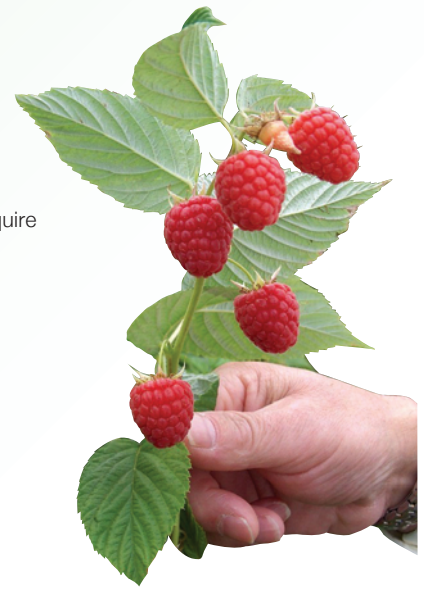
Declines in wild raspberry populations may limit the genetic resource for future raspberry breeding

Julie Graham, Mary Woodhead, Kay Smith, Bruce Marshall, Gavin Ramsay, Joanne Russell and Geoff Squire
SCRI, Invergowrie, Dundee DD2 5DA.



Introduction

The red raspberry (*Rubus idaeus* ssp. *idaeus*) is cultivated on a large scale and has frequent sympatric wild populations throughout Scotland. The high potential for gene flow between these populations has encouraged the study of the interactions among wild and cultivated forms of a species (Graham *et al.*, 1997, 2003; Marshall *et al.*, 2001).

Results

These studies have revealed that the wild red raspberry exists as a series of local populations, which are differentiated genetically (Fig. 1) and physiologically, and that the physiological differences, particularly times of flowering and fruiting, are maintained when plants are grown in the same environment. The genetic similarity between populations was found to decrease from around 80% at between sites at sea level to 50% between lowest and highest sites (Fig. 2). The wild plants are also genetically distinct from cultivated raspberries.

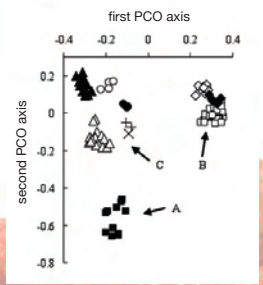
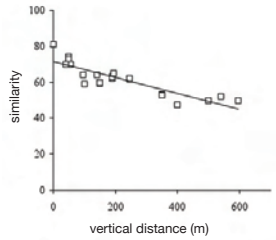


Fig. 1 Sites of genetically distinct populations can be grouped by principal coordinate analysis of genetic similarity in lowland (C), valley (B) and upland clusters (A).

Fig. 2 The effect of vertical distance on the mean genetic similarity between pairs of populations.
Linear regression: y = -0.043x + 71, r^2 = 0.76, n = 21.



Ten years after initial studies had been carried out decline in population size was determined (Graham *et al.*, 2009). The decline generally observed resulted mainly from habitat degradation. Given that each population had unique alleles, which could be identified even in a small number of plants, this loss of plants also equates to a loss of alleles or genetic diversity (Table 1).

Table 1 Plant numbers, location, altitude and flowering time status of the 12 Scottish wild red raspberry *R. idaeus* populations studied.

[z] land excavations, [y] large part removed for grazing, [x] land clearing, [w] little root sucker production for new cane, [v] no fruit development, [u] lot of root sucker production

Site	Plant numbers 1996 (approx. no)	Plant numbers 2006 (approx. no)	Population in Marshall *et al.*, 2001	Altitude (m)	Flowers open (days from 1 Apr.)
1	Unknown	2	Glen Doll	600	>70
2	16	10	Glen Doll	600	>70
3	4	2	Glen Clova	250	56-70
4	200	50[w]	Clova A	250	56-70
5	200	>500[u]	Clova B	250	49-56
6	5	2	Glen Clova	250	49-56
7	50	3[v]	Glen Clova	250	49-56
8	500	100[y]	Gella Bridge	200	42-49
9	400	10[z]	Kirriemuir	60	35-42
10	200	11[x]	Knapp	100	35-<42
11	400	200	Kingoodie	5	28-<35
12	150	46[x]	Longforgan	5	28-<35

Conclusions

These studies demonstrate plants from these locations, spanning an altitudinal cline from 5 to 600 m, are genetically diverse and exhibit significant variation in flowering and fruiting period when grown at the same altitude (Marshall et al., 2001). In light of current climate change implications these populations represent a huge genetic resource that could be utilised within commercial red raspberry breeding programmes to develop new cultivars, better adapted to a changing natural environment. However, continued reduction in population size will severely reduce genetic diversity and limit prospects for incorporating 'local' germplasm in the development of cultivars for sustainable Scottish raspberry production.

References

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