Common wild plants as biodiversity indicators

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Wild plants commonly termed ‘weeds’ are species stereotyped as being survival specialists. However, this presumption anticipates *ex gratia* the ability of a wild plant species to adapt to a changing environment. This assumption contrasts with our awareness of crop species, which are characterised by a range of different cultivars or varieties, each distinguished by their ability to exhibit one or more profitable traits, such as high yield, strong stems, short time to flowering or reduced seed dormancy. A farmer normally selects a particular variety based upon local conditions. Wild plants should not be considered as different from crops in this respect, since a single wild plant species also comprises a myriad of functionally different forms. Consequently, the ability of wild species to adapt should perhaps not be assumed as a species-property, but rather as a property of the collection of functionally distinct types that comprise that species.

The breadth of variation within a species is an important element of the biodiversity of wild plant species and

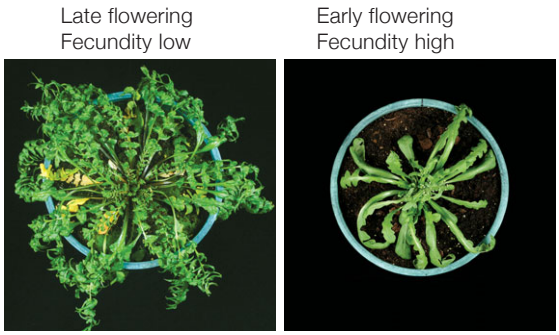

Figure 1 Two extremely different phenotypes are exemplified in the picture. Relatively early flowering plants encompassed *ca*. 85% of the accessions. Flowering quickly was also associated with a longer reproductive duration and the production of more (and smaller) seeds, compared to late-flowering accessions.

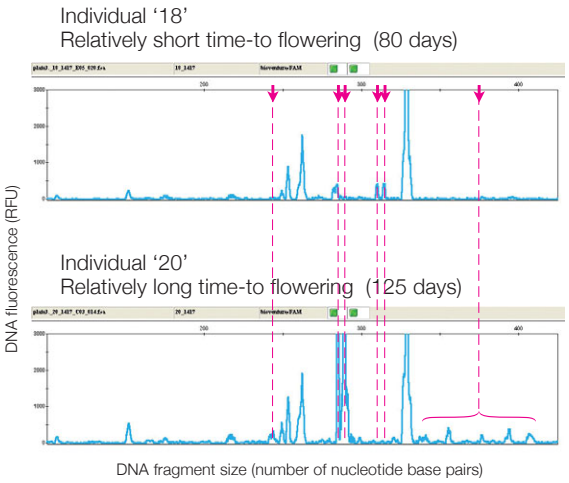

Figure 2 Molecular-fingerprinting techniques are being developed as diagnostic tools. Among these, molecular I-SSR (Inter-Simple Sequence Repeat) data provided the profiles shown above for two *Capsella* accessions with relatively long (125 days) and short (80 days) flowering times. The down-arrows and associated dash-lines highlight the presence and absence of DNA regions that distinguish the functionally different types.

may relate directly to other components of the ecosystem such as management history, soil quality, and the biodiversity of associated trophic layers, including microorganisms, insects and birds. We are currently testing whether there is a causal link between the within-species diversity of wild plants and other components of the ecosystem. If such a link were found, it might provide a means for rapid assessment of the state of a habitat.

Our research presents a novel approach, quantifying biodiversity and assessing the ecological impact of environment changes. The most scientifically accurate quantifications demand that a suitable measurement unit is defined. Historically, the measurement units for biodiversity have been species. However, species are defined largely by the structural characteristics of (for example) their stems, leaves and flowers which do not necessarily serve as indicators of their ecological function. We aim to recognise plants as individuals defined by what they actually do in terms of their ecological service and define the units to measure biodiversity in terms of ecologically significant traits.

To test the utility of our model approach, we have first assessed diversity (Fig. 1) within the common wild plant

A critical mass of highly skilled scientists is an essential component for the most efficient research projects, particularly for ecological studies. The environmental monitoring of natural plant communities demands professionally managed teams to process large numbers of samples, often within short time frames. Team co-ordination also exists across research establishments: here members of the EPI team sort leaf material gathered from across the UK.

Capsella bursa-pastoris (L.) Medic. (meaning, *"little purse-of the shepherd"* in reference to pouches traditionally worn in the Mediterranean area). It was from centres of diversity in this region that *Capsella* radiated to be grown as a food-crop and medicine throughout Europe and beyond, which may explain its prevalence as a colonist of disturbed land worldwide. The wide range of within-species variants has long been acknowledged and recorded since the mid-1800s, with up to 200 types being noted.

Our research has shown that over 85% of all the *Capsella* individuals gathered from farmed fields throughout the UK are relatively quick to flower compared to other arable plants. In addition, wide variation was also found for other ecologically important life history traits for *Capsella*. These include seed and root characteristics and leaf shape, size and number. The implications of trait-imbalance upon other components of the ecosystem, such as resource quality for insect herbivores and crop pathogens, are also being explored.

Molecular diagnostic tests for the trait differences are being developed to estimate the balance of traits for *Capsella* populations that exist on land subject to differing conditions of management and climate (Fig. 2). This information will provide a valuable insight to our understanding of the role that wild plants play in production ecosystems and provide essential information for government policy-makers.

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