

Origin of apomictic cytotypes of *Potentilla puberula* and their genetic relationship with sexuals

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Introduction

Potentilla puberula Krašan (Rosaceae) is a Central European plant species which shows a continuous ploidy series ranging from 4x to 8x. These cytotypes are associated with different reproductive modes, with the 4x being almost always sexual and self-incompatible and the 5–8x being usually apomictic and self-compatible [1].

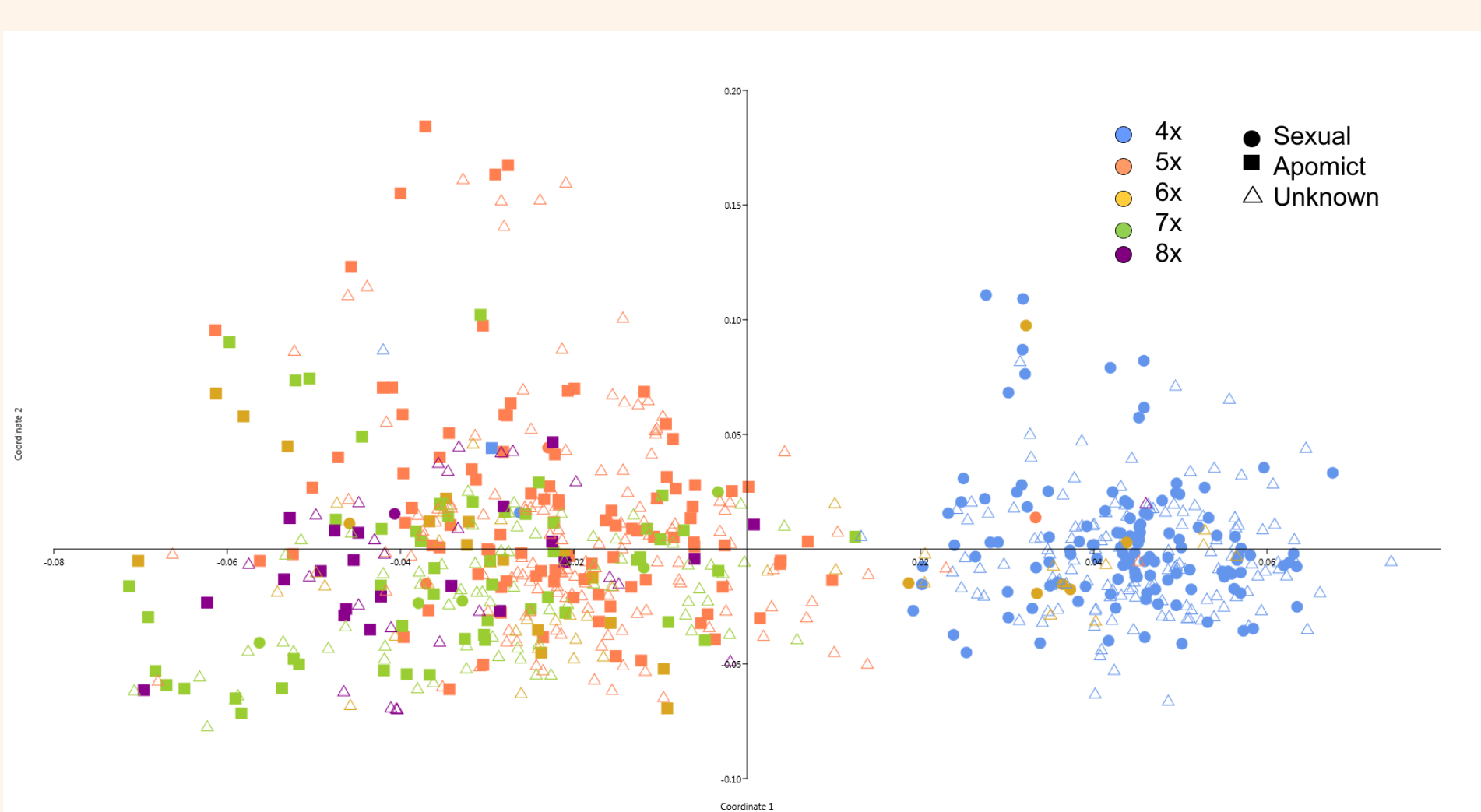
Aim of the study:

- to investigate the **genetic relationship of the cytotypes**
- to understand whether the 5–8x originated from **hybridization of 4x** with other closely-related species or via **autopolyploidy**.

Material and methods

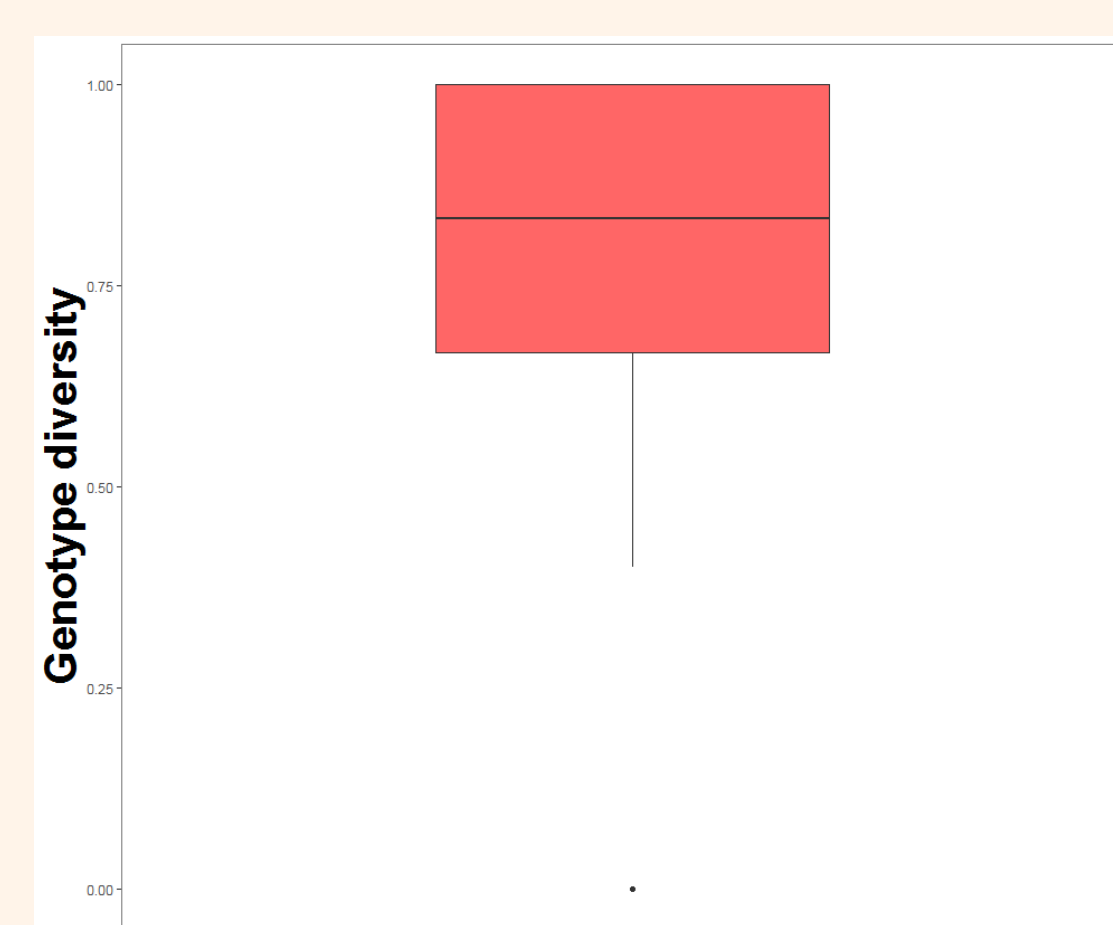
- 770 individuals of *P. puberula* from 140 populations of the Eastern Alps
- 116 individuals from 27 populations of 7 closely related species (*P. argentea* L., *P. aurea* L., *P. brauneana* Hoppe, *P. crantzii* (Crantz) Beck ex Fritsch, *P. frigida* Vill., *P. grandiflora* L., *P. incana* G.Gaertn., B.Mey. & Scherb.)
- Ploidy and genome size determined by flow cytometry, and reproductive mode by flow cytometric seed screening [2]
- AFLP fingerprinting

Result 1. Intraspecific variation



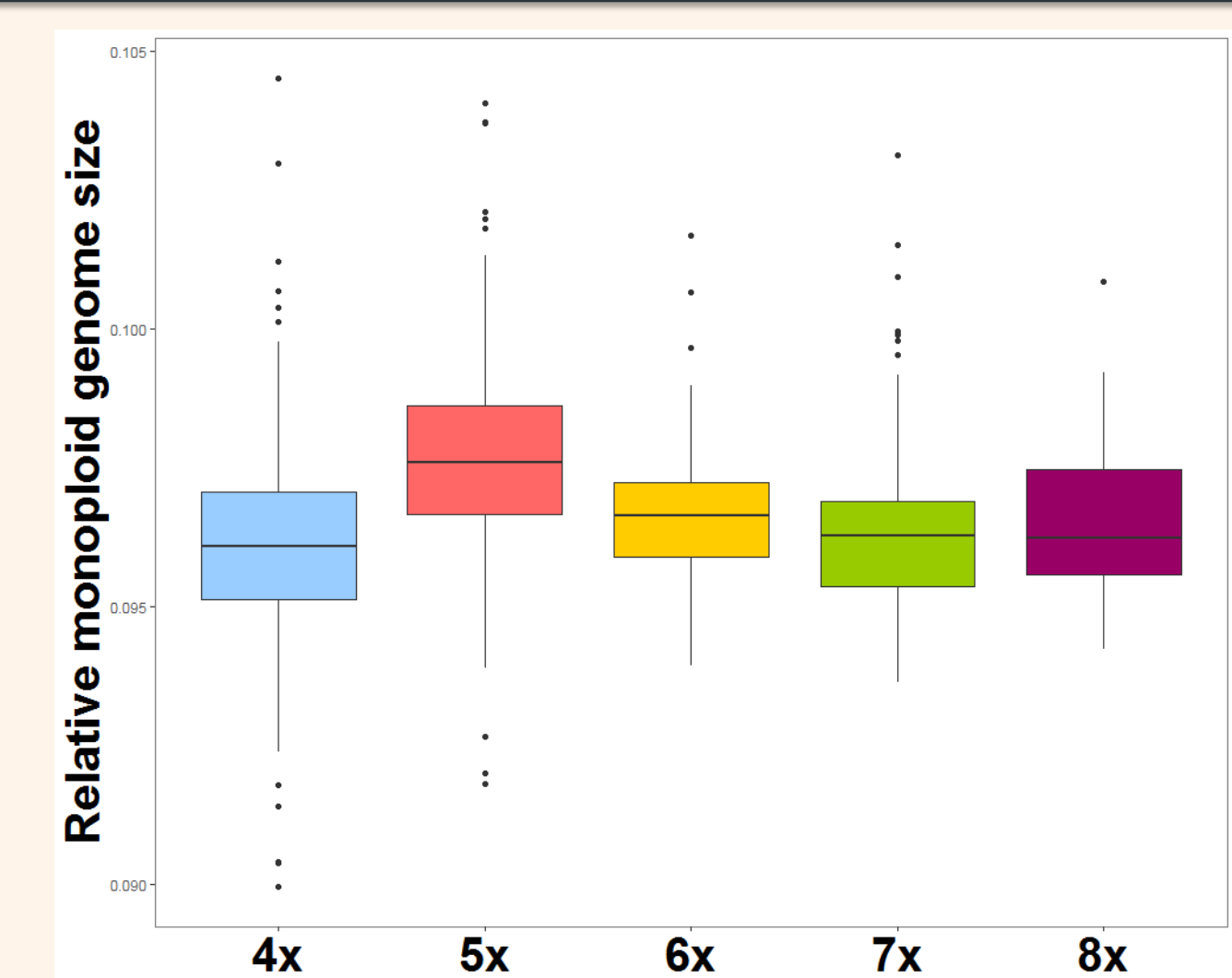
PCoA of cytotypes of *P. puberula*, based on Dice distances of 397 AFLP markers. Reproductive modes are represented in different symbols.

Result 2. Low clonality in 5-8x



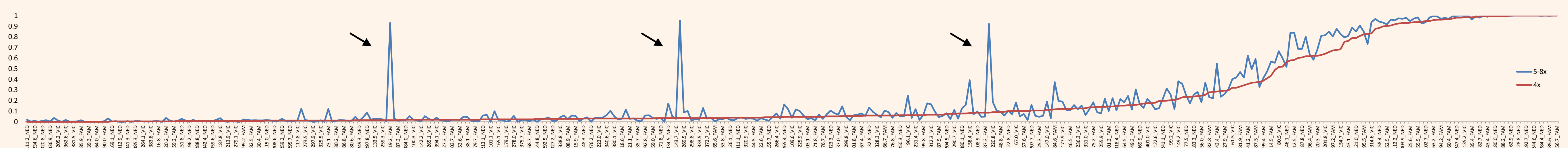
Genotype diversity after Nei [3] in apomictic 5–8x populations.

Result 3. Relative monoploid genome size



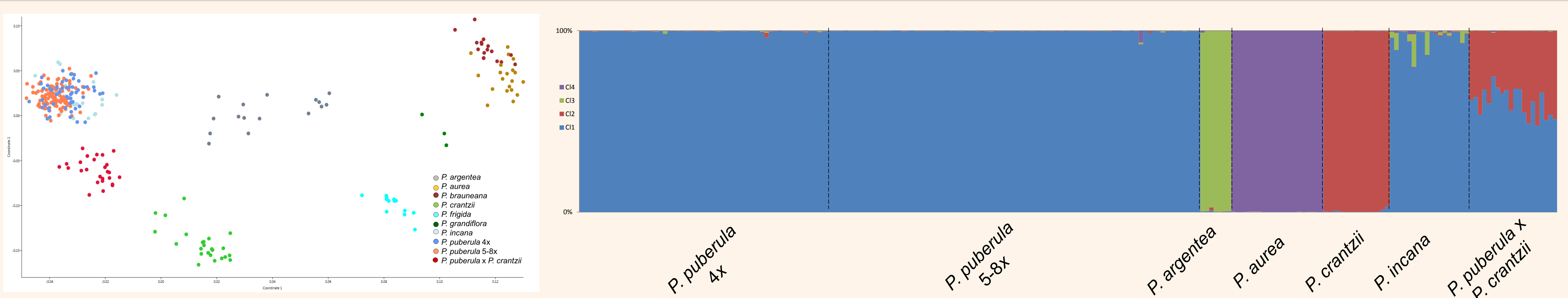
Relative monoploid genome size of *P. puberula* cytotypes. Pentaploids show a significantly higher monoploid genome size than the other cytotypes.

Result 4. Identification of private alleles in 5-8x *P. puberula*.



Frequencies of presence of each AFLP marker in 4x and 5–8x *P. puberula*, ordered by frequency in 4x. All identified hybrids *P. puberula* x *P. crantzii* were removed. The arrows indicate three markers which are fixed in 5–8x and absent from 4x. None of these was found in the other studied species.

Result 5. Relationships between *P. puberula* and other species based on 390 AFLP markers



Preliminary conclusions and further investigations

In the interspecific comparison (Result 5), the whole *P. puberula* appears as a coherent species, but very close or even conspecific to *P. incana* (both members of the *P. verna* agg.). Apomictic 5–8x are not immediately identifiable as of allopolyploid origin. However, the intraspecific comparison (Results 1 and 4) revealed that 4x and 5–8x are genetically clearly differentiated, a result not compatible with a recent autopolyploid origin of apomicts (Result 2).

We thus formulate two alternative hypotheses which potentially explain the origin of the apomictic cytotypes:

- The first 5–8x originated by **autopolyploidy** from 4x individuals. The present 5–8x diversity and distance to 4x have derived from mutational events including genomic reorganization (testifying for a very old event).
- The first 5–8x originated by **hybridization** of 4x with a very closely related species not sampled in this study, possibly one of the unidentified parental species of *P. puberula* [3].

In both cases, maintenance of the genetic differentiation between reproductive modes appears possible under the scenario of occasional fertilization of 4x by 5–8x derived pollen (asymmetric introgression from 4x to 5–8x) and consequent recurrent formation of new apomicts from within the apomictic group.

References

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