CYANOGENESIS GENE DELETION HAPLOTYPES IN *T. REPENS* ACROSS URBAN-RURAL GRADIENTS

Beata Cohan*, James S. Santangelo, Rob W. Ness, Marc T.J. Johnson

Department of Biology, University of Toronto Mississauga, Mississauga, Ontario, Canada, L5L 1C6
Correspondence: beata.cohan@mail.utoronto.ca

Urbanization has changed much of the world's terrestrial landscape, impacting the evolution of many species living in and around cities. For example, recent studies have shown that the production of hydrogen cyanide (HCN)—a potent anti-herbivore defense—gradually decreases toward urban centres, although the mechanisms structuring these phenotypic clines are unknown. HCN results from the epistatic interaction among two independently-assorting, Mendelian genes (*CYP79D15 and Li*) and plants require a dominant allele at both loci to produce HCN. Acyanogenic individuals arise due to genomic deletions at one or both loci, and each locus has multiple, putatively neutral, deletions segregating within natural populations. Here, we take advantage of the multiple deletion haplotypes responsible for acyanogenic clover genotypes to address the following question: are urban-rural phenotypic clines in HCN best explained by the segregation of one or multiple deletion haplotypes underlying the loss of cyanogenesis? We use PCR to amplify regions unique to each haplotype in clover samples collected from 40 populations spanning an urban-rural transect in Toronto, Canada. We examine how the frequency of each haplotype changes across populations along the urban rural transect and discuss the role of non-adaptive evolutionary processes in governing these changes. Ultimately, our study provides evidence for how clines in adaptive traits may be driven in tandem by adaptive and non-adaptive processes, shedding light into the mechanisms driving urban evolution.

Poster Presentation
Group B: Ecology & Evolution

THE INFLUENCE OF ANTHROPOGENIC DISTURBANCE ON THE DAILY ACTIVITY PATTERNS OF WHITE-TAILED DEER (*ODOCOILEUS VIRGINIANUS)* IN AN URBAN ENVIRONMENT AT THE RIVERWOOD CONSERVANCY PARK

Mariana F. d. C. Vicente*, Johnathan Davidson*, Tommy R. Lin*, Bansari Patel, Monika Havelka, and Christoph Richter

Department of Biology, University of Toronto, Mississauga, ON, L5L 1C6
mariana.vicente@mail.utoronto.ca, johnathan.davidson@utoronto.ca, tommyr.lin@mail.utoronto.ca, bansari.patel@mail.utoronto.ca, monika.havelka@utoronto.ca, and christoph.richter@utoronto.ca

White-tailed deer (*Odocoileus virginianus*) populations have been steadily increasing in urban areas in recent years. Their influence on urban environments as a keystone species and as a carrier for communicable diseases has been well-studied. However, the influence of urbanized environments - via phenomena such as artificial light, noise pollution, and human activity - on deer and their behaviour has received less attention. White-tailed deer in rural environments are crepuscular, showing greatest activity at dusk and dawn. Here, we examine activity patterns of white-tailed deer over the 24-hour daily cycle in an urban environment to observe the effects of anthropogenic influences on deer behaviour. We used four motion-sensor camera traps to monitor deer activity on a 24-hour basis at an urban park (the Riverwood Conservancy park in Mississauga, ON). From June 2016 to March 2018, we sampled 3,156 photos of white-tailed deer at this location. We speculate that urban white-tailed deer at Riverwood Conservancy park experience disturbance in their crepuscular activity patterns compared to rural populations due to common anthropogenic disturbances found in suburban areas. We expect deer activity to be non-crepuscular and to deviate from their typical dusk-dawn cycle to reflect new peak activity times or evenly distributed activity across 24-hour time intervals. This behaviour should reflect a shift in their circadian rhythm as a result of an urbanized environment.

Poster Presentation

Group B: Ecology & Evolution

USING PIGMENT COMPOSITION TO DETECT DIFFERENCES AMONG WHITE SPRUCE GENOTYPES

Zein Hajali*, Ariana Besik, Chris Wong, Petra D'Odorico, Ingo Ensminger
Biology department, University of Toronto, Mississauga, ON, L5L 1C6
zein.hajali@mail.utoronto.ca

Poster presentation

B: Ecology and Evolution

Climate change is expected to cause a mismatch between locally adapted species and the optimal climate conditions to which they have adapted. It follows that stress tolerance and phenology are becoming key traits to be considered in plant breeding efforts.

In this study we look at differences in pigment composition among ten white spruce genotypes as a proxy to determine stress tolerance and phenological up-/down-regulation of photosynthesis. Needle sampling was performed at three different time points in the season (June, August, October) at a white spruce forest stand in St. Casimir (Quebec). Sampling size was 300 (10 genotypes x 10 replicate trees x 3 time points). Analyzed pigments included chlorophyll a and b, alpha and beta carotene, xanthophyll cycle pigments, lutein, and alpha-tocopherol. Pigment samples were extracted using methanol and analyzed via High-performance liquid chromatography (HPLC).

It was found that different genotypes had different pigment compositions which points towards a possible divergence in adaptation to their environment.

THE EFFECT OF SPANISH RIVER CARBONATITE ON THE MICROBIAL COMMUNITIES OF A VINEYARD

Richard D Honor*, Frédérique C Guinel

Wilfrid Laurier University, Department of Biology. Waterloo, ON, N2L 3C5

richardhonor@gmail.com, fguinel@wlu.ca

Chemical fertilizers are widely used for their rapid impact on crop yield. They are applied to replenish the major nutrients in the soil, typically nitrogen and phosphorus, which are required for plant growth. However, using chemical fertilizers comes at a cost; because nutrients are applied in a soluble form, much are lost to the environment. Nitrogen can be converted to the greenhouse gas nitrous oxide and phosphorus can be deposited in aquatic systems leading to eutrophication. Furthermore, chemical fertilizers can have a negative impact on beneficial soil microorganisms; these can protect crops from pathogens, aid in nutrient acquisition, and increase crop yield. Spanish River Carbonatite (SRC) is an insoluble mineral deposit that is being investigated for its use in agricultural systems to replenish soil nutrients and remediate soil health. In this study, SRC was compared to fertilizers in plots within a vineyard before and after amendment application to assess their impact on soil microbial communities. Heterotrophic and nitrogen-fixing bacteria were enumerated, using the spread plate method, on Nutrient Agar (NA) and Yeast Mannitol Agar (YMA), respectively. Plots treated with SRC appeared to have significantly more culturable heterotrophic bacteria than plots treated with chemical fertilizer. A similar trend was observed on YMA plates as soils treated with chemical fertilizer had less culturable nitrogen-fixing bacteria; however, this result was not significant. These results support the use of SRC as a tool to remediate soil health, and provide some of the first evidence for the efficacy of SRC in a field setting.

Poster Presentation

Judged in: Ecology and Evolution

ASSESSING BACILLUS SUBTILIS STRAINS 1D-12 AND 1B-23 FOR BIOCONTROL CAPABILITIES AGAINST COMMON TOMATO PLANT PATHOGENS

Matthew M. Laird[1,2]*, Brian J. Weselowski[2], Ze-Chun Yuan[2,3]

[1]Physiology and Pharmacology, Western University, London ON, N6A 3K7 mlaird5@uwo.ca

[2]Agriculture and Agri-Food Canada, London ON, N5V 4T3 brian.weselowski@AGR.GC.CA

[3]Microbiology and Immunology, Western University, London ON, N6A 3K7 zyuan27@uwo.ca

As the world's human population continues to rapidly expand, a significant burden is placed on agriculture to satisfy the demand for food. Tomatoes are an important area of study as they are the second highest consumed vegetable in western countries and contain important antioxidants. Bacillus subtilis strains produce cyclic lipopeptides that are capable of providing protection against tomato plant pathogens and could be harvested for use in disease protection for greenhouse tomatoes. Two common tomato plant pathogens are Clavibacter michiganensis subsp. michiganensis (Cmm98-1) and Pseudomonas syringae pv tomato DC3000 (DC3000) which causes canker and bacterial speck on tomato plant leaves respectively. Bacillus subtilis strains 1D-12 and 1B-23 have been assessed for their potential biocontrol abilities against tomato plant pathogens via inoculation of tomatoes in a greenhouse and hydroponic tank environment. We hypothesized that Bacillus subtilis strains 1D-12 and 1B-23 will significantly affect tomato disease severity when applied as a biocontrol. Strains 1B-23 and 1D-12 showed significant reduction in disease severity ($P<0.05$) against plants infected with Cmm98-1 and no significant reduction in disease severity against DC3000 ($P>0.05$). Confocal laser scanning microscopy showed Cmm98-1's ability to infect the tomato plant via the roots and Bacillus subtilis strains 1B-23 and 1B-12 ability to form a protective biofilm on the tomato roots. Bacillus subtilis strains' biologically active compounds will be determined using Liquid Chromatography coupled to Mass Spectrometry (LC-MS). Upon completion of this project, Bacillus subtilis strains 1D-12 and 1B-23's active compounds and inhibition ability of tomato pathogens will be identified.

Poster Presentation

Ecology and Evolution

EXAMINING FACTORS POTENTIALLY INFLUENCING THE OUTCOME OF MATING INTERACTIONS IN *DROSOPHILA MELANOGASTER*

Dr. Tristan A.F Long & Tijana Lazova*

Biology Department, Wilfrid Laurier University, Waterloo, ON N2L 3C5; tlong@wlu.ca and lazo5160@mylaurier.ca

The common fruit fly, *Drosophila melanogaster* is an important model species for studying the operation of sexual selection. However, in studies using this species, there is often considerable variation – both within and between experiments – in the outcome of mating interactions between males and females. It has been suggested that some of this variation might be the result of one or more of the following factors: the type(s) of male present in the vial, the physiological condition of the female, the choice of colours used as identification markers (i.e. dust) and/or the presence of "rival" males. To better understand the potential importance of these factors to mating outcomes, rates and copulation latencies, we have conducted a series of choice and no-choice assays in which we varied the target male's genetic identity, the colour used to identify him, and/or the body size of the female present. By preforming two different types of mate-choice assays, we are able to examine the potential impact of experimental-design biases on mating outcomes. Although we found that the likelihood of mating with a particular clone line male was fairly consistent between the choice and no-choice assays, in the choice assays there were more potential factors that significantly influenced the specific mating patterns observed. We discuss these results in the context of what it means for future studies of *Drosophila melanogaster* and of sexual selection in general.

Poster Presentation
B: Ecology & Evolution

OPPOSING EFFECTS OF A MAJOR ICE STORM ON ALPHA AND BETA DIVERSITY IN A TEMPERATE FOREST REMAIN AFTER 20 YEARS

Jed I. Lloren*[1], Lenore Fahrig[2], Joseph R. Bennett[2,3], and Jenny L. McCune[2].

[1]Department of Biology, Carleton University, Ottawa, ON, K1S 5B6, jed.lloren@carleton.ca

[2]Geomatics and Landscape Ecology Research Laboratory, Department of Biology, Carleton University, Ottawa, ON, K1S 5B6, lenore.fahrig@carleton.ca, jenny.mccune@glel.carleton.ca

[3]Institute of Environmental Science, joseph.bennett@carleton.ca

Abstract

Few studies have tracked changes in forest plant communities over the long-term to determine their responses to natural disturbances. Disturbances which cause canopy loss lead to increased woody stem density and species richness, and can also cause changes in beta diversity. However, it is uncertain how long these changes persist, or whether forest communities will return to pre-disturbance conditions at all. Using data from re-surveys in the years immediately following, and 20 years after, a severe ice storm in Ottawa, Ontario, we measured changes in woody stem density, species richness, and beta diversity over time. The density of shrub and sapling stems increased dramatically in the second growing season after the storm, but returned to pre-storm levels by the third year. In contrast, species richness increased significantly after the storm and had not returned to pre-storm levels even 20 years later. There was a significant decrease in beta diversity after the storm for trees, which also was maintained at the 20-year mark. Our results show that the changes imposed by an ice storm on woody species in a temperate forest are still evident after two decades, emphasizing the importance of long-term studies.

Poster presentation

Group B: Ecology & Evolution

BEHAVIOURAL RESPONSES OF THE GREAT POND SNAIL (*LYMNAEA STAGNALIS*) TO THE THREAT OF RUSTY CRAYFISH (*ORCONECTES RUSTICUS*) PREDATION

Grace E. K. McKinney*[1], Thomas J. Hossie[1], Jacob Seguin[1], and Dennis L. Murray[1]

[1]Biology Department, Trent University, Peterborough, ON, K9J 0G2
gracemckinney@trentu.ca, thossie@trentu.ca, jacobseguin@trentu.ca, dennismurray@trentu.ca

When exposed to the threat of predation, prey are known to alter their behavior as a means of evasion. The interaction between the Rusty Crayfish (*Orconectes rusticus*), and the Great Pond snail (*Lymnaea stagnalis*) is an example of this relationship. Both are freshwater, aquatic species that commonly coexist in a natural environment, and as a way of evading predation the Great Pond snail has been to shown to elicit behavioural responses including floating to the surface, or leaving the water entirely. A means by the which snails are able to perceive predator presence involve detection of two chemical cues; the kairomones of a nearby threat, and conspecific alarm signals emitted by snails recently killed. Presented in this lab-based study are the observed behavioural responses of the Great Pond snail when exposed to Rusty Crayfish kairomones, conspecific alarm cues, or a combination of the two. Results indicate the most immediate and long-lasting behavioural responses of the Great Pond snail occur when exposed to a combination of kairomones and conspecific alarm cues. These findings hold merit in the context of a larger study exploring the relationship and extent of predatory crayfish stress on the phenotypic plasticity of both the offspring and grand-offspring of stressed Great Pond snails. Furthermore, in the context of perceived predation and threat detection, this research explores the degree by which Great Pond snails respond to predatory stress, and, of the two aspects studied, the method of threat detection producing the greatest response.

Poster Presentation

Ecology and Evolution

A COMPUTATIONAL ANALYSIS OF THE ORIGIN OF MENOPAUSE

Nicole E. Szabo

Biology, McMaster University, Hamilton, ON, L8S 4L8, szabone@mcmaster.ca

The evolutionary origin of menopause in humans is a decades old puzzle that continues to intrigue evolutionary biologists. Though multiple hypotheses have been put forth by researchers, there is not universal agreement on which are correct. As the evolutionary origin of menopause in female humans is still being debated, I am further investigating this topic. The impact of fixed pleiotropic mutations on survivorship curves and fertility curves, and subsequently reproductive rates, in hypothetical populations created in the computer program Mathematica are to be observed. The hypothetical populations are compared to the fertility and survivorship curves and reproductive rates of comparison populations. The comparison and hypothetical populations have varying maximum lifespans, ages at which reproduction ceases, and fertility rates, allowing the investigation of how altering these factors impacts reproductive rates in the comparison and hypothetical populations. Analyzing how the reproductive rates differ between the hypothetical populations and the comparison populations may contribute to the determination of why pleiotropic mutations such as BRCA1/2 mutations have not become fixed in human populations even though they confer reproductive benefits.

Poster presentation
Ecology & Evolution

THE ROLE OF FACIAL COLOURATION ON SOCIAL PREFERENCES IN A COOPERATIVELY BREEDING FISH

Sanduni T Talagala*, Brett M Culbert, Sigal Balshine

Dept. of Psychology, Neuroscience & Behaviour, McMaster University, Hamilton, ON, L8S 4L8
talagast@mcmaster.ca, culbertb@mcmaster.ca, sigal@mcmaster.ca

Animals often use vibrant colours to signal their quality to potential mates and social partners. However, the pigments required to produce these signals are typically in high demand and low supply. Therefore, animals may prefer to associate with individuals with such signals, as they may indicate superior quality. In complex social systems, such as that of the cooperatively breeding African cichlid *Neolamprologus pulcher*, social signals that indicate high quality may be particularly important as individuals need to choose not only mates but also helpers. *N. pulcher* have prominent yellow facial markings, however, it is unknown whether these markings serve as a signal of quality. To assess this, we artificially enhanced or removed the yellow colouration on the faces of stimuli fish and measured the amount of time focal fish spent associating with yellow enhanced vs yellow removed individuals. We found that both males and females seemed indifferent to the amount of yellow on the faces of stimuli fish when choosing potential mates, as well as social partners of the same sex. Furthermore, the yellow markings on the faces of monogamous and polygamous males in the wild did not differ, suggesting that polygamous males did not attract more females as a result of more yellow facial markings. Overall, taken together our findings from the lab and field suggest that yellow facial markings do not affect social preferences or mate choice in *N. pulcher*. Our results add to the literature of social evolution and suggests that not all species prefer bright coloration.

Poster Presentation
B: Ecology & Evolution