

A2

## Sexual and asexual genome evolution in flowering plants

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### State of the art

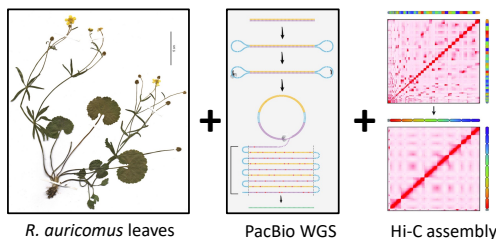
- Flowering plants can reproduce via sexual outcrossing, selfing, and via apomixis.
- Facultative sexuality might counteract genome-wide mutation accumulation<sup>2</sup>.
- Degree of facultative sexuality can be increased in plants by abiotic stress conditions (e.g., light stress, drought)<sup>1,4</sup>.
- Facultative selfing might increase purifying selection.
- Nuclear-organelle genome co-evolution in apomictic plants is unknown.

### Objectives

- To study actual mutation accumulation and other features (TEs, heterozygosity) on high-quality genomes in sexual / apomictic species pairs.
- To test experimentally that abiotic stress increases recombination rates and reduces mutation accumulation.
- To test the hypothesis that apomixis correlates with lower mutation rates in plastomes<sup>3</sup>.

### PhD 1 - Nuclear and organelle genome evolution of sexual and asexual plants

- Each three samples from sexual / apomictic tetraploid species of *Ranunculus auricomus* analyzed with PacBio Hifi, assembled with Hifiasm and Hi-C chromosome level assembly; collaboration with A. Papantonis.



- Analysis of mutation accumulation using dN/dS and the novel mutation-selection model by Söding group; comparison of structural variants, repetitive elements, heterozygosity.
- Analysis of plastomes (with additional samples with ONT sequencing) and comparison of mutation rates of apomictic / sexual taxa in plastomes (collaboration with J. & S. de Vries); optionally analysis of mt genome.

### PhD 2 - Effects of environmental stress on genome evolution

- Facultative sexual tetraploid plants exposed to different light stress conditions in climate growth chambers (selfed / outcrossed pollination)



- Analysis of sexual / apomictic seed formation via flow cytometric seed screen (Ulum et al. 2020). Progeny arrays with RADSeq to discriminate maternal / recombined seedlings.
- To test influence of stress on mutation rates, dN/dS and mutation-selection analysis on transcriptomes of seedling classes compared to mother plant and between selfed / outcrossed / apomictic progeny.
- Collaborations with S. Pöggeler on selfing and light stress, with C. Bleidorn on haploid selection, and with I. Friedrich on horizontal gene transfer.

### References

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4. Ulum FB, Costa Castro C, Hörandl E. 2020. Ploidy-dependent effects of light stress on the mode of reproduction in the *Ranunculus auricomus* complex (Ranunculaceae). *Front. Plant Sci.* 11: 104.

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