

Silene Hybridisation in Bute

Ivor Gibbs

Summary

This study of hybridisation between Silene alba and S dioica (White and Red Campion) in Bute, was undertaken in 1994 as an Open University project. The aim was to discover whether the two species interbreed on Bute (despite the rarity of the White Campion), and which factors promote hybridisation. The investigation was in two parts; two sites were chosen with differing habitats and a comparison made between them.

Site 1

Procedure

Site 1 was in SE Bute, near Ascog, on Old Red Sandstone bedrock, at an altitude of about 40m OD, under a single line of holly trees running north/south. Samples were taken on 24 July 1994, at approximately 1m intervals, using all available plants with both flowers and seeds. The characteristics measured were those listed in Appendix 1, omitting numbers 5 and 9. In respect of the latter it was noted that the population as a whole was visited by both bees and moths.

Results

These are detailed in Appendix 3, and show that of the 25 samples investigated:

2 samples are introgressed towards *S dioica*

4 samples are introgressed towards *S alba*

19 samples are hybrids

The population is polymorphic for all characters measured.

Discussion

These results indicate an hybrid population, with relatively little introgression toward either parent. The presence of *S alba* characteristics to this degree is perplexing, given that *S alba* has seldom been reported on Bute. A survey by a local botanist (Boyd 1983) reported "S dioica common on the island, 2 white varieties found in the north of the island, sport?" A survey of vascular plants on Bute (Church 1988) lists *S dioica* but not *S alba*. Local botanists have noted a single specimen in each of the last 3 years. Published distribution maps (Atlas of the British Flora) show *S dioica* to be well distributed in western Scotland, while *S alba* is mostly found in eastern Scotland with few records in the west.

Sample 11 was most introgressed toward *S dioica* compared to the population as a whole, although the spotted flowers were found on another 8 samples. Sample 5 was most introgressed toward *S alba* and shows the interesting seed patterns most frequent in the population as a whole. These were a mixture of black, brown and grey (9), the next most common being black (8) and brown (7), sample 13 being the only plant with all grey seeds.

The hybrid index histogram, Appendix 2, is neither skewed toward one parent indicating an introgression, nor a flattened peak indicating an hybrid swarm. The graph shows a peak in between the parents and from this is judged to represent an F1 population.

Site 2

Procedure and Results

Site 2 was in NW Bute, near Kildavanan, on acid soil over Dalradian Schist, along a hedgerow bordering the shore, running NW/SE. This population was about 2 weeks later in producing mature seed, and was sampled on 10th August 1994. As at site 1, the characteristics measured were those listed in Appendix 1 with the exception of numbers 5 and 9. The population was well visited by bees but evening observations were not recorded.

The results are listed in Appendix 4, and show that of the 25 samples investigated:

7 samples are introgressed towards *S dioica*

3 samples are introgressed toward *S alba*

15 samples are hybrids

With the exception of character 7 (capsule tooth angle) which was monomorphic, all other characteristics were polymorphic.

Discussion

The results indicate that there is considerably more introgression towards *S dioica* than in the first population, conversely less introgression towards *S alba*.

Sample 18 showed almost wholly *S dioica* characteristics, differing only in seed colour (mostly brown). Samples 12 & 13 were most introgressed towards *S alba*, differing only in flower colour and calyx teeth shape. The colours of the seeds were grey (10), black (6), brown (6) and mixed (3). Compared to population 1, the mixed seeds were (-6) and only 2 colours were mixed in any sample, black (-2), brown (-3) and grey (+9). It was noted that male flowers were predominantly red or dark pink. The grey seeds typical of *S alba* predominate at this site despite the introgression towards *S dioica*. One concludes that either these seeds are less viable, do not breed true or are subject to selective predation.

The histogram, Appendix 2, shows a small introgression towards *S dioica*, but the main peak is between the parents and from this it is judged an F1 population.

Some random samples from volcanic bedrock in south Bute (male flowers only, displayed on the museum flower table during May and June) were investigated for characteristics 1-4 only, (Appendix 1), with the following result:

0 samples introgressed towards *S dioica*

4 samples introgressed towards *S alba*

6 samples hybrids

Assuming that *S dioica* and *S alba* were allopatric populations the appearance of the *S alba* characteristics presents a difficulty. Being insect pollinated, *Silene* pollen will not travel very far, and the sea acts as a geographical barrier. However some gardeners have this year (1994) imported *S alba* to the island, and it is probable that this was how it was introduced in the past. This introduction of *S alba* produced an hybrid zone where all combinations of parental characteristics and degrees of hybridity are present. The small *S alba* population was unable to establish itself, but enough gene flow was established with *S dioica* to cause hybridization.

Conclusion

Taking into account the small sample from the flower display, the author concludes that all the *Silene* on the island are probably hybrids. The evidence from the hybrid indices indicates a cline from S to N, with characteristics of *S alba* declining along it. The changing soil

conditions, volcanic/old red sandstone/schist, also form a S to N cline. The evidence from seeds and hybrid indices together indicates that, while the south favours characteristics of *S. alba* and the north *S. dioica*, hybrids are more viable in any of the conditions than the parents. Therefore (from a very small study) the major factor in the hybridization of *Silene* on the island appears to be environmental conditions.

References

Atlas of the British Flora, 3rd Edition, 1990 Botanical Society of the British Isles.

Boyd, W, 1983 Collection in Bute Museum.

Church, A R, 1988 *A Survey of Vascular Plants on Bute* in Museum Library.

Postscript

While this paper was in press a population of White Campion was found on Bute at St Ninians Bay: leaf and calyx measurements as per *S. alba*, seeds not yet set. Possible implications will be assessed in a future paper, but some of the present conclusions may require revision.

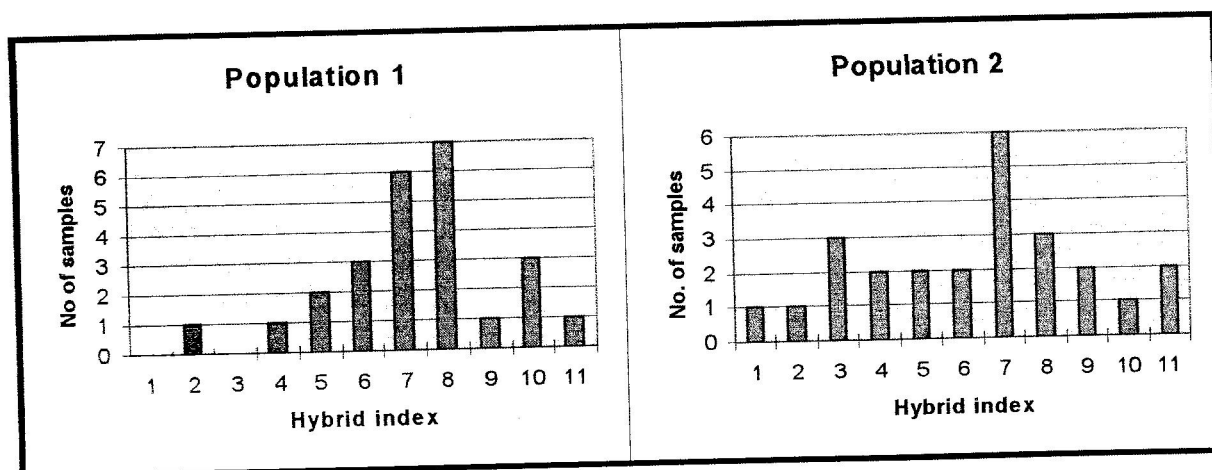
Appendix 1

Discriminating characters for *Silene dioica* and *alba*.

Number	Character	<i>S. dioica</i>	<i>S. alba</i>
1	flower colour	rosy red/deep pink	white
2	leaf shape: length/width	~2	>2
3	calyx shape: length/width	~1.5	>1.5
4	calyx tooth shape	triangular	elongate/spear shaped
5	evening scent	absent	present
6	capsule shape	broadly ovoid	egg-shaped/conical
7	capsule tooth angle	rolled	curved
8	seed colour	black	grey
9	pollinators	bees, butterflies	moths

Appendix 2

Histograms of hybrid indices for both populations.



Appendix 3

Results from site 1: character numbers as in Appendix 1.

	1	2	3	4	6	7	8	hybrid index
1	pale pink	1.7	1.23	triangular	egg	curved	brown	8
2	pale pink	3.52	1.96	triangular	egg	reflex	black	8
3	dark pink	2.13	2.12	triangular	ovoid	rolled	black	4
4	dark pink, white spots	3.12	1.99	triangular	ovoid	reflex	50/50 black/brown	7
5	pale pink	2.39	2.08	spear	egg	reflex	50% grey 25%black/brown	11
6	pale pink	2.15	1.67	spear	egg	reflex	black	10
7	pale pink, white spots	2.24	1.96	triangular	ovoid	rolled	grey/light brown	6
8	pale pink	2.64	2.18	triangular	egg	reflex	38 grey, 5 light brown	9
9	dark pink	2.54	2.0	triangular	ovoid	reflex	black/dark brown/grey	6
10	pale pink	2.34	2.0	triangular	egg	rolled	black/brown/grey	8
11	pink, white spots	1.84	1.56	triangular	ovoid	rolled	black	2
12	pale pink	3.23	1.47	triangular	egg	curved	black/brown/grey	8
13	pale pink	2.03	1.92	spear	egg	reflex	grey	10
14	dark pink with white	2.16	1.86	triangular	egg	curved	black/brown/grey	10
15	dark red , white spots	2.7	1.73	spear	ovoid	reflex	black	8
16	red, white spots	2.7	1.73	spear	ovoid	reflex	black	8
17	pink	2.34	2.0	triangular	ovoid	rolled	black	5
18	pale pink, white spots	2.06	2.0	triangular	egg	reflex	pale brown	7
19	deep pink	2.66	1.71	triangular	ovoid	reflex	pale brown	6
20	pale pink	2.31	1.83	triangular	ovoid	reflex	brown	7
21	pale pink	1.88	1.80	triangular	egg	curved	brown	8
22	pale pink with white	2.17	1.84	triangular	egg	rolled	black irregular	7
23	pink	2.12	2.34	triangular	ovoid	reflex	dark brown	7
24	deep pink	2.69	1.59	triangular	ovoid	curved	dark grey/black	5
25	pale pink, white spots	3.15	1.47	spear	ovoid	reflex	brown	7

Appendix 4

Results from site 2: character numbers as in Appendix 1.

	1	2	3	4	6	7	8	hybrid index
1	red	2.44	1.79	spear	egg	rolled	black	8
2	pink	1.89	1.48	triangular	ovoid	rolled	grey	3
3	red	2.54	1.79	spear	ovoid	rolled	grey	8
4	red	1.85	1.90	triangular	ovoid	rolled	brown	3
5	red	2.24	2.07	spear	egg	rolled	grey	10
6	pale pink	2.40	1.66	triangular	ovoid	rolled	grey	7
7	dark pink	2.17	1.49	triangular	ovoid	rolled	light brown	3
8	pale pink	2.34	1.98	triangular	egg	rolled	black	7
9	pale pink	1.99	1.55	spear	conical	rolled	grey	5
10	pale pink	2.14	2.21	triangular	egg	rolled	brown	8
11	dark pink	2.50	1.93	spear	ovoid	rolled	grey	9
12	pale pink	2.62	2.20	spear	egg	rolled	grey	11
13	pale pink	2.49	2.23	spear	egg	rolled	grey	11
14	dark pink	1.73	1.41	triangular	egg	rolled	grey	5
15	dark pink	2.38	2.30	spear	egg	rolled	brown irregular	7
16	pale pink	1.84	1.61	triangular	spear	rolled	black/grey	7
17	dark pink	2.09	1.69	triangular	ovoid	rolled	grey	4
18	dark pink	2.08	1.59	triangular	ovoid	rolled	5-1 brown /grey	1
19	pale pink	1.9	2.11	triangular	egg	rolled	light brown	6
20	dark pink, white spots	2.58	1.89	spear	egg	rolled	black	9
21	pale pink	2.17	2.27	spear	ovoid	rolled	black	7
22	dark pink	2.15	2.09	spear	ovoid	rolled	3-1 brown /black	7
23	red	2.21	2.31	triangular	egg	rolled	black	7
24	dark pink	1.82	1.88	triangular	egg	rolled	brown	6
25	red	1.95	2.03	triangular	ovoid	rolled	black	2