Social and transgenerational effects of parasitism: could they affect biological control of a stored product pest

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Project background
Parasites are a ubiquitous component of an organisms environment and parasitic infection can have a dramatic effect on the behaviour and fitness of the infected individual. Organisms are therefore expected to evolve behavioural strategies that allow them to maximise fitness in the face of parasitic attack. These strategies potentially have consequences for the dynamics of populations and hence understanding how different factors affect behavioural decisions can be key in understanding the long term fate of populations which we might wish to conserve or eradicate. The bean weevil, C. maculatus is a major stored product pest but can be parasitized by various biological control agents (eg the entomopathogenic fungus Beauveria bassiana which is currently undergoing field tests as a potential biocontrol agent). Since such an infection will affect a number of life-history trade-offs and it is important to take these into account in any pest control strategy. In particular, if parasite infection reduces her longevity females may shift resources to early reproduction and increase her egg laying rate. Such fecundity compensation in response to parasitism has been observed in a number of other species but could be an undesirable effect for a pest control strategy. Females may also alter allocation levels to offspring – what consequences would this have for the reproductive potential of surviving sons and daughters. Infected individuals may also decrease levels of competition within a population: what effect might this have on uninfected individuals in a population and overall levels of reproduction in the longer term?

This project will investigate the impact of infection on life-history trade-offs, mating behaviour and mating success and the transgenerational consequences of infection for male and female offspring. There is scope of the student to direct the project to look at particular aspects of mating behaviour they find most of interest and to expand it to consider the effects of infection on interacting non-parasitised members of the population and the hence the consequences of parasitism at the population level.

Key research questions
How does infection impact on host traits in different populations in different environments? Which type of traits are most likely to be affected by infection at different life stages? How does infection impact across generations? What are the social consequences of infection and how do effects via non-hosts combine to impact at the population level?

Methodology
The project will involve designing and implementing controlled experiments to examine the impact of infection and immune challenge on different individuals in a population – both hosts, non-hosts and their family members. Populations can be created that mimic the pests
species’ natural environment and conditions can be manipulated to mimic different environmental conditions. There is scope to measure the impact of infection on a range of life history traits at both individual and population level and to break these down into different components depending on the student’s area of interest e.g. egg provisioning, ejaculate components, physiological measures. Multi-generation experiments are easily conducted in the proposed system as is the tracking of individuals or populations over time.

Training
A comprehensive training programme will be provided comprising both specialist scientific training and generic transferable and professional skills including experimental design, animal handling and husbandry, and parasitological lab based skills as well as training in data management and analysis in a range of statistical packages including R. The project also provides the student the opportunity to interact with a number of bodies involved with biological control and pest management while addressing questions of fundamental biological interest to evolutionary ecologists.

Requirements
Students need at least an upper 2.1 degree in a related biological subject and in a first class undergraduate degree or MSc in ecology or evolution would be an advantage. All training will be provided but any related experience would be an advantage.

Further reading


Project summary
This project will investigate the impact of infection on host and non-host members of a population across subsequent generations. What impact might these have in the biological control of a stored product pest?