Research and Scholarly Activity Fund Award Final Report

Ken Naumann January 2017

The European Fire Ant as an Invasive Species: Multiple Origins and Super-colonies in British Columbia, Canada

The stinging, invasive European fire ant (EFA), *Myrmica rubra*, has become a public health issue in southwestern British Columbia. It also causes profound negative effects on the existing ant fauna and other insects and is projected to have an economic cost of over $100 million/year if it spreads across its potential range in the province. Is its successful invasion due to the formation of genetically-uniform super-colonies? Was there a single origin to the British Columbia EFA populations or has there been more than one introduction? Has genetic divergence occurred since the first introduction(s)? Answers to these questions could be found through both behavioural assays, which score the degree of aggression between individuals from different nests, or by quantifying the degree of molecular similarity at the level of DNA. The aim of the RSAF-funded research has been to quantify the degree of genetic diversity between the major areas of EFA outbreak in the province, and to compare it to that seen in two closely related species, one native, and the other a relatively recent introduction. After exploring several options, this was accomplished via polymerase chain reaction (PCR) amplification and DNA sequencing of two mitochondrial genes, cytochrome oxidase and cytochrome b. This work has been carried out in collaboration with Dr. Mario Moniz de Sa of the Biology Dept. and two Langara College students, Eleanor Lewis and Roshan Noronha.

As of January 2017, DNA samples from individual ants have been sequenced and the differences between them used to construct a tree that shows the relative genetic similarities of individuals from different species and different outbreak areas. Statistical analysis of those results will then allow comparison with estimates of genetic similarity determined by already completed behavioural assays. We are currently preparing a manuscript for publication in a refereed journal and hope to make submission by the end of the summer term.

This project has allowed two students to participate in an original research project and to be responsible for carrying out hands-on tasks in the lab and making original contributions to technical aspects of the project. This degree of direct involvement in original research is unusual at the undergraduate level, particularly for students in lower level courses. Both students will be coauthors of any publication(s) that include the molecular data.

Methodologies arising from this project are already being incorporated into laboratory exercises for second year molecular biology courses, giving those students a chance to work on a system that is currently being investigated, and opening up the possibility that

future cohorts of students could contribute directly to data collection while carrying out their lab exercises.

Equipment that was purchased for this project will be used in second year biology lab exercises. For the faculty involved, this research has been both a source of new knowledge and inspiration, both of which find their way into the classroom. It has also been a good example of a collaboration between faculty members from different disciplines of Biology, i.e. an ecologist and a molecular biologist.

This particular aspect of the EFA project has no external partner but has involved interactions with various agencies who gave permission to collect ants on lands that they administer. These groups include the City of Vancouver, the City of Richmond, the Greater Vancouver Regional District, the University of British Columbia Botanical Garden, the Canadian Wildlife Service, the Burnaby and Region Community garden Association, and homeowners in greater Victoria, and Chilliwack.

The results of this work will be of particular interest to municipal and provincial governments who currently are dealing with this invasive species. It will also be of interest to researchers who study invasive species. Several species of invasive ants have had similar ecological effects when arriving in different parts of the globe, i.e., the formation of super-colonies and a decrease in the biodiversity of native species. The knowledge gained here may have broader application in understanding this phenomenon as a whole. An understanding of how and why some invasive ant species switch to super-colony formation may point towards a way to mitigate such invasions. This would potentially be of interest to different levels of government and to research funding agencies such as NSERC.