Capsella biodiversity: an indicator of environmental change and ecological impact.

Pietro Iannetta*, Jane Wishart, Graham Begg, Ali Karley, Mark Young, Cathy Hawes, Geoff Squire
SCRI, Invergowrie, Dundee DD2 5DA.

Capsella accesions exhibit a wide variety of heritable leaf shapes.

- Historically, these leaf shape variants are used to imply functional differences.
- We isolated 157 accessions (from 53 lines), from 34 arable fields across the UK.
- Phenotypic traits were measured, including leaf shape, under controlled conditions.
- However, leaf shape was only weakly linked to functional differences.

A significant distinctive, leaf shape independent, trait balance was observed.

- Factor 1: correlated the traits of time to flowering, reproductive duration, stem number, weight and seed production; associating traits that determine reproductive output.
- Factor 2: associated traits that apportioned resources into somatic tissue: such as reproductive duration and leaf parameters such as SPAD, leaf number and rosette diameter.
- There is no obvious trade-off between reproductive output and somatic input.
- However, 90 % of accessions exhibited relatively low somatic input and relatively high reproductive output.

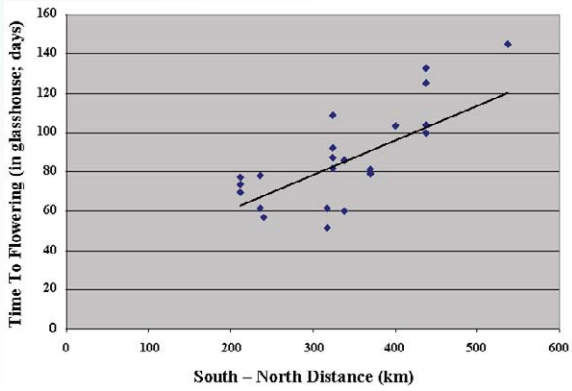
Functional trait analyses: using 'Maximum Likelihood'

	Factor 1	Factor 2
SS loadings	2.99	1.96
Cumulative Variance	0.272	0.450
	Loadings	
Time To Flower	0.767	-0.621
Reproductive Duration	0.694	-0.163
Rosette Diameter	0.140	0.567
Leaf Number	0.046	0.629
Stem Number	0.774	0.215
Stem Weight	0.665	0.432
Total Seed Weight	0.720	-0.121
Seed Area	-0.397	0.092
Seed Viability	0.315	0.078
Max. SPAD	-0.289	0.609
Dormant1	0.015	-0.440

Sum of squares and cumulative variance explained and loadings for a two factor model

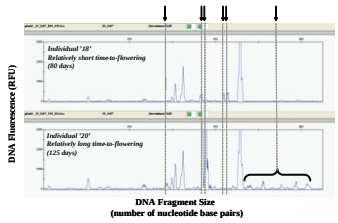
In addition, flowering time correlates with latitude.

Time to flowering (mean of parental lines) in relation to latitude (distance north in British National Grid) for accessions collected from the seedbank at spring oilseed rape fields in Farm Scale Evaluations (FSE; http://www.defra.gov.uk/environment/gm/fse/) sites in 2002 (except Scotland). Regression significant: P<0.001; 57.8 variance).



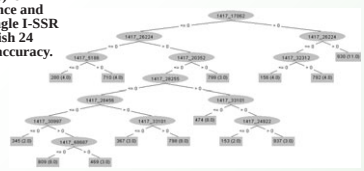
Molecular markers are now being developed.

Fluorescent I-SSR genotyping using ABI GeneMapper® software is being developed to test the utility of I-SSRs as a molecular diagnostic tool to distinguish the accessions and their associated functional traits.



The profile of fluorescent I-SSR PCR products from two functional variants are exemplified in the graph opposite. Distinguishing peaks are arrowed.

This 'decision tree' (opposite) is based upon only peak presence and absence data from only a single I-SSR primer can already distinguish 24 test accessions with 97.5 % accuracy.



Future work.

- Testing the ecological signifcance of the trait balance upon trophic layers and ecosystem functioning.
- Using molecular diagnostics to survey the trait balance in non-arable areas.
- Establishing *Capsella* as an indicator of ecological and management change.

References.

- Hawes C., Begg G.S., Squire G.R., Iannetta P.P.M. (2005) *Oikos* 109, 521-534.
- Iannetta P.P.M., Begg, G.S., Hawes, C., Young M., Russell, J., Squire, G.R. (2007) *Physiologia Plantarum* 129, 542-554.

* Contact: Pete.Iannetta@scri.ac.uk