2022_57_DoLS_Gill: Investigating how trait responses to climate change shape Arctic plant-pollinator networks

Supervisors: Richard Gill (mailto:r.gill@imperial.ac.uk); Phil Stevenson (Kew Gardens, UK); Keith Larson (Umea University, Sweden)

Department: Department of Life Sciences

Our understanding of how interaction networks, such as plant-pollinator relationships, are being affected by climate change remains in its infancy. This is primarily due to our limited knowledge of the underlying mechanisms determining how plant and pollinator populations respond to climatic variation. We know little as to how functional traits that mediate plant-pollinator interactions respond to environmental change, particularly about how susceptible certain traits can be. Moreover, we lack studies that have integrated trait response data (for both plants and pollinators) with detailed observations of individual-level interactions. Bringing such data together will enable us to better understand how environmentally driven changes to functional trait distributions and levels of functional redundancy, determine plant-pollinator interaction turnover and co-extinction risks. Ultimately understanding these outcomes can better inform targeted conservation efforts to safeguard ‘at risk’ interactions, and improve accuracy in predicting pollination provision.

This project will study an Arctic plant-pollinator community located in Lapland (Sweden) and will take advantage of a unique phenology transect spanning an elevational gradient. From the subsequent thermal cline, the student will study plant-pollinator interactions across an environmental gradient. Using a space-for-time substitution approach, the student will investigate responses across a [localised] climatic range. The student will collect field data on how plant and pollinator [bumblebee] traits vary within and between species, primarily analysing how different aspects of temperature determine this. For plants, measures will include floral morphology, nectar and pollen reward composition (e.g. carbohydrates, amino-acids, lipids, sterols) and plant thermal profiles. For pollinators, measures will include body size, proboscis length and body thermal profiles. The project may also include common garden experiments to investigate plant trait plasticity versus local adaptation.

How localised changes in floral traits affect pollinator foraging behaviour and health, is still largely unexplored. The student will look to fill this evidence gap by investigating:

i) how temperature variation influences plant trait frequency distributions at different points spanning the elevational range, and how such traits change over time
ii) the levels to which both plant and pollinator traits spatiotemporally turn over
iii) how changes to plant traits can predict pollinator visitations, and how this might alter between and within species competition
iv) model how functionally-based plant-pollinator networks reshape under future climate scenarios

For more information on how to apply to us please visit: https://www.imperial.ac.uk/grantham/education