Resolving taxonomic complexity in diploid and tetraploid British eyebrights (*Euphrasia*)

THE UNIVERSITY of EDINBURGH

Royal Botanic Garden Edinburgh

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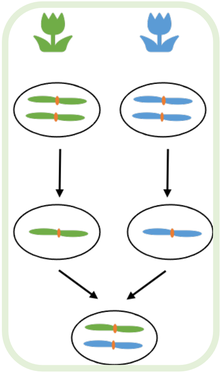
Introduction

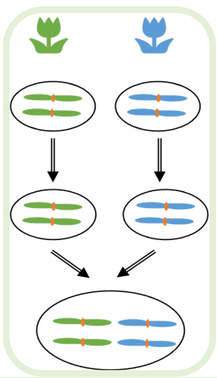
< breeding system

hybridisation >



< local adaptation

polyploidy >



- Taxonomically complex groups (TCGs) are difficult to assign to discrete and unambiguous species due to the following reasons (see left <<)
- Understanding genetic structure is the basis for TCG conservation, because inappropriate preservation will trigger a series of problems (like the 'butterfly effect', right >>)

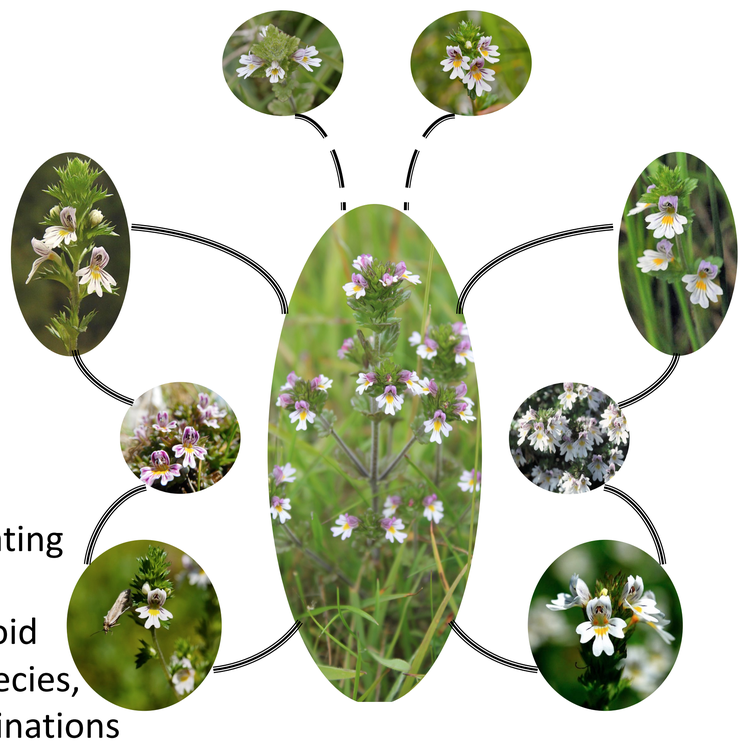
Study system

Data analyses

- Genotyping by sequencing
- TASSEL pipeline for SNP calling (ref genome: *E. anglica* & *E. arctica*)
- Population genetic statistics; PCA, fastStructure, isolation by distance

Euphrasia

- Phenotypic plasticity;
- Recent speciation;
- Extensive hybridisation;
- Diverse in polyploidy, mating system, ecology
- 862 samples from 4 diploid species, 14 tetraploid species, 35 putative hybrid combinations



Questions

1. What are the most distinctive clusters in all British eyebrights?
2. Do clusters correspond to species or geography?
3. Is there evidence of genome-wide differentiation across species?

Hypotheses

1. Diploids vs tetraploids is the primary axis of divergence
2. Geography drives clusters due to local hybridisation
3. Low species-level differentiation with a few outlier regions

Results 1

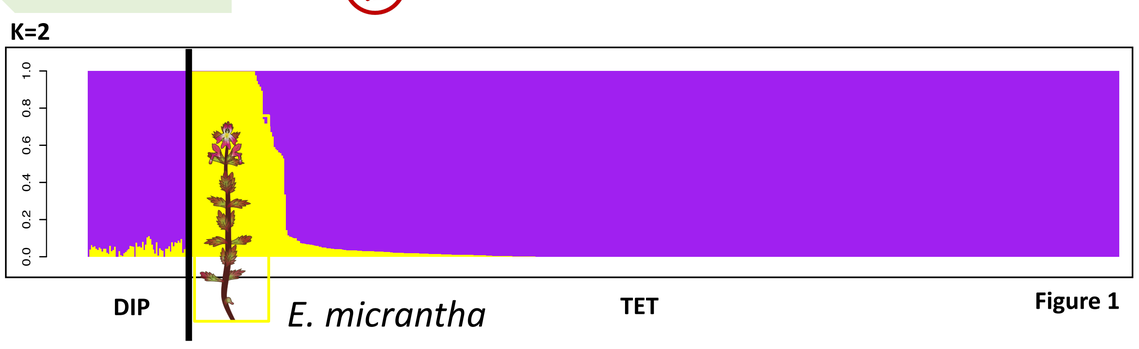
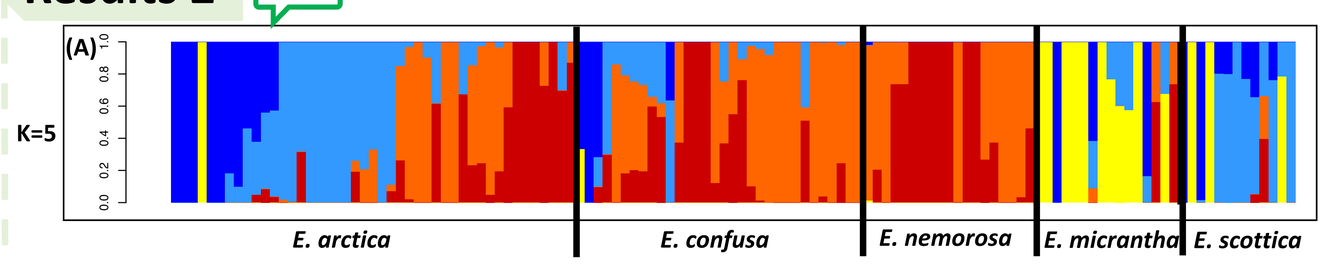
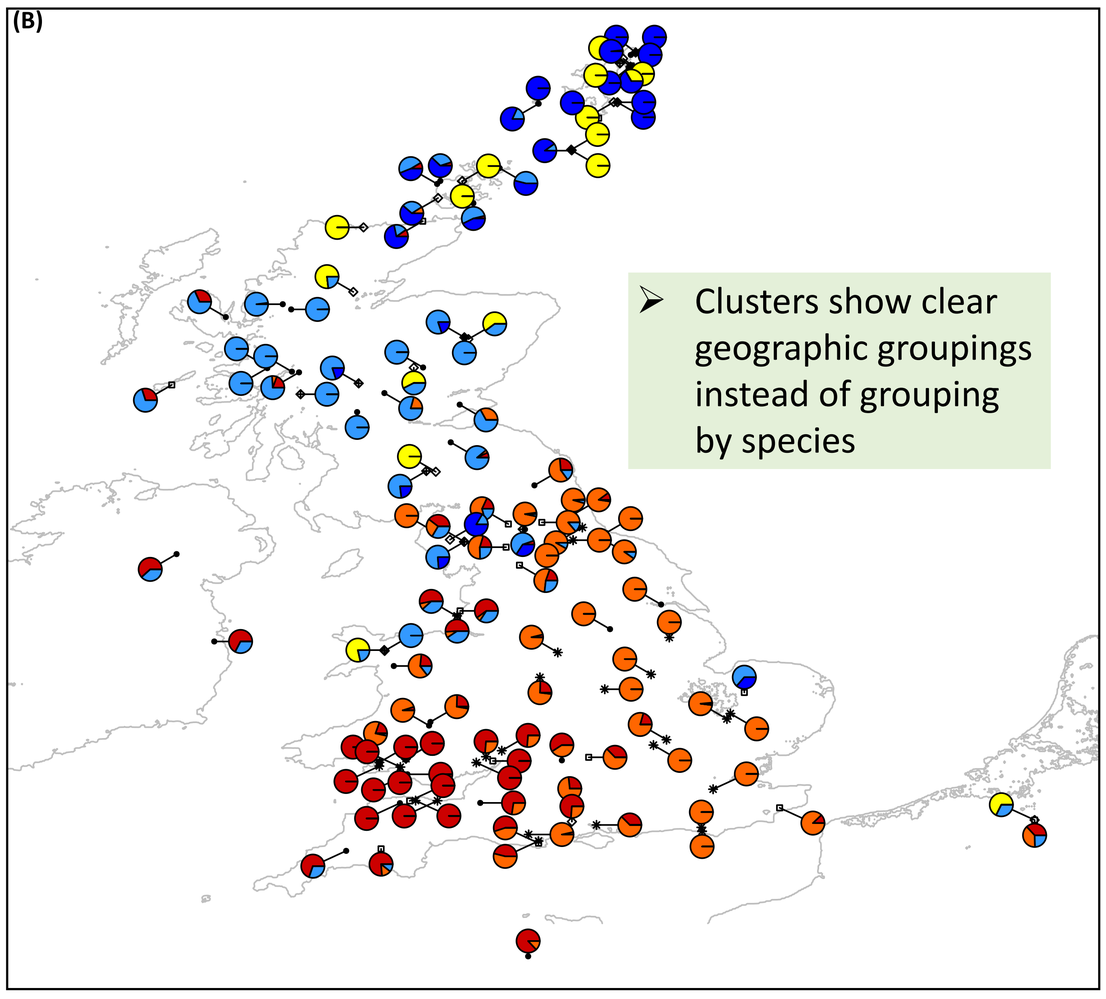


Figure 1

➢ Northern *E. micrantha* forms a distinctive genetic cluster from all other populations, rather than clustering by diploids vs tetraploids

Results 2





➢ Clusters show clear geographic groupings instead of grouping by species

Figure 2

Results 3

Table1 Outliers and mean Fst among closely related species *E. nemorosa*, *E. arctica*, *E. confusa* (SNP in total: 19,666 SNPs) and 5 clusters (from Fig. 2)

Type	Outlier SNP	Mean Fst
intra-species inter-cluster	*12.5%*	*0.125*
intra-species intra-cluster	*8.2%*	*0.091*
inter-species intra-cluster	*5.4%*	*0.036*

➢ Fewer genomic differences were observed between closely related species than between geographic regions, indicating low species-level differentiation

Summary

1. **In the UK, northern *E. micrantha* is genetically distinctive, indicating a different colonization history**
2. **Across the UK, geography plays an important role. We hypothesized that it related to selfing / hybridisation, this needs follow-on study to find out details**
3. **In closely related species, genome scans showed low species-level differentiation with a few outlier regions, these regions might underlie species differences**

Acknowledgements

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Reference

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