

~~For the return journey we headed south, back into California. On the way we passed the enormous peak of Mount Shasta, over 14,000 ft. high, and had a very pleasant walk alongside Shasta lake. Eventually we reached Quincy, via the gorge of Route 70, and set out to look for more plants. It was a very interesting area, and we found *C. californicum* in a dwarf form. There were lots more *E. gigantea*, including some *ocroleuca* types that lacked the nice redness of normal plants. We looked hard, but again could not locate any *C. fasciculatum* in flower. However, we were very pleased to find an area in the Butterfly Valley Reserve of the Plumas Forest where there were two superb *C. austinae* in full bloom. Also, we had our first sighting of *Platanthera dilatata* var. *leucostachys*, and both types of *C. maculata*. Finally heading back to San Francisco, there was one more site to see on route. This was for the Californian version of *Spiranthes porrifolia*, which we found established in seeps along the roadside near Downieville. There were a few in bloom, and this made a perfect climax before heading back to the airport.~~

HOS *Platanthera* spur-length survey is a great success

Richard Bateman and Roy Sexton

Background

As described in an earlier *JHOS* article (Bateman & Sexton 2007), this highly collaborative “membership participation” project was conceived by us in order to extend the geographical coverage of our own efforts to obtain measurements in general, and spur lengths in particular, from across the geographical and habitat ranges of the two European butterfly-orchids; *Platanthera bifolia* (Lesser Butterfly-orchid) and *P. chlorantha* (Greater Butterfly-orchid). Our interest in these two species was driven by their remarkable genetic similarity, the limited but clear-cut morphological differences that distinguish them, and uncertainty over the occurrence in the British Isles of hybrids between them (Bateman 2005). In particular, we wished to explore the presumed critical contribution of spur length towards ensuring different pollinators for the two species, as outlined in some classic studies of orchid–pollinator co-evolution (e.g. Nilsson 1983; Maad & Nilsson 2004). We provided detailed instructions to HOS members describing how best to measure spur length, aiming to maximize consistency among inexperienced analysts (Bateman & Sexton 2007).

Results

By the close of the 2007 field season, our combined database of spur lengths contained 120 datasets (49 for *P. bifolia*) totalling 1876 individual plants (625 for *P. bifolia*). Datasets ranged in sample size from a single plant to 118 plants. Of these 120 datasets, 33 were generated by Bateman, 26 (many as large samples) by Sexton and the remaining 61 by 17 other HOS members – most notably two datasets from southern England and five from Austria by Tony Hughes, four from southern England by Katherine Stott and David Pearce, 11 from Cumbria by Alan Gendle, a

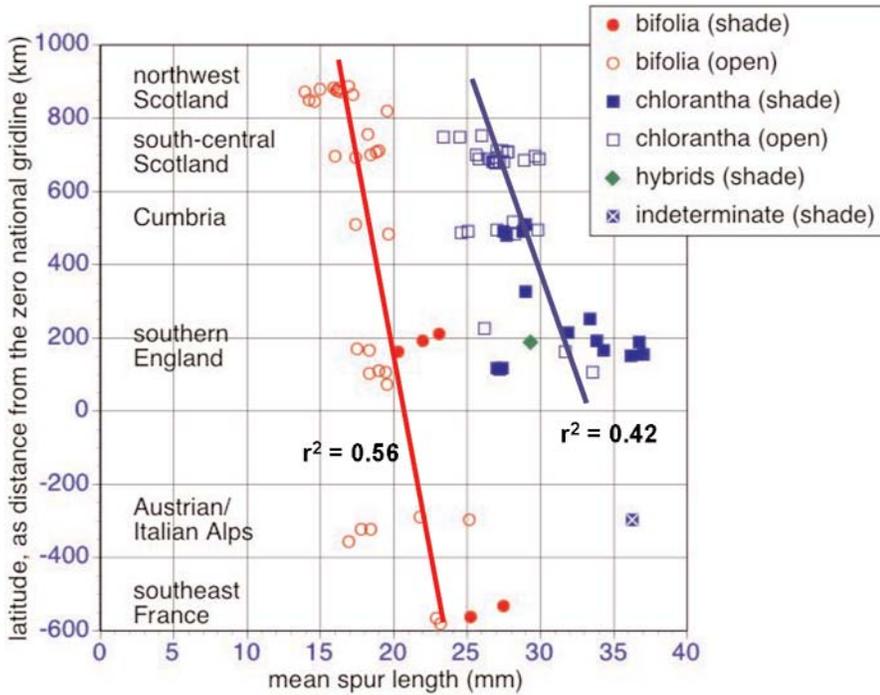


Figure 1. Mean spur length (mm) plotted against latitude for populations of *Platanthera bifolia* (left) and *P. chlorantha* (right).

further four from Cumbria by James Fenton, seven from west-central Scotland by Sarah Longrigg, and a further 15 from Scotland by David and Christine Hughes. The net result was clustering of sampled populations in the Vercors, the Alps, southern England, Cumbria, southern Scotland and northwestern Scotland, reflecting concentrations of these species.

Rigour of the results

Before discussing the broader implications of the results, we would like to congratulate several HOS members on voluntarily developing, within the broad context of this study, their own sub-projects. Some of these sub-projects helped to demonstrate the reliability of the data collected during the survey, while others offered additional biological insights. Dave Stott plus Kathy Pearce, James Fenton and Roy Sexton chose to reanalyze particular populations during the same flowering season, demonstrating that there were no significant differences in the measurements. Other sites were visited, in some cases deliberately and in other cases accidentally, by different analysts in the same year (Dave Stott and Kathy Pearce, Alan Gendle and James Fenton) or in different years (Richard Bateman and Tony Hughes). All but one of

these duplicated visits again yielded no statistically significant difference in mean spur lengths.

In contrast, repeat visits to several sites in successive years by Roy Sexton revealed significant differences in spur length in half of the case-studies, suggesting that environmental (presumably climatic) differences between years can influence average spur length. Tony Hughes demonstrated that spur length was acceptably consistent across individual inflorescences. However, Richard Bateman compared spur lengths in flowers that were fully open with those in the same inflorescence that were just about to open, and surprisingly found a 25% difference between the two groups, showing that spurs continue to lengthen even as the flowers open. The overall message of these experiments was clear and positive – the results of the spur-length survey were acceptably accurate and reproducible.

Interpretation

So what has the survey actually shown so far? The recorded lengths of both species contradict those given in most floras and monographs, and convincing hybrids, apparently introgressing (back-crossing with their parents), were recognized in Oxfordshire, Gloucestershire and probably Cornwall. The remaining results, which will soon be published in greater detail elsewhere (Bateman & Sexton in press), are summarised here in Figure 1. They challenge the widely held assumption that adaptation to proboscis length of pollinating moths is the dominant factor controlling spur length. Instead, at any particular latitude, *P. bifolia* has spurs approximately two-thirds the length of those of *P. chlorantha*. Interestingly, both species show latitudinal gradients, spur length increasing by an average of 2.2% per 100 km from north to south. This gradation of spur size could simply reflect greater resourcing of plants in lower latitudes, perhaps permitted by the greater availability of light. However, summer day-length is actually greater at *higher* latitudes. Also, at any particular latitude, populations growing in shady habitats (especially those of *P. bifolia*) tend to have somewhat longer spurs than those growing in the open (Figure 1), suggesting that the resourcing and vigour of the plants may be more strongly controlled by warmth and soil moisture than by light.

The next step – please can you help?

Given the considerable excitement aroused by the 2007 results, we plan to extend this survey into 2008 (and most likely beyond). Firstly, there are obvious gaps in our geographical coverage. Within the British Isles, we lack data from Ireland or Wales, and have little from East Anglia, the Midlands or northeast England (or from northern Scotland for *P. chlorantha*). Our data from Continental Europe are much more sparse; thus far, we have information only from *P. bifolia*, and then only from the Alps and southern France. Also, it is desirable that, without making data collection too complicated or time consuming, we attempt to test our new hypothesis that the

latitudinal variation in spur length reflects resourcing. In order to achieve this goal, we plan to begin to measure the width and number of expanded leaves of each plant, which together should allow us to assess how much light can be trapped by that plant. **Leaf number** should be easy to record, since most plants produce only two expanded leaves (excluding bract-like leaves sometimes found higher up the flowering stem) and almost all of the remaining plants have only one such leaf. Similarly, **leaf width** is simple to measure because the leaf can, while still attached to the plant, be flattened against the recommended 15 cm-long steel rule and then measured at its widest point to the nearest millimetre. When combined with the measurement of **spur length** from its tip to the back of the lateral sepals (full instructions were given by Bateman & Sexton 2007), these straightforward measurements should allow us to determine whether there is a strong positive correlation between spur length and energy generated by the plant. In the meantime, it remains for us to thank HOS members for their already excellent contribution to this ongoing, and thoroughly rewarding, project.

References

- Bateman, R. M. (2005) Circumscribing and interpreting closely related orchid species: *Platanthera*, *Dactylorhiza* and the crucial role of mutation. *Journal of the Hardy Orchid Society* 2(4): 104–111.
- Bateman, R. M. & Sexton, R. (2007) Survey of the spurs of European butterfly-orchids. *Journal of the Hardy Orchid Society* 4(2): 60–63.
- Bateman, R. M. & Sexton, R. (in press) Is spur length of *Platanthera* species in the British Isles adaptively optimized or an evolutionary red herring? *Watsonia*.
- Maad, J. & Nilsson, L. A. (2004) On the mechanism of floral shifts in speciation: gained pollination efficiency from tongue- to eye-attachment of pollinia in *Platanthera* (Orchidaceae). *Biological Journal of the Linnean Society* 83: 481–495.
- Nilsson, L. A. (1983) Processes of isolation and introgressive interplay between *Platanthera bifolia* (L.) Rich. and *P. chlorantha* (Custer) Reichb. (Orchidaceae). *Botanical Journal of the Linnean Society* 87: 325–350.

~~Are the Nippers Badgers or Birds?~~

~~Derek Larter~~

~~I was interested to read Alan Blackman's report of the Kent field trip on 27th May 2007, particularly his comments on the activities of Muntjac Deer (JHOS 4: 139). It seems illogical somehow that if deer find *O. purpurea* to their taste (unlike *Neottia* species) they should simply nip off the spikes, and leave them on the ground. I recognise the site from Alan's description, and visited it regularly from 1981 to 1990, when I moved from the area. The nipping off of flower spikes has been going on since I first visited the site, and I remember meeting Dot Whittaker (KTNC now~~