Adapting to climate change: the impact of changing day light regimes on range-shifting insect populations

Supervisors

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Project description

A consistent effect of the warming of the earth's climate is shift or expansion of species' ranges to higher latitudes. However, while the climate in the new range may match the pre-climate change conditions at the lower latitude, other aspects of the environment will not match. A notable example of this is day length: with increasing latitude the difference in summer and winter day length increases and therefore also the rates of day-length change in spring and autumn. This is particularly important for the many insect species that have to enter a specialised overwintering state (diapause) at the right time in autumn, and emerge from this state at the right time in spring. Changing day length in autumn and spring is generally the crucial environmental trigger for these important changes in the life cycle. In theory, exposure to higher latitude day length regimes can cause the start and end of diapause to be either delayed or advanced, depending on a number of variables. These changes can range from being highly counter-adaptive to neutral. The responses are also likely to vary widely among species, which may lead to a disruption of species interactions in communities, with increasing effects across trophic levels .

This project will break significant new ground in this understudied field of research. For a model system of herbivores (aphids) and their natural enemies (parasitoid wasps) we will determine their responses to different day length regimes, the level of within and between population variation in response, the scope for rapid evolutionary changes in range shifting populations, and the population dynamic consequences of different responses by herbivores and their enemies.

The student will collect experimental populations from a range of latitudes between the south of France and the north of Scotland. They will then carry out experiments in the laboratory using a suite of incubators that are designed to mimic day light cycles for different latitudes, while keeping climate constant. They will have access to a new light-pollution research facility that will make it possible to manipulate day length in field experiments to study the consequences of phenological shifts under realistic environmental conditions.

The student will be part of active research groups focussing on population/community ecology (van Veen, Exeter), ecological effects of light (Gaston, Exeter) and ecological and evolutionary genetics (Bridle, Bristol) and will gain valuable experience and receive training in multiple disciplines.