

Supplementary Table S1. Candidates of putative GP patterns with uncertain data

Taxon	Family	Arctic/alpine	Type of apomixis	Type of pollination	Ploidy difference of apomicts/sexuals	GP pattern	Record
<i>Leontopodium alpinum</i> ¹	Asteraceae	yes	GA	A	yes	?	[1]
<i>Draba spectabilis/spectrobrachia</i> ²	Brassicaceae	yes	?	?	?	?	[2]
<i>Calamagrostis purpurascens</i> ³	Poaceae	yes	?	?	?	?	[2]
<i>Poa alpina</i> ³	Poaceae	yes	GA, SA, vivipary	P	yes	?	[1, 2]
<i>Poa fendleriana</i> ⁴	Poaceae	yes	GA	A	?	?	[2]
<i>Alchemilla spp.</i> ⁵	Rosaceae	yes	GA	A	unknown	?	[1]
<i>Potentilla delphinensis</i> ³	Rosaceae	yes	GA	A	unknown	?	[1]
<i>Potentilla niveda</i> ³	Rosaceae	yes	GA	A	unknown	?	[1]

¹Only sexual reproduction in the Alps found more recently [3, 4]

²Original record does not give evidence for apomixis

³Geographical istribution of sexual/apomictic taxa unknown or not documented in publications

⁴Recorded as abstract only, no other published data

⁵Many obligate apomictic, polyploid taxa in the European Alps, but sexual relatives unknown

- Hörandl, E., Evolution and biogeography of alpine apomictic plants. *Taxon* **2011**, 60, 390-402.
- Bierzychudek, P., Patterns in plant parthenogenesis. *Experientia* **1985**, 41, 1255-1264.
- Hörandl, E.; Dobes, C.; Suda, J.; Vit, P.; Urfus, T.; Temsch, E.M., . . . Ladinig, U., Apomixis is not prevalent in subnival to nival plants of the European Alps. *Annals of Botany* **2011**, 108, 381-390. 10.1093/aob/mcr142
- Pegoraro, L.; Baker, E.C.; Aeschmann, D.; Balant, M.; Douzet, R.; Garnatje, T., . . . Pellicer, J., The correlation of phylogenetics, elevation and ploidy on the incidence of apomixis in Asteraceae in the European Alps. *Bot. J. Linnean Soc.* **2020**, 194, 410-422. 10.1093/botlinnean/boaa058

Supplementary Table S2. Presence/absence Table of data reported in Table 1 and statistical tests of associations between factors.

Data of Table 1 (columns arctic/alpine, Type of pollination, ploidy difference, and GP patterns separately for S, L, N, G were coded as presence/absence according to the literature cited in Table 1; cases with missing data were excluded from the respective analysis. Percentages of presences are visualized in Figure 1. Associations between the main putative causal factors were calculated as contingency tables and tested with chi square and Fisher's exact test using Past vs. 4.03 [1], the null hypotheses is no association). Degree of freedom = 1 in all calculations. Significant associations marked in bold.

Presence/absence matrix

Species	arctic/alpine	Separation	Pollination type	Ploidy difference	Larger	Northern	Glaciated
<i>Antennaria friesiana</i>	1	1	1	1	1	1	0
<i>Antennaria monocephala</i>	1	1	1	1	1	1	0
<i>Antennaria parlinii</i>	0	1	1	0	0	0	1
<i>Antennaria rosea</i> complex	1	1	1	1	1	1	0
<i>Arnica alpina</i>	1	1	1	1	1	1	0

<i>Arnica amplexicaulis</i>	1	1	1	1	1	1	0
<i>Arnica angustifolia</i>	1	1	1	1	0	0	1
<i>Arnica chamissonis</i>	1	1	1	1	1	1	0
<i>Arnica lessingii</i>	1	1	1	1	1	1	0
<i>Arnica lonchophylla</i>	1	1	1	1	1	1	1
<i>Arnica louiseana</i>	1	1	1	1	1	1	0
<i>Arnica mollis</i>	1	1	1	1	1	1	0
<i>Chondrilla juncea</i>	0	1	1	1	1	1	0
<i>Crepis acuminata</i>	0	0	1	1	0	0	0
<i>Crepis bakeri</i>	1	1	1	1	1	1	0
<i>Crepis exilis</i>	1	1	1	1	1	1	0
<i>Crepis modocensis</i>	1	1	1	1	1	1	1
<i>Crepis monticola</i>	1	1	1	1	1	1	0
<i>Crepis occidentalis</i>	1	1	1	1	1	1	1
<i>Crepis pleurocarpa</i>	1	1	1	1	1	1	0
<i>Erigeron strigosus</i>	0	1	1	1	1	1	0
<i>Eupatorium altissimum</i>	0	1	1	1	1	1	1
<i>Eupatorium cuneifolium</i>	0	1	1	1	1	1	0
<i>Eupatorium lecheaefolium</i>	0	1	1	1	1	1	0
<i>Eupatorium leucolepis</i>	0	1	1	1	1	1	0
<i>Eupatorium pilosum</i>	0	1	1	1	1	1	0
<i>Eupatorium rotundifolium</i>	0	1	1	1	1	1	0
<i>Eupatorium sessilifolium</i>	0	1	1	1	1	1	1
<i>Hieracium alpinum</i>	1	1	1	1	1	1	1
<i>Hieracium intybaceum</i>	1	1	1	1	0	0	0
<i>Hieracium pilosella</i> s.l.	1	1	1	1	0	1	0
<i>Parthenium argentatum</i>	0	1	0	1	1	1	0
<i>Taraxacum</i> Sect. <i>Alpestris</i>	1	1	1	1	1	1	1
<i>Taraxacum</i> Sect. <i>Ruderalia</i>	1	1	1	1	1	1	0
<i>Taraxacum</i> Sect. <i>Erythrosperma</i>	1	1	1	1	1	1	0
<i>Townsendia condensata</i>	1	1	1	1	1	1	1
<i>Townsendia exscapa</i>	1	1	1	1	1	1	1
<i>Townsendia grandiflora</i>	1	1	1	1	0	0	0
<i>Townsendia hookeri</i>	1	1	1	1	1	0	1
<i>Townsendia incana</i>	1	1	1	1	1	1	0
<i>Townsendia leptotes</i>	1	1	1	1	1	1	1
<i>Townsendia montana</i>	1	1	1	1	1	1	0
<i>Townsendia parryi</i>	1	1	1	1	1	1	1
<i>Townsendia rothrockii</i>	1	1	1	1	0	0	1
<i>Townsendia scapigera</i>	1	0	1		0	0	0
<i>Townsendia spathulata</i>	1	0	1		0	0	0
<i>Townsendia strigosa</i>	1	1	1		0	1	0
<i>Handroanthus ochraceus</i>	0	1	0	1	0	0	0
<i>Boechera collinsii</i>	0	0	0	0	0	0	0
<i>Boechera crandallii</i>	1	1	0	0	0	0	0
<i>Boechera divaricarpa</i>	1	0	0	0	0	0	0
<i>Boechera fendleri</i>	1	0	0	0	0	0	0
<i>Boechera holboellii</i>	1	0	0	0	0	0	0

<i>Boechera lemmonii</i>	1	0	0	0	0	0	0
<i>Boechera lyallii</i>	1	0	0	0	0	0	0
<i>Boechera microphylla</i>	1	0	0	0	0	0	0
<i>Boechera pallidifolia</i>	1	0	0	0	0	0	0
<i>Boechera pauciflora</i>	1	0	0	0	0	0	0
<i>Boechera pendulocarpa</i>	1	0	0	0	0	0	0
<i>Boechera perennans</i>	0	0	0	0	0	0	0
<i>Boechera pinetorum</i>	1	0	0	0	0	0	0
<i>Boechera puberula</i>	1	0	0	0	0	0	0
<i>Boechera retrofracta</i>	1	1	0	1	0	0	0
<i>Boechera sparsiflora</i>	1	0	0	0	0	0	0
<i>Boechera spatifolia</i>	1	0	0	0	0	0	0
<i>Boechera stricta</i>	1	1	0	0	0	0	0
<i>Boechera williamsii</i>	1	0	0	0	0	0	0
<i>Hypericum perforatum</i>	1			1			
<i>Hypericum maculatum</i>	1			1			
<i>Eriotheca gracilipes/pubescens</i>	0	1	0	1	1	0	0
<i>Nigritella nigra complex</i>	1	1	1	1	1	1	1
<i>Spirnathes magnicamporum</i>	0	1	1		0	0	0
<i>Spiranthes ochroleuca</i>	0	1	1		0	1	0
<i>Limonium algarvense</i>	0	1	1	1	0	0	0
<i>Limonium binervosum/ovalifolium</i>	0	1	1	1	1	1	1
<i>Bouteloua curtipendula</i>	0	0	0	1	0	0	0
<i>Calamagrostis stricta</i>	1	1	1	1	0	0	0
<i>Paspalum intermedium</i>	0	1	0	1	1	1	0
<i>Paspalum simplex</i>	0	1	0	1	1	1	0
<i>Poa cusickii</i> ssp. <i>cusickii</i>	1	1	1	1	0	0	0
<i>Poa pringlei</i>	1	1	1		0	1	0
<i>Ranunculus auricomus</i> agg.	1	1	0	1	1	1	1
<i>Ranunculus kuepferi</i>	1	1	0	1	1	1	1
<i>Ranunculus parnassifolius</i> s.l.	1	1	0	1	1	1	1
<i>Amelanchier bartramiana</i>	0	1	0	1	0	1	0
<i>Amelanchier cusickii/alnifolia</i>	1	1	0	1	0	1	0
<i>Crataegus</i> ser. <i>Douglasiana</i>	0	1	0	1	1	1	0
<i>Potentilla crantzii</i>	1	1	0	1	1	1	1
<i>Potentilla puberula</i>	1	1	0	1	0	1	0
<i>Rubus</i> sect. <i>Rubus</i>	0	1	0	1	1	1	0
Sum of cases	90	88	88	84	88	88	88
Presence	64	68	54	65	48	53	21
Absence	26	20	34	19	40	35	67

Percentages of presences 71,1% 77,3% 61,4% 77,4% 54,5% 60,2% 23,9%

Test statistics

Pairwise comparisons	No. of cases	Chi-square p	Fisher's exact p	association
Arctic/alpine - geographical separation (S)	90	0.396	0.498	yes
Autonomous apomixis (A) - geographical separation (S)	88	0.022	0.033	no
Autonomous apomixis (A) - larger distribution area of apomicts (L)	88	0.359	0.448	yes
Autonomous apomixis (A) - more polar distribution of apomicts (N)	88	0.887	1.000	yes
Autonomous apomixis (A) – only apomicts in previously glaciated areas (G)	88	4.90E-07	7.87E-07	no
Ploidy difference - Autonomous apomixis (A)	82	0.012	0.019	no
Ploidy difference - geographical separation (S)	84	1.000	1.000	yes
Ploidy difference - larger distribution area of apomicts (L)	84	0.008	0.013	no
Ploidy difference - more polar distribution of apomicts (N)	84	0.019	0.03	no
Ploidy difference – only apomicts in previously glaciated areas (G)	84	1.11E-11	1.09E-11	no

1. Hammer, O. Past 4 - the Past of the Future. (PAleontological Statistics). <https://www.nhm.uio.no/english/research/resources/past/> (30th Nov 2022),