1. Polyploidy as evolutionary mechanism: Somatic origin of autopolyploidy?

Polyploidy, i.e. whole-genome duplication (WGD), is an efficient shortcut to generate both phenotypic and genotypic variation and is regarded as an important driver of plant evolution. One of the major knowledge gaps regarding autopolyploid is related to formation of polyploidy. This project will add to reduce this knowledge gap and increase our understanding of autopolyploidy as an evolutionary mechanism.

Subject keywords: autopolyploidy, stress, somatic polyploidy, formation of autopolyploid lineages
Background needed: Bachelor's in biology, familiar with evolutionary principles, knowledge of arctic vegetation is an advantage.

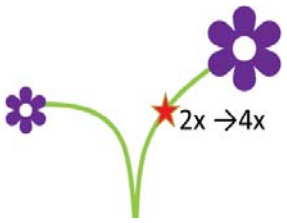

Figure 1 *When chromosome number is doubled in vegetative tissue that gives rise to reproductive organs, the formation of autopolyploid lineages can be mediated through somatic polyploidization.*

This thesis addresses the following questions

- Do somatic polyploidisation occur in natural S. oppositifolia? If so
- Under which environmental conditions is somatic polyploidisation induced (evaluated in both natural and controlled lab settings)?
- What happens when somatic polyploidisation is chemically induced under laboratory settings?

Methods: Field work and measures in situ, some invasive sampling, ploidy estimates through flow cytometry, experiments in climate lab, statistical analyses

2. Polyploidy as evolutionary mechanism: Resource allocation and photosynthetic capacity among ploidy levels along environmental gradients

Polyploidy, i.e. whole-genome duplication (WGD), is an efficient shortcut to generate both phenotypic and genotypic variation and is regarded as an important driver of plant evolution. One of the major knowledge gaps regarding autopolyploid is related to establishment of new polyploid lineages. For a new lineage to establish, a niche shift must occur; the competitive exclusion principle states that two species can't coexist if they occupy exactly the same niche. This project use Saxifraga oppositifolia as model species to evaluate morphological and physiological differences induced by polyploidization, and how this may have enabled a niche shift and thus establishment of a tetraploid lineage.

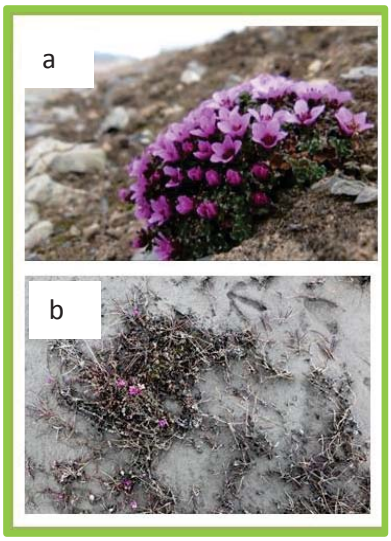

Fig. 1 *Saxifraga oppositifolia is an outcrossing, insect-pollinated species that thrives in a wide range of habitats, from early-melting, extremely dry ridges with long growing season (a), to moist river beds (b).*

Subject keywords: autopolyploidy, photosynthetic capacity, niche differentiation, establishment of autopolyploid lineages

This thesis addresses the following questions

- *How do photosynthetic activity vary in relation to ploidy level, habitat, growth form and resource allocation, and how do these parameters interact?*
- *Seen in the light of the competitive exclusion principle, how are putative ploidy-specific traits related to putative ploidy-specific habitats?*

Background needed: Bachelor's in biology, familiar with evolutionary principles, knowledge of plant physiology is an advantage.

Methods: Field work, invasive sampling for allocation analyses, photosynthetic yield measurements using mini-pam II, ploidy estimates through flow cytometry, experiments in climate lab, statistical analyses

3. The flower – pollinator interplay: impact of pollinator guild on efficient outcrossing

Plants are not mobile and are dependent on vectors such as pollinators to aid in the transfer of pollen (plant sperm) from one plant to another to produce offspring that are genetically diverse individuals. In insect pollinated plants, timing of flowering must therefore match the periods where pollinators are present. But the in the Arctic there are few available pollinators, and the pollinator guilds present are often dominated by more generalist pollinators. The arctic-alpine plant species *Silene acaulis* (L.) Jacq. provides a well-suited study system to investigate links between pollinator guild, reproductive output and genetic diversity (Fig.1). In this project you combine collection of own data and utilize available data collected over two seasons from three different locations with contrasting pollinator guilds.

Figure 1. *Silene acaulis* grow dense cushions. The microclimate in the cushion usually makes flowers appear first on the south side of the cushion.

Subject keywords: reproduction, genetic diversity, pollination, gender bias

This thesis addresses the following questions

- *How do pollinator numbers and composition differ among locations?*
- *Are there discrepancies among overall pollinator community and pollinators visiting Silene acaulis?*
- *How do pollinator numbers and composition relate to factors such as population density, demography, reproductive output, gender composition (i.e. hermaphrodites with the ability of self-pollination versus females that are dependent on outcrossing?*
- *How do pollinator numbers and composition relate to genetic diversity (at population level and between mother and off-spring)?*

Background needed: Bachelor's in biology, familiar with evolutionary principles, knowledge of molecular analyses and R is an advantage.

Methods: Analyses of time-laps pictures, molecular lab/genotyping through microsatellites, statistical analyses