

Presentation Abstracts

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Yeast enhances the attraction of yellowjackets to dried fruit and fruit powder

Tamara Babcock¹, R. Gries¹, L. Palmero¹, G. Gries¹, J. Borden², A. Mattiacci³, M. Masciocchi³, J. Corley³, ¹Simon Fraser University, ²Scotts Canada, ³GEPI-INTA

There is need for the development of a better trap bait which can effectively trap pestiferous yellowjacket species. We field tested dried fruit and fruit powder baits with and without yeast, and found that the addition of yeast improved the attractiveness of fruit baits to yellowjackets by up to 50-fold.

Toxin diversity and specificity in a *Drosophila* defensive symbiosis

Matt Ballinger and Steve Perlman, Department of Biology, University of Victoria

Ribosome-inactivating proteins (RIPs) have been implicated in *Spiroplasma* symbiont-mediated defense of *Drosophila* against parasitic nematodes. We test the activity of these toxins against parasitoid wasps, implicating them in protection against endo- but not ectoparasitoids, and examine the role of diverse natural enemies of insects in driving the evolution of bacterial toxin repertoires.

Population state-dependent invasion potential of the mountain pine beetle in Alberta

Jordan Lewis Burke, Richard Hamelin, Allan Carroll, Dept. of Forest and Conservation Sciences, Faculty of Forestry, University of British Columbia

The mountain pine beetle [MPB] has invaded novel pine habitat in Alberta, and has transitioned from the native species, lodgepole pine, into the novel boreal species, jack pine. While evidence currently supports the prediction that MPB will have an advantage in jack pine during epidemic population phases, the fate of low-density endemic populations is unclear. Here, I present two studies conducted over the last two years, which surveyed trees typically selected by endemic MPB for competitor dynamics in the field, and compared MPB symbiont growth characteristics under a range of conditions and compared these to an antagonistic competitor in the lab. Results demonstrate a clear disadvantage for endemic MPB in jack pine compared to lodgepole. MPB, and potentially other eruptive bark beetles, are likely to exhibit population state-dependent invasion potential, where epidemic behavior may lead to success while endemic behaviors may lead to failure to establish in novel systems with no coevolutionary history. These results support continued effort by forest managers in Alberta to prevent MPB populations from breaching epidemic thresholds, as their populations at low-density are unlikely to be stable, and unable to persist long-term.

Creating a DNA biomarker to identify dengue refractory and susceptible *Aedes aegypti*

Heather Coatsworth, Clara Ocampo, Carl Lowenberger, Simon Fraser University

Dengue viruses transmitted by *Aedes aegypti* infect 50-100 million people each year. In Colombia, 30% of feral *Ae. aegypti* are dengue refractory. We conducted a genome-wide association study comparing susceptible and refractory mosquitoes. Variants were

investigated for possible relevance to the phenotypes. Secondary validation of these variants is currently underway.

Cutworm Killer: an Okanagan *Beauveria bassiana* isolate shows promise for climbing cutworm control in vineyards

Naomi DeLury and Tom Lowery, AAFC-SuRDC

Climbing cutworms (Lepidoptera: Noctuidae) are a major pest of grapevines in the Okanagan and Similkameen valleys of BC, attacking grape buds early in the spring when temperatures are low. We compare the efficacy of a local field-collected isolate of *Beauveria* and commercial strains against local and introduced cutworm species.

Mixed pathogen interactions: how does host nutrition modulate disease?

Pauline S. Deschodt, Olivia J. H. Walker, Alana K. Breikreutz and Jenny S. Cory, Department of Biological Sciences, Simon Fraser University

Individual hosts are commonly challenged by multiple pathogen species. Yet, studies on insect-pathogen interactions mainly focus on interactions between a single host and a single pathogen. Two (or more) pathogens co-infecting a host may compete directly (interference) or indirectly, for resources or via the host immune system. These competitive interactions could increase or decrease host mortality, or result in no change, as well as alter the transmission of disease within the population. In insects, increased dietary protein can increase survival, to pathogens such as baculoviruses and bacteria, even when nutrition is altered post-infection. However, the role of nutrition in mixed pathogen infections is not known, but is likely to relate to the relative cost of resistance to different pathogen groups. Using the cabbage looper, *Trichoplusia ni*, its nucleopolyhedrovirus (TnSNPV) and the entomopathogenic fungus, *Beauveria bassiana*, we asked whether host nutrition could alter the outcome of a mixed infection. We challenged *T. ni* larvae with either a single pathogen species or two simultaneously; then reared the larvae on an artificial diet differing in levels of two major macronutrients, protein and digestible carbohydrate (quality) or the total amount of these two macronutrients (quantity). The results suggest that the virus and fungus respond differently to host nutritional intake, especially on different ratios of protein and carbohydrate. As expected, poor quantity diet exacerbates the negative effect of pathogen on host survival. Moreover, in co-infection, the effect of diet composition on host mortality is greater at lower pathogen doses. These results indicate that diet could be an important modulator of mixed infections.

Within-individual repeatability of behavioural activity levels of the parasitoid *Pachycrepoideus vindemmiae*

Wendy Fleming, University of Victoria

A model system for tracking parasitoid behavioural activity levels and connecting them to biological control performance was developed using the pupal parasitoid *Pachycrepoideus vindemmiae*. Three aspects of activity levels were studied: i) circadian patterns; ii) links to sex and body size; and iii) within-individual repeatability ("personality").

How to Train your Parasitoid (in Sawdust)

Jessica Y.W. Leung¹ and Paul K. Abram², ¹Simon Fraser University, ²Agriculture & Agri-Food Canada

In a proof-of-concept study, we show that the parasitoid *Pachycrepoideus vindemmiae*, a candidate biological control for the berry pest *Drosophila suzukii*, can be retained for longer in a realistic substrate where hosts are usually present (sawdust mulch) when it has been "trained" to associate the substrate with *D. suzukii* pupae.

Synthetic Aphid Honeydew Volatiles Attract Mosquitoes (Diptera: Culicidae)

Dan A.H. Peach, N. Young, R. Gries, S. Kumar, G. Gries, Simon Fraser University

Adult mosquitoes exploit a variety of plant sugar sources. Plant-derived semiochemicals guide mosquitoes to inflorescences and fruit, but the cues that attract mosquitoes to other sources remain largely speculative. Drawing on literature reports of aphid honeydew volatiles, we tested the attraction of synthetic honeydew volatile blends to *Aedes aegypti* mosquitoes.

Flash in the pan or long term threat? MPB in novel pine habitats

Stan Pokorny, University of British Columbia

No abstract provided.

Manipulating Vector Competence in the Yellow Fever Mosquito, *Aedes aegypti*

Lea Sanchez Milde, Heather Coatsworth, and Carl Lowenberger, Simon Fraser University

Aedes aegypti is the principal vector of dengue viruses. We are using CRISPR-Cas9 technology to knock out specific mosquito genes to generate dengue-refractory mosquitoes. We then will evaluate fitness and vector competence of the knockout lines to determine their suitability for use in dengue reduction programs.

Effect of nutrition status on the lifespan and reproductive output of the click beetle *Agriotes obscurus*

Kari Zurowski¹, Jenny Cory¹, Jessi Ly¹, Danielle White², Todd Kabaluk³, Alida Janmaat²,
¹Simon Fraser University, ²University of the Fraser Valley, ³Agriculture and Agri-Food Canada

Adult *A. obscurus* were paired and provided with an apple slice (fed) or no apple (starved) to determine the effect of nutrition on reproduction. Egg numbers and oviposition were recorded. Starved females laid fewer eggs for a shorter period than fed females, suggesting nutrition is important for *A. obscurus* reproduction.

Trade-offs between reproduction and disease resistance in the click beetle *Agriotes obscurus*

Kari Zurowski¹, Jenny Cory¹, Jessi Ly¹, Danielle White², Todd Kabaluk³, Alida Janmaat²,
¹Simon Fraser University, ²University of the Fraser Valley, ³Agriculture and Agri-Food Canada

Adult *A. obscurus* were challenged with a high concentration, a low concentration, or a control of *M. brunneum* and their reproduction was monitored. Egg numbers and oviposition were recorded. Females challenged with the pathogen laid fewer eggs for a shorter amount of time than unchallenged insects, suggesting lifespan restricted fecundity.

Effect of duration and location of pheromone trap placement in field margins on population estimates of two click beetle species

Wim Van Herk, Agriculture & Agri-Food Canada

Pheromone traps can be used to approximate the population size of pest click beetle species in areas where their larvae (wireworms) cause extensive damage to field crops (e.g. in PEI). If trap catches are used for making decisions in an IPM program for wireworms, it is important to know under what conditions trap catches are representative of the beetle populations present. The main pest click beetle species in Canada disperse primarily by walking, and hence it is likely that keeping a pheromone trap in a permanent location (e.g. in field margins) causes the population immediately around it to be depleted. Hence depending on how long they are maintained in a fixed location in the field, traps may underestimate actual populations. In this talk we demonstrate that this occurs, is affected by weather, and that it varies with species.

A trait-based approach to predicting spread rates of invasive forest insects

Brian Van Hezewijk & Lara Van Akker, Natural Resources Canada, Pacific Forestry Centre

Being able to predict how fast an invasive species will spread is crucial information for the management of novel alien species. Based on an historical database that documents the invasion of Canada's forests by 329 species of arthropods, we developed a statistical model that incorporates biological traits as well as geographic variables to predict the asymptotic rate of spread of new invaders.