PROJECT TITLE: How do disease vector populations respond to climate change?
DTP Research Theme(s): Living World
Lead Institution: University of Bristol
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Project keywords: climate change, disease vector, evolutionary response, maternal effects, plasticity

Project Background
One of the major concerns about climate change is how it will influence future distribution of important disease vectors. Such effects are likely to be significant – insects are highly sensitive to temperature for vital rates – yet difficult to predict or to generalise across species. While much research has focused on how mean changes in temperature might influence survival and development in some important vectors, there are major questions unanswered. Climate change involves increases not only in mean temperature, but in variability and unpredictability of extreme events. We know very little about how insect populations respond to this variability, particularly in the context of disease vectors. This project will focus on responses to temperature variability at crucial stages of development in the tsetse fly, vector of deadly sleeping sickness in humans. Using an exciting combination of field, laboratory and theoretical approaches, this project has potential to gain important insights for predicting of tsetse responses to climate change, as well as developing exciting new theory on the evolution of sensitive windows and role of mothers in adaptation.

Project Aims and Methods
The aim of this project is to investigate how tsetse populations respond to changes both in the mean and variability in temperature at different stages of development, and in particular whether tsetse are robust to episodic periods of extreme temperature.

The methodology involved can take several approaches:

1. Laboratory experiments rearing tsetse under controlled climate conditions will allow for specific testing of the thermal limits of tsetse pupae to temperature extremes; whether effects of temperature are stronger for one sex or another.

2. Field observations will allow for accurate recording of the microclimate that tsetse pupae experience at different sites and seasons. The project team already has extensive field data that the student will be able to use, but there is a possibility to continue field observations at the long-standing tsetse research station in Rekomechi, Zimbabwe.

3. Theoretical modelling will explore predicted tsetse population dynamics under different climate change scenarios, using insights gained from the experiments. These can be extended to consider how maternal behaviour (in terms of deposition site choice or allocation during the larval period) may buffer populations against these climatic effects.
The student will have considerable flexibility to tailor this project depending on their interests. For example, a student who wants to spend more time in the field could develop a ‘natural laboratory’ to examine in greater detail how the microclimate that pupae experience buffers against extreme temperatures; or a student with strength in mathematical modelling may prefer to extend these models and consider how evolutionary responses may occur at longer time-scales.

**Candidate Requirements**

Candidates should have a BSc in Biology (or any subject in the Biological Sciences). Ideally, they would also have some research experience on insects either in the laboratory or field, and/or strength in mathematical biology (or be able to demonstrate enthusiasm to learn these skills).

**Training**

The student will be trained in:

- Planning and conducting research from idea through to publication;
- Methodology to record and manipulate temperature (in the field and laboratory);
- Cutting-edge techniques to measure a range of thermal physiology traits in insects;
- Conducting population simulations informed by ecological data;
- Developing evolutionary models incorporating temperature sensitivity and maternal behaviour.

The student will benefit from the input of a team of supervisors with diverse expertise and across different disciplines, including field ecology (Bridle, English [Bristol, UK]), evolutionary theory (Kuijper [Exeter, UK]), and insect physiology and demography (Terblanche, Hargrove [Stellenbosch, South Africa]).

**References / Background reading list**


**Links:**

School URL

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/2019/doctoral/phd-great-western-four-dtp/

How to apply to the University of Bristol:

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