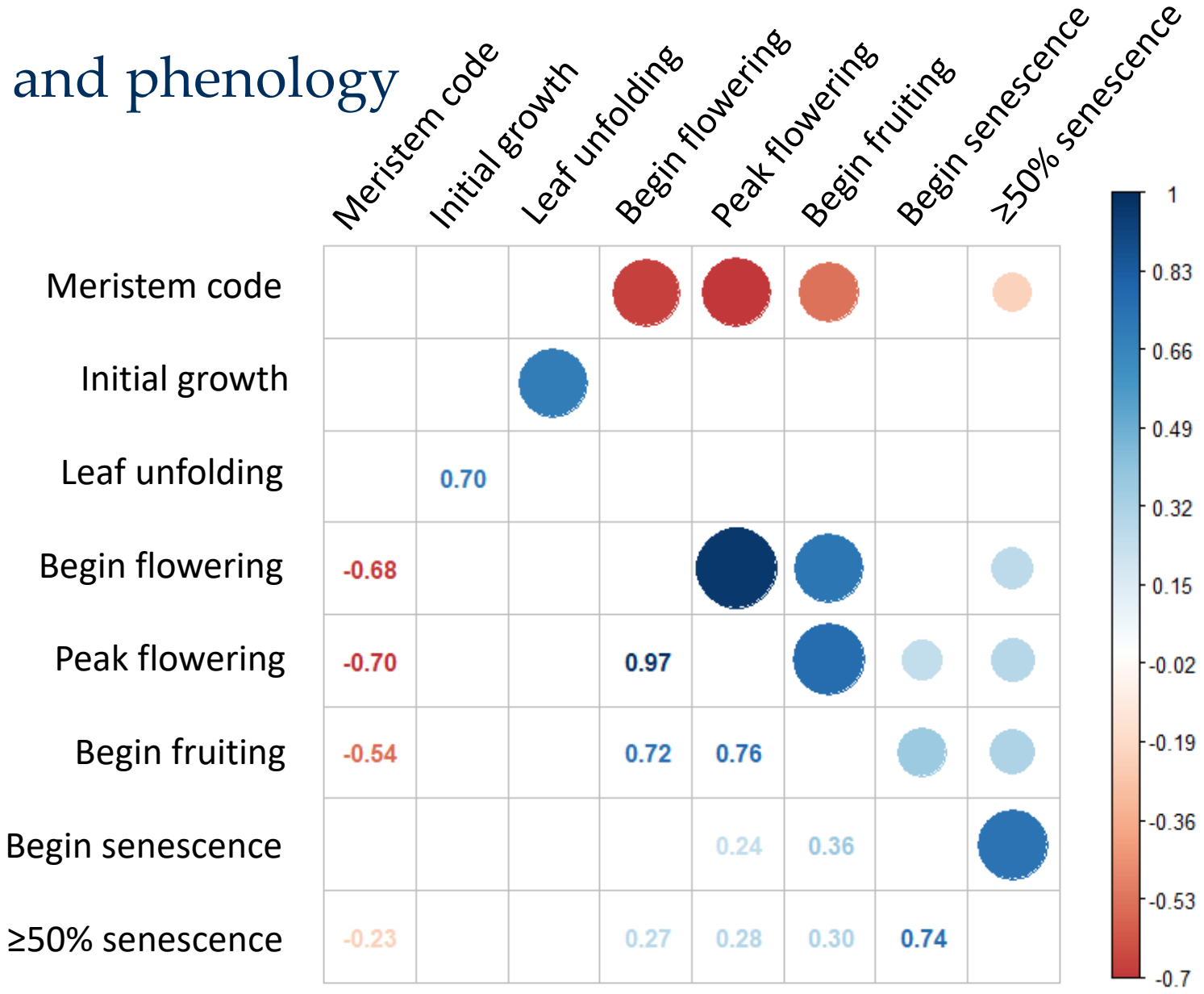
- Bud collection for 86 species
- Buds collected in Jena and Průhonice

Nordt et al. (2021), Journal of Functional Ecology

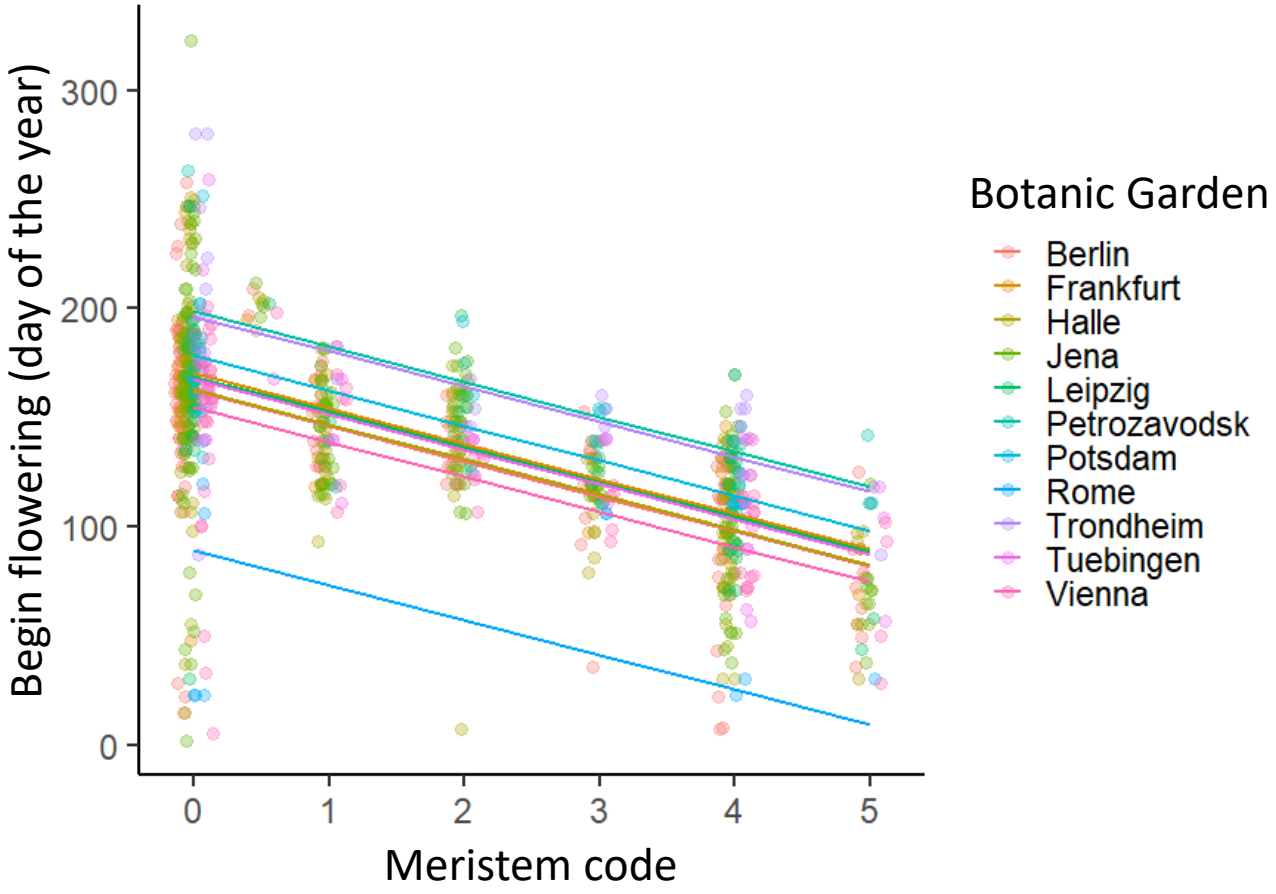
Bud collection in Jena 26.11.2020

Inflorescence preformation and phenology

- Plants with highly developed meristems grow and flower earlier and have an earlier fruit set and start senescence earlier
- Meristem developement has no effect on initial growth and begin of senescence



Phenology between the gardens

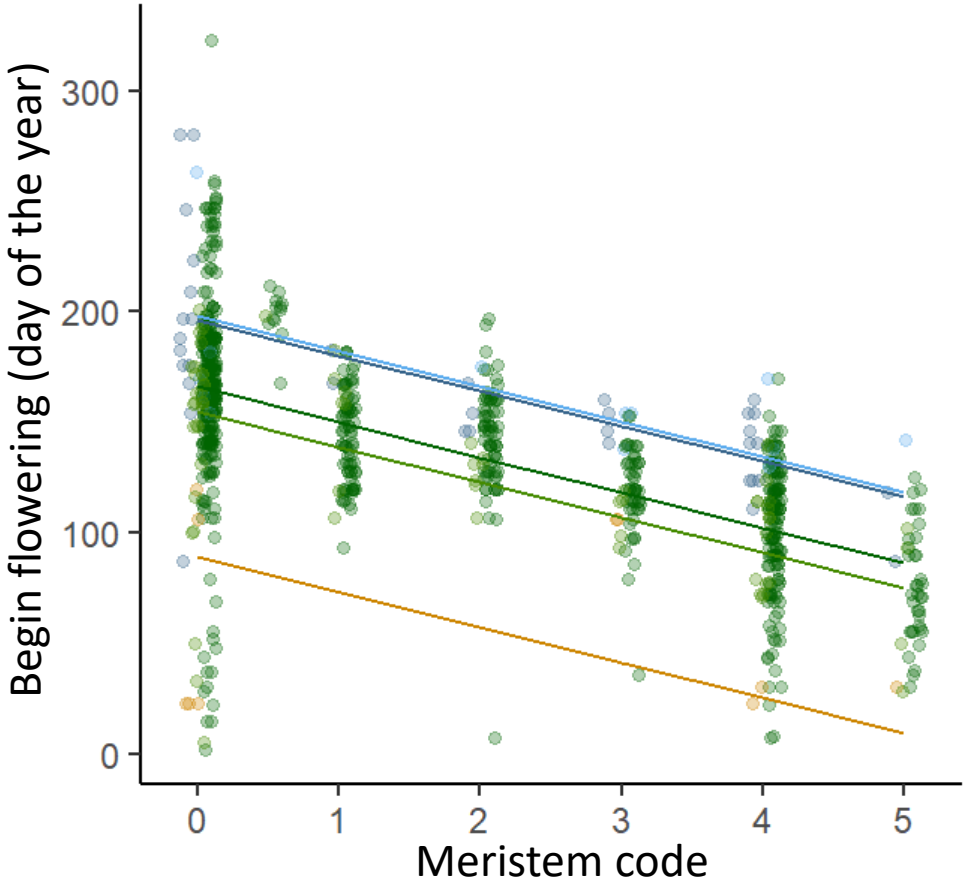


$R^2 = 0.45$, $F_{11, 800} = 58.9$, $p < 0.001$

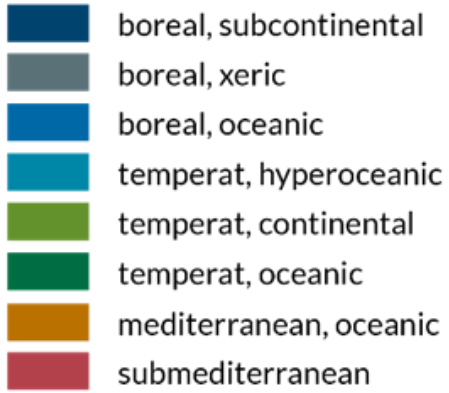
The higher meristem developed, the earlier the beginning of flowering

Trend consistent between gardens

Phenology between the gardens



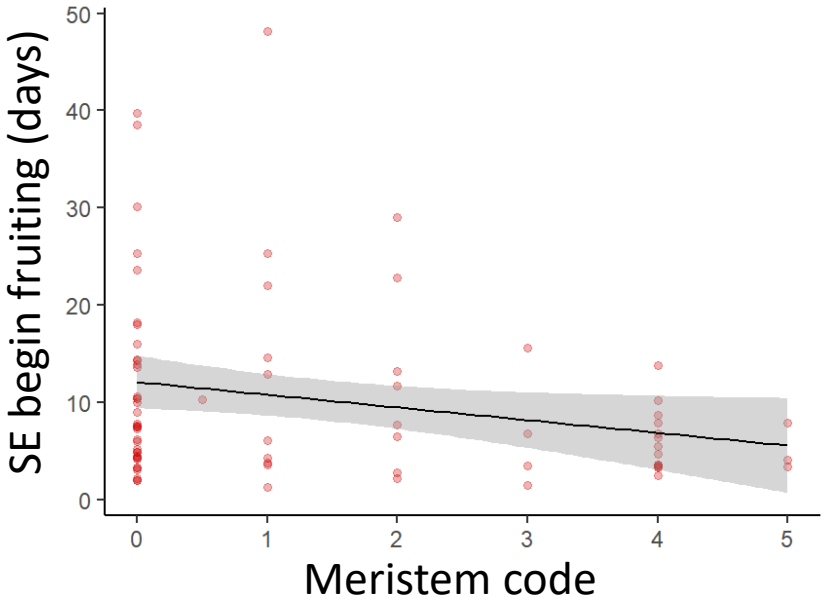
$R^2 = 0.44$, $F_{5, 806} = 126.9$, $p < 0.001$



Also consistent across climate types of gardens

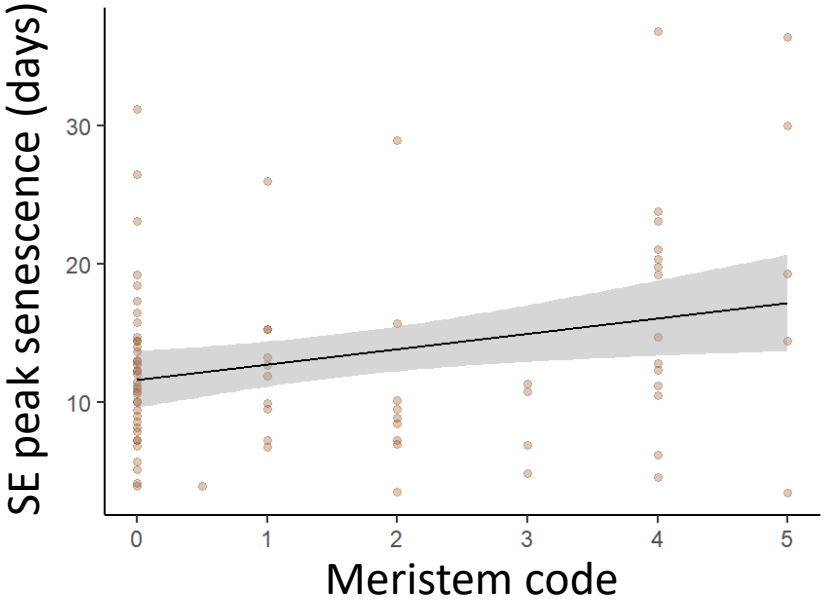
Meristem code and changes in phenology

Variability in phenology assessed via the standard error



$R^2 = 0.06$, $F_{1, 75} = 4.5$, $p < 0.05$

The higher meristem is developed, the less variable the onset of fruiting



$R^2 = 0.07$, $F_{1, 80} = 6.2$, $p < 0.05$

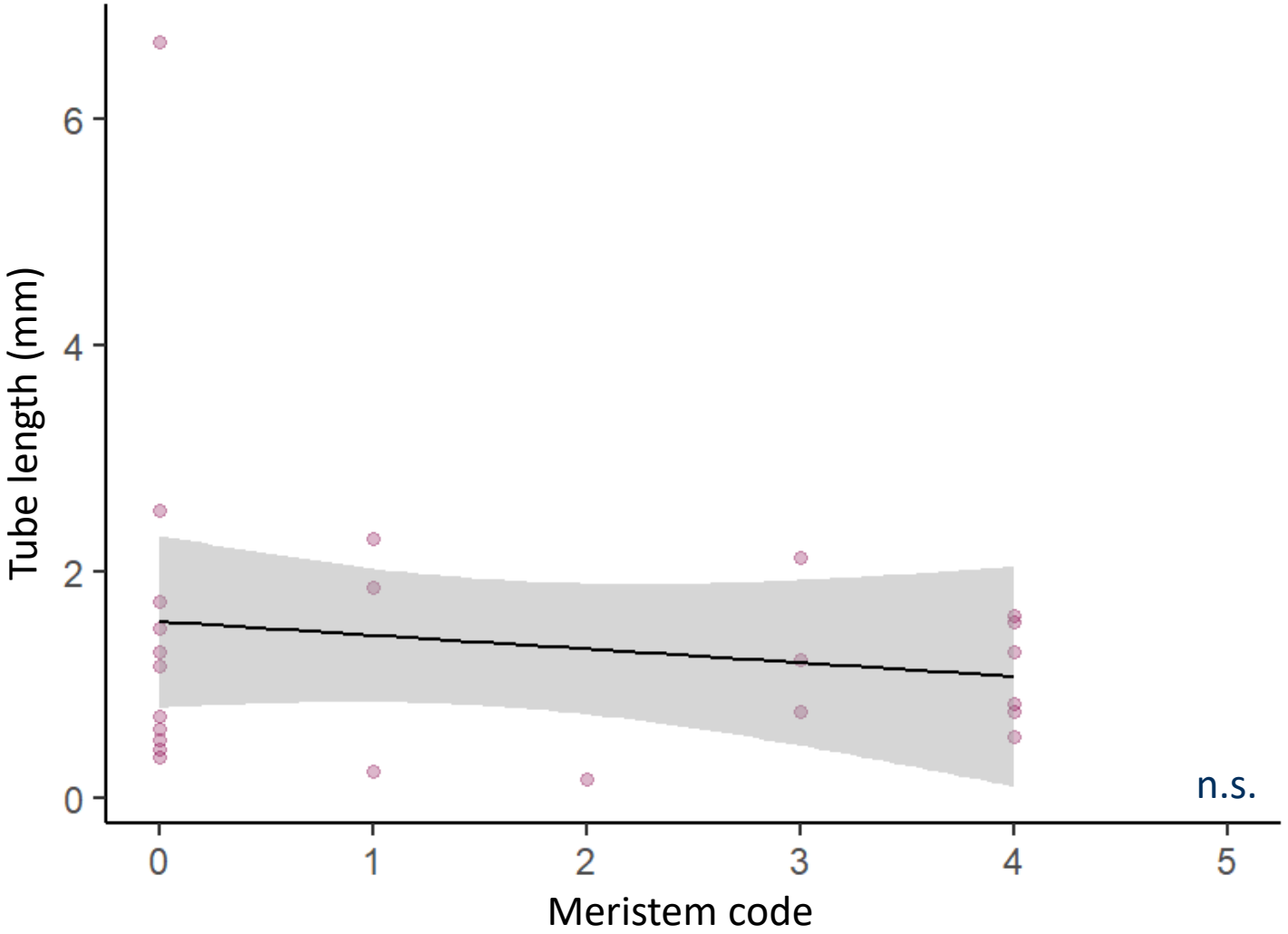
… but the more variable the onset of senescence

Meristem code and traits

- Smaller plants tend to have higher developed meristems
- No relationship with other leaf traits or seedmass

Meristem code and flowers

Meristem preformation is not related to flower traits such as tuble length, nectar content or flower size



Take home message

1. Inflorescence preformation is a widely understudied plant trait which affects phenology of species
2. The higher the stage of preformation, the earlier flowering phenology
3. Preformation impacts the variability of fruiting and senescence within species
4. Preformation is not linked to leaf or flower traits besides plant height

PhenObs
Botanical Gardens as a Global Phenological Observation Network

@BucherSolveig
Solveig.franziska.bucher@uni-jena.de

Thank you for listening

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