

Survey of the Spurs of European Butterfly Orchids

Richard Bateman and Roy Sexton

Background

HOS members who regularly attend meetings or read the *Journal* will likely be aware that we have been pursuing research on the two British species of *Platanthera* using detailed morphometric measurements. One of us has studied both *P. chlorantha* and *P. bifolia* in southern England, supported by DNA-based data (Bateman 2005; Bateman *et al.* in prep.), while the other has studied *P. chlorantha* morphologically in southern Scotland (Sexton & McQueen 2005).

Although we have measured a wide range of characters (42 in the English study), perhaps the most interesting are those describing the size of the spur. Along with the distance separating the adhesive discs at the base of the pollinia, the dimensions of the spur are considered to be critical in determining the identity of the pollinators. Specifically, the moths' probosces reach deep into the spur in order to access the nectar held in the lower quarter to one third of its length (e.g. Nilsson 1983). It therefore seems reasonable to suspect that spur length plays a key role in maintaining the evolutionary gap that is universally assumed to separate the two European species of *Platanthera*, *P. chlorantha* (Greater Butterfly-orchid) and the relatively small-flowered, narrow-columned *P. bifolia* (Lesser Butterfly-orchid) (Figure 1).

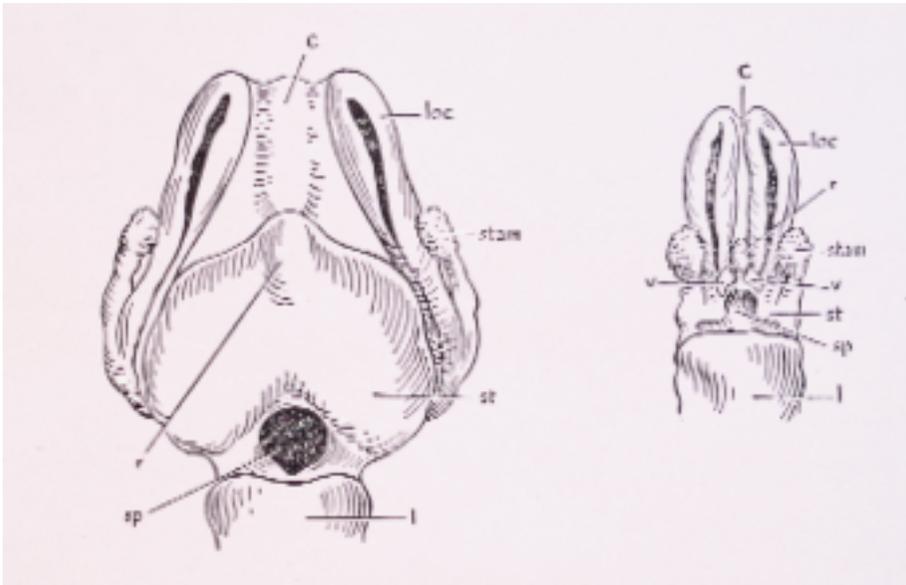


Fig. 1 Comparison of the columns of *Platanthera chlorantha* (left) and *P. bifolia* (right). From V.S. Summerhayes (1951), *Wild orchids of Britain*.

Many of our results to date fulfilled our expectations. The distribution of spur lengths in each measured population duly formed a conventional bell-shaped curve. Also, when the various study populations in southern England were combined, the two species showed very little overlap in spur length. And as expected, spurs of *P. chlorantha* were typically considerably longer than those of *P. bifolia* (averaging 34 mm vs 19 mm). However, we also encountered some surprises. Data from Scotland (very limited in the case of *P. bifolia*) suggest that *P. bifolia* retains its English dimensions there, whereas spurs of *P. chlorantha* are significantly shorter (typically 27 mm: Sexton & McQueen 2005). It is even more startling to compare spurs of English populations of *Platanthera* with those in Sweden (Nilsson 1983), where the two species exchange typical spur lengths (Bateman 2005; Bateman *et al.* in prep.); spurs of *P. chlorantha* are actually *shorter* than those of *P. bifolia* (average lengths 25 mm vs 40 mm).

The impression gained from these observations is that both of these species show small-scale local adaptation and also larger scale regional adaptation to pollinators. If so, this would make them an unusually good model system for studying plant–pollinator co-evolution. *We are seeking your assistance to help test these scientific hypotheses.*

The new survey

It is only possible to compare local with regional variation in traits such as spur length by sampling populations at many different geographical localities. This goal can be accomplished by few researchers over many years or many researchers over few years. We would greatly appreciate your help in taking the second, and so speedier, approach.

The main advantage of spur length for this ‘citizen scientist’ project is that it is relatively easy to measure consistently; far easier, for example, than spur width, as both the cross-sectional shape and flattened width of the spur vary considerably along its length (Bateman *et al.* in prep.). The ideal tool for measuring these spurs is a 15 cm steel ruler, as the finely divided millimetric scale runs to the very end of the rule. This end of the ruler can then be pressed against the backs of the lateral sepals (red arrow in Figure 2), and the length of the spur thereby readily measured from this point to the apex of the spur (yellow arrow in Figure 2). The spur is generally more-or-less straight and parallel to the ovary, though in a few cases it needs to be gently straightened prior to measurement. By this method, the spur measurements can be obtained non-destructively; the chosen flower remains firmly attached to the ‘parent’ spike, so there are no conservation implications. (In the absence of a steel ruler, it would also be possible to adapt a plastic ruler, by carefully truncating the end adjacent to the beginning of the ruled margin.)

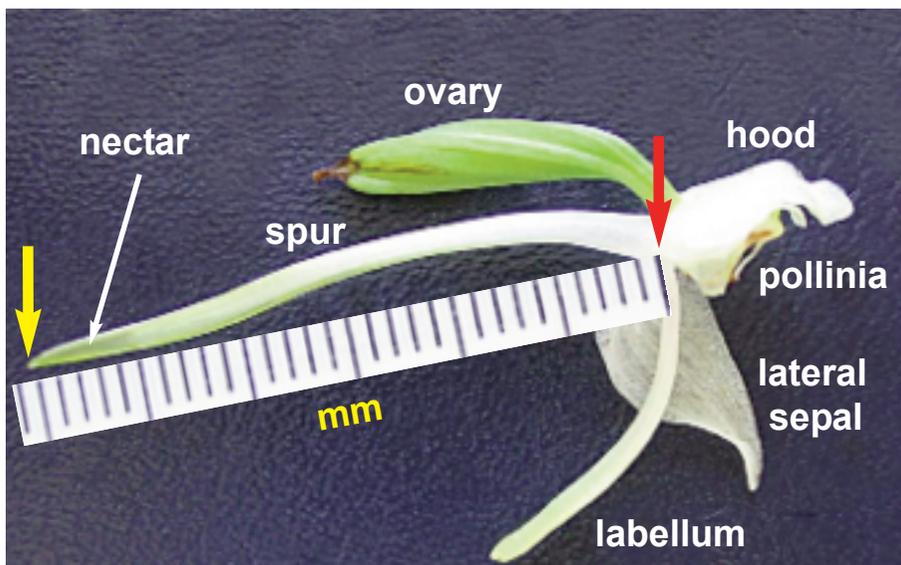


Fig. 2 Lateral view of flower of *Platanthera chlorantha* (the nearer lateral sepal removed) to show the spur length measurement required for the present survey (between the red and yellow arrows; this individual is about 30 mm long). Please note the fact that, during the actual survey, the chosen flowers should not be detached but should remain firmly attached to their ‘parent’ inflorescences.

Photo by Roy Sexton, modified by Richard Bateman.

An ideal sample from each population would be measurements (each to the nearest 0.5 mm) of single flowers from at least 20 inflorescences per population. It is important that, for each inflorescence, the flower is fully open and it is chosen from the middle of the inflorescence, as for almost all orchid species the flowers decrease considerably in size from the base to the apex of the inflorescence (Bateman & Rudall 2006). Records from mixed populations of *P. chlorantha* and *P. bifolia* would be especially welcome, as such populations are uncommon. However, when tackling such a mixed population, it would be important to use additional characters, notably the orientation of the pollinia (parallel in *P. bifolia*, strongly convergent in *P. chlorantha*: Figure 1), to confirm the identity of each plant measured. Even in such unusually problematic populations, it should require no more than 10–15 minutes to take the 20 spur measurements needed. If just 10% of HOS members measured (a) their local butterfly-orchid population in the UK and (b) one population on their next suitably timed European trip, our database would treble in size during a single field season!

In addition to the set(s) of spur length measurements, we would appreciate information on the date of measurement and the location, habitat and sizes of the population(s) studied.

Please send any results by mail or e-mail (MS Word or Excel attachments welcome) to Richard Bateman, Jodrell Laboratory, Royal Botanic Gardens Kew, Richmond, Surrey, TW9 3DS (r.bateman@kew.org). Respondents will be acknowledged in any resulting populations – and the results will of course be summarised with alacrity in *JHOS*!

Acknowledgement

We thank HOS members who have already contributed in various ways to our *Platanthera* studies, and Ian Denholm for contributing the first data-sets to the present butterfly-orchid survey (from Keltneyburn and Boat of Garten, in the Scottish Highlands).

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