University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

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BSc (University of Victoria, 2015)

"Genetics and Ecology of an Unusual Sex Ratio Distorter in the Booklouse *Liposcelis* sp."

Department of Biology

Monday, December 17, 2018
9:00 A.M.
Engineering and Computer Science Building
Room 128

Supervisory Committee:
Dr. Steve Perlman, Department of Biology, University of Victoria (Supervisor)
Dr. Juergen Ehlting, Department of Biology, UVic (Member)
Dr. Christopher Nelson, Department of Biochemistry and Microbiology, UVic (Outside Member)

External Examiner:
Dr. Dietmar Schwarz, Department Biology, Western Washington University

Chair of Oral Examination:
Dr. Caren Helbing, Department of Biochemistry and Microbiology, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Selfish genetic elements can distort the sex ratios of their hosts by increasing their own transmission to the next generation in a non-mendelian fashion. These elements can be either nuclear genes on a sex chromosome or cytoplasmically inherited microbes, and achieve an increased transmission by manipulating gametogenesis or host reproduction. Often these selfish elements benefit from a female biased population (for example heritable microbes are passed on maternally in the egg cytoplasm), while non-selfish, autosomal genes are selected to produce a balanced sex ratio. These differing reproductive strategies cause a genetic conflict that results in an “evolutionary arms race” that can promote the evolution of sex determination systems. In this thesis, I investigate an extreme sex ratio distortion in a species of booklouse, *Liposcelis* sp. This species contains two distinct female types, one of which carries a maternally transmitted selfish genetic element that results in exclusively female offspring being produced. Recently, a candidate for the sex ratio distortion was identified as a horizontally transferred bacterial gene, that we have called Odile, and that is present in the genome of the (distorter) female carrying the distorting element. The gene originates from the endosymbiotic bacterium *Wolbachia* that is well known for its ability to distort the sex ratio of its hosts.

I investigated this horizontal gene transfer event and attempt to characterize Odile. I provide evidence that this *Wolbachia* gene has been integrated into the genome of the distorter females and is not a bacterial contaminant. I found that the Odile gene has been duplicated and may have been horizontally transferred from *Wolbachia* independently to at least three other insect genomes. Additionally, I found that Odile is transcribed at low levels in a life-stage specific manner that is suggestive of a role in development. Additionally, I looked into male mate choice in this species as one aspect of the persistence of the distorting element. I found that male *Liposcelis* sp. do not discriminate between the two female types and do not spend more time mating with one female type over the other. These results contribute to ongoing research into the extreme sex ratio distortion found in this species and the candidate gene that may be the cause. Selfish genetic elements are an important driver of sex determination evolution, and *Liposcelis* sp. provides a unique and exciting system to investigate the implications of selfish elements in a genome further.