THE STANLEY SMITH (UK) HORTICULTURAL TRUST

Application Summary Sheet (please do not extent beyond one page)

Contact details

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About your project

Please provide a project title and short, high level description of the project which you are applying for a grant for.

Phylogeny and speciation of the genus Autonoe (Scilloideae, Asparagaceae) in the Macaronesian region

Use of nuclear and plastid DNA markers combined with phylogenetic analysis to resolve species relationships and boundaries in the predominantly Macaronesian genus Autonoe (Madeiran Squill) using multiple samples from throughout the natural range.

Please identify the category of the Trust's objectives which you believe your project meets.

To promote the conservation of the physical or natural environment by the promotion of biological diversity through the application of horticultural techniques.

Please describe personnel who will be participating in the project (if appropriate).

An international collaboration between Hannah Hall and Alastair Culham in Reading,
Ricardo Mesa and Mario Martínez-Azorín in Spain.

Please describe your long-term plans for the future of the project once the grant has been used (if applicable).

To produce a revision of the genus Autonoe for publication in a scientific journal as part of a larger collaboration for World Flora Online. We would also seek to provide a more accessible account of the genus in horticultural publications, such as The Plant Review, The International RockGardener and Alpine Garden Society newsletter, to draw attention to the genus and enable people to check the identification of their plants.

Financial Information

Please attach all relevant financial information such as expected other income and proposed expenditure.

Sum applied for: £ 5000

Please send your application (including this cover sheet and any supporting documents) preferably in electronic form, hard copy or both to the following addresses:

Postal address (hard copies): Dr David Rae, Director, Stanley Smith (UK) Horticultural Trust, Royal Botanic Garden Edinburgh, 20a Inverleith Row, Edinburgh EH3 5LR

E-mail address (electronic copies): d.rae@rbge.org.uk

Long description:

Introduction

Over recent years the large, well-known bulbous plant genus *Scilla* has been found to comprise a number of smaller genera, amongst which is a small group of species that occur in the Macaronesian region, mainly on the Canary Islands, Madeira and adjacent Morocco. This group is now often recognised as the genus *Autonoe* and includes five or six named species, although the identity of some of these is uncertain as they were described in the early nineteenth century and modern records of them are minimal. The most well-known horticulturally is *Scilla*, now *Autonoe*, *madeirensis*, commonly found in glasshouse collections. It is distinctive for its bulbs with reddish-purple tunics and the tall inflorescence with many small star-like flowers, which appear in late autumn or during the winter. The Macaronesian region is famous for the many unusual endemic species and genera, and *Autonoe* is no exception, being largely restricted to this region. However, strangely, this group of species has received very little attention and, as noted above, modern collections of the species are few. As a result, many questions arise about the identity and relationships of these plants.

Through existing research at the University of Reading we have sequenced one sample each of three of the species of *Autonoe* (*A. madeirensis*, *A. latifolia* and *A. haemorrhoidalis*) but this is limited sampling in terms of the geographical and taxonomic coverage of the genus, especially so as all three samples were from plants in cultivation. Working with colleagues in the University of Alicante and in the Canary Islands, we aim to sequence recent collections from the Canary Islands to gain a better understanding of the genetic and taxonomic diversity of the genus. This research will enable us to support work to conserve the species in their natural habitats.

Molecular analysis has shown that *Scilla* in the broad sense breaks up into three major evolutionary lineages: the Scilla, Fessia and Hyacinthoides clades. *Autonoe* belongs in the latter, which also includes *Hyacinthoides* (the English bluebell, *H. non-scripta*, amongst others), *Oncostema* (the "peruvian" squill, *Oncostema peruviana*) and *Tractema* (the spring squill, *Scilla*, now *Tractema*, *verna*), all of which share a broadly western European or Atlantic distribution. This work was presented at Monocots VII (Hannah Hall's travel to give a presentation was funded by the Stanley Smith Horticultural Trust £2000). While questions remain about all these genera, it is *Autonoe* about which we know the least and therefore the opportunity to work on this group arising from contacts in the Canary Islands makes this a fascinating and potentially very rewarding piece of research.

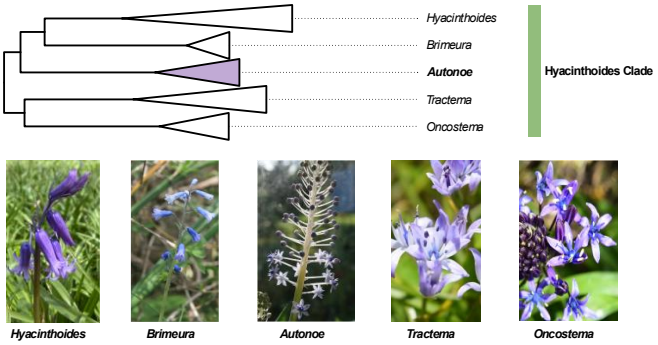
Plants of the *Scilla* group and *Autonoe* in particular are frequently misidentified in collections, leading their being of poor value for conservation and scientific research. This programme of research aims to support the improved identification of plants in cultivation, as well as in their natural habitats.

Research approach/techniques – We have extensive experience of generating next generation DNA sequence data from silica dried and herbarium collections of Asparagaceae subfamily Scilloideae. Our plan is to exploit the recently published Asparagaceae bait set for nuclear DNA enrichment combined with genome skimming for plastid and mitogenome DNA sequence recovery. We have eighty samples of *Autonoe* covering all major island distributions and samples from mainland Morocco with which to generate a well-resolved phylogenetic tree that will allow a formal exploration of the patterns of speciation in this complex genus. These will be sequenced and analysed using Likelihood, Bayesian and Astral tree building approaches to explore divergence and hybridization among lineages.

Costings – detailed breakdown of costs for the research. Extraction of eighty samples (80 * £3.80 = £304), enrichment and DNA sequencing of enriched and non-enriched DNA libraries for 80 samples (£11000). Total cost is £11304 for which we are requesting a contribution of £5000.

Autonoe taxonomy and distribution

- A genus in the Hyacinthoides group, distinguished by inflorescence structure, fruit and bulb morphology.
- Distributed across the Canary Islands, Madeira and Atlantic Morocco
- No comprehensive study since Webb & Berthelott's Histoire Naturelle des Iles Canaries (1845-48) – only 4 species
- There is a critical need for a modern treatment of the genus
- This is important for conservation planning and collections management
- Next generation DNA sequencing will produce large datasets from nuclear and chloroplast genomes
- Work on related genera indicates such data will help resolve relationships and aid species definition



Autonoe bulbs

Autonoe fruit

Currently, three species are widely recognised, *A. madeirensis* in Madeira, *A. haemorrhoidalis* in the Canary Islands, and *A. latifolia* in the Canary Islands and Morocco.