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## ***Cyclamen libanoticum*, a species that knows its identity!**

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One of the challenges in plant classification is to decide where lines should be drawn in natural variation to delimit species, subspecies and varieties. Plants can vary in morphology, chromosome number, flower colour and many other traits while still being treated as a single species. *Crocus biflorus*, to take one example, has chromosome counts varying from 8 to 22 but this does not link to any other feature and so the different individuals are treated together as one species (Brighton et al. 1973). *Anemone coronaria* can have flowers of bright red, pink, blue-purple and white in natural populations (Horovitz, 1976) but again is treated as a single species. In these kinds of cases differing taxonomic opinion can lead to the splitting of species into smaller groups, and then sometimes the lumping back again. You could argue that these are less than ideal species, and looking at synonyms for these two names it takes moments to find 23 other names for *Anemone coronaria* and 43 for *Crocus biflorus* in Catalogue of Life (Roskov et al. 2014). So what might we expect for *Cyclamen libanoticum*? It has a narrow and well defined distribution (Mathew, 2013), only a small amount of morphological variation (Haber & Semaan, 2013) but is in a well-studied genus (something that tends to increase the number of synonyms). Catalogue of life lists no synonyms for the species, nor does The Plant List (***The Plant List (2013). Version 1.1.*** **Published on the Internet;** <http://www.theplantlist.org/>).

Samples collected by the Cyclamen Society Expedition in 2014 From around Jabal Moussa in Lebanon were sampled for DNA and sequences from six different regions of chloroplast DNA (*atpH-atpF*, *matK*, *psbI-psbK*, *rps16*, *trnH-psbA* and *trnLF*) were sampled to look for variation that might identify populations or other local variation. Three of these DNA sequences (*psbI-psbK*, *rps16* and *trnLF*) were also compared with other *Cyclamen* that occur in this area: *Cyclamen coum*, *C. persicum* and *C. pseudibericum*. Current taxonomic opinion is that *C. libanoticum* is most closely related to *C. cyprium* Compton et al (2004), Yesson & Culham (2006) so that also needed to be compared even though it is geographically separated on Cyprus. The methods for DNA extraction and sequencing are given in a previous Cyclamen Society expedition report (Könyves and Culham, 2014a). The DNA sequence data were analysed to generate a pattern of similarity (=relationship) among the samples following established methods (Könyves and Culham, 2014a).

Analysis of the chloroplast DNA from the six regions shows that, in *C. libanoticum*, only one base-pair difference is found among samples within the analysed 7066 base-pairs. This one base-pair difference (9 'A's vs 10 'A's) was found in the samples collected from sited 14/04 and 14/05 (Table 1) and could represent a very minor change in DNA sequence or even show the limits or accuracy of the sequencing system used.

Data from the three geographically related species shows that they are very different from *C. libanoticum* with no close genetic overlap. However, comparison with *C. cyprium* shows the same close relationship previously reported Yesson et al (2009) (Figure 1). We previously estimated that *Cyclamen cyprium* and *Cyclamen libanoticum* genetically

separated around 1.0-1.5 million years ago, and the two species remain in close geographic proximity but are now separated by the effective barrier of seawater.

What do the results tell us about the diversity and biology of *Cyclamen libanoticum*? Firstly, and very importantly, the species remains distinct from others that grow in the same general area so there is no risk to the species through hybridization with commoner and more widespread species. Secondly, when conservation of *Cyclamen* is considered, *C. libanoticum* must be considered alongside *C. cyprium*. Thirdly, that the low level of variation seen (compare with our report on *C. colchicum* in the Spring journal; Könyves and Culham, 2014b) indicates that this small and narrow distribution is that of either a very young species that has not yet accumulated much genetic diversity or that the species has gone through a genetic bottleneck leaving it genetically homogeneous. Whatever the genetics say, this is a beautiful and under cultivated species.

Table 1. Details of the studied cyclamen samples.

<b>Taxon name</b>	<b>Collector and Number</b>	<b>Provenance</b>	<b>Haplotype</b>
<i>C. libanoticum</i>	CSE14002	site 14/02	H1
<i>C. libanoticum</i>	CSE14008	site 14/04	H2
<i>C. libanoticum</i>	CSE14003	site 14/05	H2
<i>C. libanoticum</i>	CSE14004	site 14/06	H1
<i>C. libanoticum</i>	CSE14006	site 14/07	H1
<i>C. libanoticum</i>	CSE14007	site 14/07	H1
<i>C. libanoticum</i>	CSE14009	site 14/09	H1
<i>C. libanoticum</i>	CSE14010	site 14/09	H1
<i>C. libanoticum</i>	CSE14011	site 14/11	H1
<i>C. libanoticum</i>	CSE14012	site 14/12	H1
<i>C. libanoticum</i>	CSE14013	site 14/13	H1
<i>C. libanoticum</i>	CSE14015	site 14/16	H1
<i>C. libanoticum</i>	CSE14019	site 14/20	H1
<i>C. cyprium</i>	Tile Barn 'M'	Cyprus	H3
<i>C. coum</i>	Tile Barn 'P',	Caucasus	H4
<i>C. pseudibericum</i>	Peter Moore	unknown	H5
<i>C. persicum</i>	CSE98338	Symi, Greece	H6

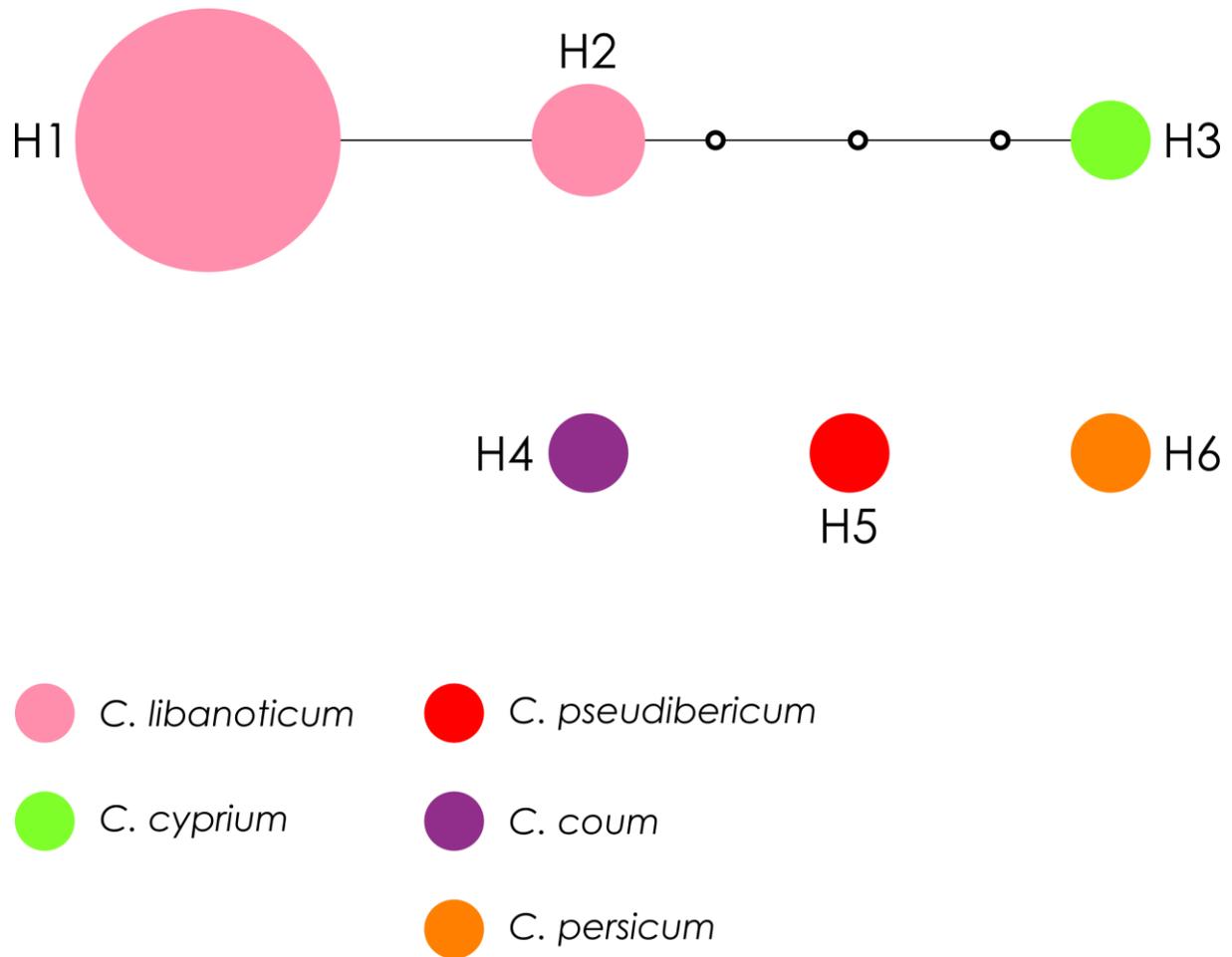


Figure 1. Haplotype network of *C. libanoticum* samples and related species based on three chloroplast DNA regions. Open circles indicate 1bp change and length of line does not have a meaning. Coloured circles are recorded DNA sequence types. Haplotype numbers (H) correspond to those found in Table 1.

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