PROJECT TITLE: The diets of solitary bees: ecology and evolution.
DTP Research Theme(s): Living World

Lead Institution: University of Bristol
Main Supervisor: Professor Jane Memmott
Co-Supervisor: Dr Andrew Higginson, School of Psychology, University of Exeter
Co-Supervisor: Dr Natasha de Vere, National Botanic Garden of Wales (CASE Partner)

Project Enquiries: Jane.Memmott@bristol.ac.uk

Image Caption: Andrena fulva, a ground-nesting solitary bee (left) and Anthophora plumipes, the hairy-footed flower bee (right).

Project Background
There are approximately 270 species of solitary bee in the UK, but we know remarkably little about their ecology in comparison to bumblebees and honeybees. Whilst most solitary bee species visit a wide range of plants, some have remarkably specialized diets in that they visit only a few species of flowers. The reasons for these differences are not well understood. This project has two main components. First, we will use molecular approaches to evaluate the true diet breadth of solitary bees in the field by assessing how many species of pollen are found on their bodies. Secondly, we will use modelling to understand the evolutionary and ecological factors that determine the breadth of diet of solitary bee species.

Project Aims and Methods
This project aims to understand the variation in solitary bee diet breadth; to ask why some solitary bees are generalists while others are highly specialised in their flower choices. Much of the current data on specialization in solitary bees is anecdotal and this project will provide the first rigorous field assessment of the flower visitation patterns of solitary bees.

1) What is the diversity of species and families of plants visited by solitary bees in the UK? Field collections will be made of solitary bees and the pollen on their bodies sampled. DNA metabarcoding will be used to determine the plants individual bees have visited prior to capture. By comparing pollen DNA sequences against our Barcode UK database, we will determine how many plant species are visited.

2) What are the evolutionary and ecological factors that determine the distribution of resource plant use by solitary bees? How do these factors interact to cause generalism and specialism. We will use mathematical analysis and/or computer simulations to make predictions that we can test using our field data, by considering how foraging costs, informational constraints, and intra- and inter-specific competition shape diet breadth.
Candidate
This project will suit a PhD student interested in ecology and evolution and keen to learn a broad range of skills: molecular, field, and ecological modelling.

Case Award Description
The Case partner on the project is Dr Natasha de Vere who is based at the National Botanic Garden of Wales. Dr De Vere will provide the molecular training on the project and the molecular component of the project will take place at the National Botanic Garden of Wales. The CASE Partner will provide £1000 a year and cover the cost of the student’s accommodation during a 6-month working visit to the molecular laboratory in the Botanic Garden.

Training
1) Field Skills: designing and implementing field sampling protocols: Training will be provided by Memmott in sampling design and protocols, entomology and ecology.
2) Molecular techniques: de Vere will provide training in DNA extraction, PCR, next generation sequencing and bioinformatic analysis.
3) Ecological modelling: training will be provided by Higginson on mathematics, computer coding, and evolutionary modelling. Hi
4) Generic training for all PhD students is provided in Scientific writing, data analysis and presentation skills

References / Reading List


Links
School webpage http://www.bristol.ac.uk/biology/courses/postgraduate/
NERC GW4+ DTP Website: http://nercgw4plus.ac.uk/
Bristol NERC GW4+ DTP Prospectus: http://www.bristol.ac.uk/study/postgraduate/2017/doctoral/phd-great-western-four-dtp/

Application deadline: 23.59 GMT, Sunday 7 January 2018
How to apply to the University of Bristol: http://www.bristol.ac.uk/study/postgraduate/apply/

General Enquiries:
Bristol NERC GW4+ DTP Administrator Email: bristol-nercgw4plusdtp-admin@bristol.ac.uk