6th Joint Annual Meeting
Entomological Societies of Alberta and Saskatchewan
October 3-5, 2019
Elkwater Lodge, Elkwater, Cypress Hills

PROGRAM

THURSDAY OCTOBER 3

Executive board meeting: *5:00 – 7:00 pm*

Registration and Mixer: *7:00 – 10:00 pm*

FRIDAY OCTOBER 4: MEETING BEGINS AT 8:00 AM

7:00 – 8:00 am BREAKFAST (on your own) Buglers at the hotel is open

7:15 – 8:00 am Registration will be open

8:00 – 8:10 am: Introduction and Welcome

Organizing Committee Welcome: Hector Carcamo

Entomological Society of Alberta President: Lisa Lumley

Entomological Society of Saskatchewan President: Daniel Wiens

8:10 – 11:30 AM - GEORGE BALL SYMPOSIUM – Moderators: Aaron Bell & Tyler Wist

* Before the title denotes a student presentation; presenter name is underlined

8:10 – 9:00	**Keynote speaker – Our Quarter: entomology of the prairie homestead.** David Larson.
9:00 – 9:30	**Faunistic entomology, post-glacial biogeography, and the legacy of Professor George E. Ball.** John Acorn. University of Alberta.
9:30 – 9:45	**BREAK**
9:45 – 10:15	**Beetles, books and Ball: the context and style of George Ball's influence on insect systematics.** Felix Sperling. Department of Biological Sciences, University of Alberta, Alberta.
10:15 – 10:45	**Wireworm research in the Prairies: past & present, similarities & differences.** Wim Van Herk. Agassiz Research and Development Centre, British Columbia.

10:45 – 11:00 **Ants in Alberta, and Canada: An Update.** James Glasier. Fish and Wildlife Specialist MNA.

11:00 – 11:15 ***Moth biodiversity survey of southeastern Alberta.** Leah Jackson and Sperling, F. University of Alberta, Department of Biological Sciences, Edmonton, AB.

11:15 – 11:30 ***Testing for Evidence of the Large-X Effect in Spruce Budworm and related *Choristoneura*.** Marnie Wright and Sperling, F.A.H. Department of Biological Sciences, University of Alberta, Edmonton, AB.

11:30 – 1:00 LUNCH (on your own, Buglers at the hotel is an option)

1:00 – 2:45 pm ORAL PRESENTATIONS: SESSION 1 – Moderators: Berenice Romero & Heather Proctor

* Before the title denotes a student presentation; presenter name is underlined

1:00 – 1:15 ***Elucidating the Distribution of a Non-Native Species of Katydid in Alberta Using Bioacoustics**. Alexandre Caouette. Department of Biological Sciences, MacEwan University, Edmonton, AB.

1:15 – 1:30 ***Population genetic structure of forest tent caterpillar in relation to larval host, forest zones and geography.** Kyle Snape[1,2], Roe, A.D.[2], and Sperling, F.A.H.[1] [1]Department of Biological Sciences, University of Alberta, Edmonton, AB. [2] Natural Resources Canada, Canadian Forest Service, Great Lakes Forestry Centre, Sault Ste. Marie, ON.

1:30 – 1:45 ***Seasonal migration of corixids (Hemiptera: Corixidae) as a linkage between wetland and river ecosystems.** Stephen Srayko[1], Jardine, T.[2], Phillips, I.[1,] and Chivers, D.[1]. [1] Department of Biology, 112 Science Place, University of Saskatchewan, Saskatoon, SK. [2]School of Environment and Sustainability, 117 Science Place, University of Saskatchewan, Saskatoon, SK.

1:45 – 2:00 ***Influence of larval diet on disease prevalence in the forest tent caterpillar, *Malacosoma disstria* (Lepidoptera: Lasiocampidae).** Flavio Preti[1] and Evenden, M.[2] [1]Biological Sciences Building B205, University of Alberta, Edmonton, AB. [2]Biological Sciences Building CW405, University of Alberta, Edmonton, AB.

2:00 – 2:15 ***Mass attack threshold and optimal attack density of mountain pine beetle (*Dendroctonus ponderosae* Hopkins) in Alberta pines.** Antonia Musso[1], Shegelski, V[1]., Carroll A.L.[2], and Evenden, M.L.[3] [1]CW 312 Biological Sciences Building University of Alberta, Edmonton AB. [2]3034 – 2424 Main Mall University of British Columbia, Vancouver BC. [3]CW405 Biological Sciences Building University of Alberta, Edmonton AB.

2:15 – 2:30 **Plenty of fish? Mate choice depends on perceived mating opportunities in mountain pine beetles.** Kavanagh, M. and Mary Reid. Biological Sciences, University of Calgary, Calgary, AB.

2:30 – 2:45 **Effects of insect pests and diseases in short rotation hybrid willow plantations.** Seung-Il Lee, Pohl, G., Myrholm, C., Tomm, B., Ramsfield, T. and Krygier, R. Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre, Edmonton, AB.

2:45 – 3:00 **BREAK**

3:00 – 5:00 pm ORAL PRESENTATIONS: SESSION 2 – Moderators Ishita Patel & Boyd Mori

* Before the title denotes a student presentation; presenter name is underlined

3:00 – 3:15 ***Distribution and infestation parameters of the quill mite *Betasyringophiloidus seiuri* in flight feathers of the Ovenbird (*Seiurus aurocapilla*).** Alexandra Grossi and Proctor, H. Department of Biological Sciences, University of Alberta, Edmonton, AB.

3:15 – 3:30 ***Trying to fit in: testing Harrison's Rule in Proctophyllodes feather mites**. Andrew Cook[1] and Proctor, H.[2] [1]CW312 Student Services, Biological Sciences Building, Edmonton, AB. [2] CW405 Biological Sciences Building, Edmonton, AB.

3:30 – 3:45 ***Variability in the microbiome of Winter tick, *Dermacentor albipictus*.** Janet Sperling, Normandeau, J., MacDonald, Z., Merrill, E., Sperling, F. and Magor, K. Departments of Biological Sciences & Renewable Resources, University of Alberta. Edmonton, AB.

3:45 – 4:00 **Are differences in genitalia, ornamentation and seta length in males and female *Trouessartia* feather mites the product of sexually antagonistic coevolution?** Heather Proctor[1] and Byers, K.[2] [1]Department of Biological Sciences, University of Alberta, Edmonton, AB. [2]Department of Zoology, University of British Columbia, Vancouver, BC.

4:00 – 4:15 ***Eating Scared.** Stephanie De Heij and Willenborg, C. University of Saskatchewan, Agriculture Building. 51 Campus Drive, Saskatoon, SK.

4:15 – 4:30 ***Effect of landscape structure on abundance, infestation and parasitism rate of cabbage seedpod weevil in Canola in the Prairies.** Piratheepa Jegatheeswaran[1], Carcamo, H.[2], Johnson, D.[1], Meers, S.[3], Vankosky, M.[2] and Tansey, J.[4] [1]Department of Geography, University of Lethbridge, 4401 University drive W., Lethbridge, AB. [2]Agriculture and Agri-Food Canada, Lethbridge Research center, PO Box 3000, Lethbridge, AB. [3]Alberta Agriculture and Forestry, Crop Diversification Centre South, Brooks, AB. [4]Production Technology, Ministry of Agriculture, 125-3085 Albert Street, Regina, SK.

4:30 – 4:45 ***The development and refinement of bioclimatic and forecasting models for insect pests in Canadian agroecosystems.** Dylan Sjolie[1,2], Vankosky, M.[1] and Willenborg, C.[2] [1]Saskatoon Research and Development Centre, 107 Science Place, Saskatoon SK. [2]University of Saskatchewan, 51 Campus Drive, Saskatoon SK.

4:45 – 5:00 **Ebb and Flow: Tracking populations of the invasive weevils, *Ceutorhynchus obstrictus* and *Sitona lineatus* in Western Canada.** James Tansey[1], Vankosky, M.[2], Meers, S.[3], Weiss, S.[2], Barkley, S.[3], and Peru, C.[1]. [1]Saskatchewan Ministry of Agriculture, [2]Agriculture and Agri-Food Canada, [3]Alberta Agriculture and Forestry.

5:00 – 5:10 **GROUP PHOTO**

6:00 – 7:00 pm POSTER SESSION

* Before the title denotes a student poster

Wireworm pests in spring wheat in southern Alberta, Canada. Haley Catton[1]. and Van Herk, W.[2] [1]Agriculture and Agri-Food Canada, Lethbridge Research and Development Centre 5403 – 1 Ave S, Lethbridge, AB. 2Agriculture and Agri-Food Canada, Agassiz Research and Development Centre 6947 Lougheed Way, Agassiz, BC.

Launch of the Massive Open Online Course: Bugs 101, Insect-Human Interactions. Maya Evenden and Domnich, I. Dept. Biological Sciences, University of Alberta, Edmonton, AB.

Surveying for potato psyllid (*Bactericera cockerelli*) in southern Alberta, Saskatchewan, and Manitoba, and detection of *Candidatus* Liberibacter solanacearum, zebra chip pathogen of potatoes. Dan Johnson[1], Kawchuk, L.[2], Meers, S.[3], Henrickson, A.[2], Kalischuk, M.[2], Lynn, J.[2], Bisht, V.[4], and Wahab, J.[5] [1]University of Lethbridge, Lethbridge, AB. [2]Agriculture and Agri-Food Canada, Lethbridge, AB. [3]Alberta Agriculture and Rural Development, Brooks, AB. [4]Manitoba Agriculture, Food & Rural Development, Carman, MB. [5]Agriculture and Agri-Food Canada, Saskatoon, SK.

***Functional response of two generalist predators *Pterostichus melanarius* Illiger (Crabaidae) and *Coccinella septumpunctata* (Coccinellidae) on Diamondback moth.** Sharavari Kulkarni[1], Cárcamo H.A.[2] and Evenden, M. L.[3] [1]B217 Biological Sciences Building University of Alberta, Edmonton AB. [2]Agriculture and Agri-Food Canada, Lethbridge, AB.. [3]CW405 Biological Sciences Building University of Alberta, Edmonton AB.

Will the 'real' *Dentizetes rudentiger* Hammer 1952 please wave a leg? Lisa Lumley. Royal Alberta Museum, 9810 103a Ave NW, Edmonton, AB.

Investigating swede midge, *Contarinia nasturtii*, host plant interactions: a multi-pronged approach. Boyd Mori[1]*, Hladun, S.[1], Soroka, J.S.[1], Olfert, O.O.[1], Nambara, E.[2], Hegedus, D.D.[1] and Erlandson, M.A.[1] [1]Agriculture and Agri-food Canada, Saskatoon Research and Development Centre, 107 Science Place, Saskatoon, SK. [2]University of Toronto, Department of Cell and Systems Biology, 25 Willcocks St., Toronto, ON. *Present Address: University of Alberta, Department of Agricultural, Food and Nutritional Science, Edmonton, AB.

***A Survey of Pollinators Contributing to Fava Success in Saskatchewan.** Samantha Morrice. and Prager, S. Department of Plant Sciences, College of Agriculture and Bioresources, University of Saskatchewan, Saskatoon, SK.

***The Impact of Pea Leaf Weevil Damage and Management on Subsequent Nitrogen Availability and Crop Performance.** Patty Reid[1], Carcamo, H.[2], Daniels, S.[2], Wijerathna, A.[3], Evenden, M.[3] and Tidemann, B.[1] [1]Agriculture and Agri-Food Canada Lacombe, 6000 C&E Trail, Lacombe, AB, T4L 1W1 [2]Agriculture and Agri-Food Canada Lethbridge, 5403 – 1 Ave South, Lethbridge, AB, T1J 4B1 [3]University of Alberta, Department of Biological Sciences, 11455 Saskatchewan Drive, Edmonton, AB, T6G 2E9

***Antennal length of male Caloptilia fraxinella (Lepidoptera: Gracillariidae) captured in pheromone-baited traps in Edmonton, Alberta.** Katie Schulze[1], Santos, M[2]. and Evenden, M.[1] [1]Department of Biological Sciences, University of Alberta Edmonton, AB. [2]Faculdade de Tecnologia e Ciências: Salvador, Bahia, Brazil.

***Toxicity and Effects of *Cannabis sativa* Oils on *Bombus impatiens*.** Jacqueline Verhallen and Prager, S. Department of Plant Sciences, University of Saskatchewan, Saskatoon, SK.

Status of *Aphodius fimetarius/pedellus* complex in Canada. Diana Wilches[1], Coghlin, P.[1], Smith, A.[2] and Floate, K[1]. [1] Agriculture & Agri-Food Canada, Lethbridge, AB. [2] Canadian Museum of Nature, Ottawa, ON.

***The effectiveness of different Insecticides for controlling Pea Aphids in lentil and faba bean.** Ninxing Zhou[1], Wist, T.[2], and Prager, S.M.[1] [1]Dept. of Plant Sciences, College of Agriculture and Bioresources, University of Saskatchewan, 51 Campus Dr. Saskatoon, SK. [2]Agriculture and Agri-Food Canada. Saskatoon, SK.

7:00 – 9:30 pm BANQUET FOLLOWING BY ESA AWARDS AND EVENING PRESENTATION

Cam Goater: "Zombie ants, endemic landsnails, and more: Cypress Hills as a biodiversity Hotspot" – Moderators: Danielle Stephens and Diana Wilches

SATURDAY OCTOBER 5: MEETING BEGINS AT 8:30 AM

7:30 – 8:30 BREAKFAST (on your own) Buglers at the hotel is open

8:30 – 11:30 am ORAL PRESENTATIONS: SESSION 4 – Moderators Stephen Srayko and Andrew Cook

* Before the title denotes a student presentation; presenter name is underlined

8:30 – 8:45 ***Pea aphid fecundity and biosis on wild and cultivated lentil species.** Ishita Patel, Prager, S. and Vandenberg, A. Department of Plant Sciences, University of Saskatchewan, Saskatoon, SK.

8:45 – 9:00 ***Effects of overwintering length and temperature on pea leaf weevil (Coleoptera: Curculionidae) survival and oviposition.** Asha Wijerathna[1]., Evenden, M.L.[1], and Càrcamo, H.A.[2] [1]Department of Biological Sciences, University of Alberta, Edmonton, AB. [2]Agriculture and Agri-Food Canada, Lethbridge, AB.

9:00 – 9:15 ***Semiochemical-based population monitoring of pea leaf weevil, *Sitona lineatus* L. (Coleoptera: Curculionidae) in Alberta, Canada.** Siena Achal[1] and Evenden, M.L.[2] [1]CW-205 Biological Sciences Building University of Alberta, Edmonton, AB. [2]CW-405 Biological Sciences Building University of Alberta, Edmonton, AB.

9:15 – 9:30 ***The abundance and diversity of ground beetles (Coleoptera: Carabidae) captured in semiochemical-baited traps targeting the pea leaf weevil, *Sitona lineatus* L. (Coleoptera: Curculionidae) in pulse crops on the Canadian Prairies.** Maggie MacDonald. and Evenden, M. University of Alberta, 116 St & 85 Ave, Edmonton, AB.

9:30 – 9:45 ***Of leafhoppers and phytoplasmas: host-choice behaviour of *Macrosteles quadrilineatus* in the Canadian Prairies.** Berenice Romero. and Prager, S. Department of Plant Sciences, University of Saskatchewan, Saskatoon, SK.

9:45 – 10:00 **Horizontal gene transfer of "Parasitoid Killing Factor" genes among multiple virus families and insect hosts shapes lepidopteran larval susceptibility to parasitoids.** Martin Erlandson[1,2], Sieminska, E.[2], Harris, S.[1], Baldwin, D.[1], Hegedus, D.D.[1], Nakai, M.[3], Theilmann, D.A.[4] et al. [1]Agriculture and Agri-Food Canada, Saskatoon Research Center, 107 Science Place, Saskatoon, SK. [2]Department of Biology, University of Saskatchewan, 112 Science Place, Saskatoon, SK. [3]Institute of Agriculture, Tokyo University of Agriculture and Technology – Saiwai, Fuchu, Tokyo 183-8509, Japan [4]Agriculture and Agri-Food Canada, Pacific Agri-Food Research Centre, Summerland, BC.

10:00 – 10:15 **BREAK**

10:15 – 11:15 am ORAL PRESENTATIONS: SESSION 4 – Moderators Dylan Sjolie & Piratheepa Jegatheeswaran

* Before the title denotes a student presentation

10:15 – 10:30 **Discovery of the *Culicoides sonorensis*, a vector of Bluetongue virus, in Ontario.** Adam Jewiss-Gaines. 445B Halifax St, Regina, SK.

10:30 – 10:45 **Collecting on the Edge of Everything: Part II.** Bette Beswick[1] and Swann, John[2]. [1] 63 Lott Creek Hollow, Calgary, AB. [2] ABI Environmental Services 3911 Varsity Dr NW, Calgary, AB.

10:45 – 11:00 **Preliminary results from a province-wide wild bee monitoring program in Alberta.** Meghan Evans[1] Cartar, R.V.,[2] and Prescott, D.R.C.[3] [1]Alberta Native Bee Council. [2]University of Calgary. [3]Alberta Environment and Parks

11:00 –11:15 **Passive traps can be poor samplers of bee abundance: sobering insights from pan traps in the rough fescue grasslands.** Ralph Cartar[1], Wonneck, M.[2], and Evans, M.M.[3] [1]University of Calgary [2]Agriculture & Agri-Food Canada [3]Alberta Native Bee Council.

11:15 – 12:15 ENTOMOLOGICAL SOCIETY OF ALBERTA – ANNUAL GENERAL MEETING

12:15 pm MEETING ADJOURNED – Please feel free to explore Cypress Hills park!

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FARMING SMARTER

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George Ball Symposium speakers (in order of presentation)

Keynote speaker – Our Quarter: entomology of the prairie homestead. Larson, D.

The role of the small holding in the development and maintenance of prairie insect biodiversity.

Faunistic entomology, post-glacial biogeography, and the legacy of Professor George E. Ball. Acorn, J. University of Alberta, Alberta.

The legacy of George Ball in Alberta extended over 65 years, and his earlier contributions were just as profound as those that followed. He trained many graduate students in faunistic entomology, such that each species within a broader taxon was properly understood not only in terms of its place in the classification and phylogeny of its group, but also in terms of its habitat, feeding ecology, current distribution, and glacial refugial origin. Studies of this nature were rigorous, meticulous, and foundational, and many are still in use today. A shift toward experimental and hypothesis driven science has displaced faunistic research from graduate programs, into the realm of field guides and online identification resources. Simultaneously, a more nuanced view of biogeographic events during and since the Wisconsinan glaciation has complicated our understanding of the biogeographic origins of the current entomofauna, while molecular techniques have improved the resolution of such questions. It is likely that, with continued public interest in both biodiversity conservation and the biotic consequences of climate change, faunistic expertise will continue to enjoy strong disciplinary relevance, even if it is also undervalued by many of today's biologists.

Beetles, books and Ball: the context and style of George Ball's influence on insect systematics. Sperling, F.A.H. Department of Biological Sciences, University of Alberta, Alberta.

George Ball's passing earlier this year left a huge gap in our entomological community. But we are still fortunate to have so many of his beetles, books and continuing influences. By themselves, the many books he accumulated in his library illustrate his astonishing intellectual breadth and they continue to benefit new generations. But they also demonstrate his seminal role at the intersection of classical taxonomy and numerous successive waves of new technical and conceptual developments in systematics. His lasting legacy is thus not only his celebrated lineages of academic descendants, but a style of scholarship and interactions that brought out the best in countless colleagues, students and friends.

Wireworm research in the Prairies: past & present, similarities & differences. Van Herk, W. Agassiz Research and Development Centre, British Columbia.

Wireworm research in Canada began in 1920's with the pioneering work of K.M. King in Saskatchewan and E. H. Strickland in Alberta. Virtually all we know of the biology and management of native pest elaterids in Canada is based on the work of these pioneers, and of those whose careers they influenced. After a nearly two-decade hiatus, wireworm research in Canada resumed in earnest in the late 1990's, but focussed mostly on the introduced *Agriotes* species. Only in recent years has work resumed on native pest species. Meanwhile both agricultural practices, and pest management approaches have undergone significant changes. In this talk we discuss some of the key Canadian wireworm researchers from the 1930's to 1970's and some of their main findings, as well as the current pest situation and research needs.

ABSTRACTS (alphabetical order by first author)

Semiochemical-based population monitoring of pea leaf weevil, *Sitona lineatus* L. (Coleoptera: Curculionidae) in Alberta, Canada. Achal, S.S.[1] and Evenden, M.L.[2] [1]CW-205 Biological Sciences Building University of Alberta, Edmonton, AB. [2]CW-405 Biological Sciences Building University of Alberta, Edmonton, AB.

The pea leaf weevil, *Sitona lineatus* L. (Coleoptera: Curculionidae) is an economically important pest of field pea (*Pisum sativum*) and faba bean (*Vicia faba*). The pea leaf weevil is native to Europe and North Africa, but has expanded its range to North America and other pulse growing regions. The pea leaf weevil was first established in southern Alberta, Canada in 1997, and populations have since spread into central and northern Alberta. Current monitoring methods use adult feeding damage on the host plant to indirectly estimate populations. Semiochemical-based monitoring is an alternative method that can be used to delineate populations in the expanded range. This study aims to delimit the range expansion of pea leaf weevil in northern Alberta. We trapped adult weevils in pitfall traps baited with male aggregation pheromone (4-methyl-3,5-heptanedione) during the 2 adult activity periods in 2018 and 2019 in pulse growing regions of central and northern Alberta. In addition, we compare the number of weevils captured in pheromone-baited traps to notching damage on field pea and faba bean crops at the same sites. A preliminary analysis showed that pea leaf weevil trap capture differs between pea and faba bean crops. Further analyses will determine the effect of year, season, and pheromone treatment on trap capture of pea leaf weevils. Findings from the study add to the current knowledge of pea leaf weevil range expansion and will lead to the development of an alternative monitoring tool to sample this pest for an integrated pest management strategy.

Collecting on the Edge of Everthing: Part II. Beswick, B[1] and Swann, J.[2]. [1] 63 Lott Creek Hollow, Calgary, AB. [2] ABI Environmental Services 3911 Varsity Dr NW, Calgary, AB.

At the 2015 ESA conference, we described the launch of our invertebrate collecting program at Beauvais Lake Provincial Park, located in the southwest corner of the province. This presentation will provide an update. We will describe our continuing field program and some of the challenges we've encountered, what we've collected, and what remains to be done.

Elucidating the Distribution of a Non-Native Species of Katydid in Alberta Using Bioacoustics. Caouette, A. Department of Biological Sciences, MacEwan University, Edmonton, AB.

Accumulating evidence has shown that climate change is causing shifts in species distributions. For species that produce audible vocalizations, bioacoustics may provide a useful tool to better understand how animals are responding to the pressures of climate change. Recently, *Roeseliana roeselii*, a species of Orthoptera native to Europe, was discovered near Edmonton, Alberta, outside of its naturalized range in Eastern North America. This discovery presents a unique opportunity to elucidate the provincial distribution of *R. roeselii* by using bioacoustics software. This project will use automated audio recognition software to sort through province-wide field recordings from the Alberta Biodiversity Monitoring Institute (ABMI). I recorded *R. roeselii* individuals from several locations in Alberta to create a recognizer algorithm.

With this algorithm, I will be able to sort through several thousand ABMI recordings taken across the province in hopes to gain a wider breadth of *R. roeselii*'s distribution. This project will lay the groundwork for research looking into both the range expansion of *R. roeselii* and range changes of other acoustic insects in North America.

Passive traps can be poor samplers of bee abundance: sobering insights from pan traps in the rough fescue grasslands. Cartar, R.V.[1], Wonneck, M.[2], and Evans, M.M.[3] [1]University of Calgary [2]Agriculture & Agri-Food Canada [3]Alberta Native Bee Council.

We often sample communities of bees using passive traps (pan or blue vein) coloured to attract bees to their deaths. Such traps integrate catches over many days and can provide large samples of local biodiversity. But do these traps directly reflect local bee abundance? We might assume that a large catch of bees reflects high local bee abundance, but what if it instead reflects low local flower abundance, or some combination of the two? We tested this premise in rough fescue grasslands of SW Alberta, relating 1-day catches in pan traps to walking transect counts of the abundances of flowers and bees at flowers. When flower abundance was low, there was a strong positive relationship between bee abundance in traps and at flowers. But bee abundance in traps and at flowers were unrelated when flower abundance was intermediate, and negative when flowers were abundant. In a world rich with flowers, bees ignored the passive traps. The take-home message: across a wide range of flower abundances, bee abundance in a trap did not positively reflect bee abundance (at flowers). Perhaps we should also measure local resources when estimating bee abundance using passive, attractive traps (or switch to malaise traps).

Wireworm pests in spring wheat in southern Alberta, Canada. Catton, H.[1] and Van Herk, W.[2] [1]Agriculture and Agri-Food Canada, Lethbridge Research and Development Centre 5403 – 1 Ave S, Lethbridge, AB. [2]Agriculture and Agri-Food Canada, Agassiz Research and Development Centre 6947 Lougheed Way, Agassiz, BC.

Wireworms are the subterranean larval stage of click beetles (Coleoptera: Elateridae), and are known as crop pests around the world. Wireworms are chewing pests that consume cereal and root crops in the seed and seedling stage, thinning crops and reducing yield. There are currently no effective chemical controls available for this pest in Canada, which has approximately 20 species of pest wireworm. Species composition varies by region. Wireworms have multi-year life stages, living several years in the soil, and therefore may respond to previous crop rotations. We sampled wireworms and click beetles weekly from spring to harvest in 12 commercial spring wheat fields in the Lethbridge area in southern Alberta, Canada for each of 2017 and 2018 (=24 fields total). To be eligible for sampling, study fields had to be suspected of having a wireworm problem by the farmer, be seeded to spring wheat in the year of sampling, and have one of the following rotations in the previous two years: cereal-cereal, cereal-canola, canola-cereal, pulse-canola. Here we report preliminary results on wireworm species compositions, specimen sizes, and timing of insect activity.

Trying to fit in: testing Harrison's Rule in Proctophyllodes feather mites. Cook A.[1] and Proctor, H.[2] [1]CW312 Student Services, Biological Sciences Building, Edmonton, AB. [2] CW405 Biological Sciences Building, Edmonton, AB.

Vane-dwelling feather mites (Sarcoptiformes: Analgoidea, Pterolichoidea) are obligate symbionts of birds, living on the surface of flight feathers and consuming oil and fungal spores for food. Although these symbionts are known from almost all families of birds and can attain high densities on their hosts, many questions remain about how they partition space among and within feathers, and whether particular aspects of feather structure correlate with mite body size. In my thesis work I am exploring how vane-dwelling mites in the genus Proctophyllodes (Analgoidea: Proctophyllodidae) partition wing feathers on spring migrants in Alberta, looking for correlations between mite body size and feather microstructure, and testing whether mite size and host body sizes are positively correlated (Harrison's Rule). I am using both laboratory- and field-based approaches to document abundance and orientation of mites on the wing of living birds, and to compile the first dataset of feather microstructure measurements in North American birds.

Eating Scared. De Heij, S. and Willenborg, C. University of Saskatchewan, Agriculture Building. 51 Campus Drive, Saskatoon, SK.

Virtually all animals are on the menu of another, and this affects their behavior. This holds true for insects as well, including those that are considered beneficial in agriculture. So how does an insects' interaction network with potential predators affects its behavior? And how can this affect its biocontrol potential? That is what I am exploring in the case of carabid beetles (Coleoptera: Carabidea) in regards to their contribution to weed seed loss in agricultural fields.

Horizontal gene transfer of "Parasitoid Killing Factor" genes among multiple virus families and insect hosts shapes lepidopteran larval susceptibility to parasitoids. Erlandson, M.A.[1,2], Sieminska, E.[2], Harris, S.[1], Baldwin, D.[1], Hegedus, D.D.[1], Nakai, M.[3], Theilmann, D.A.[4] et al. [1]Agriculture and Agri-Food Canada, Saskatoon Research Center, 107 Science Place, Saskatoon, SK. [2]Department of Biology, University of Saskatchewan, 112 Science Place, Saskatoon, SK. [3]Institute of Agriculture, Tokyo University of Agriculture and Technology – Saiwai, Fuchu, Tokyo 183-8509, Japan [4]Agriculture and Agri-Food Canada, Pacific Agri-Food Research Centre, Summerland, BC.

Tritrophic interactions among insect hosts, parasitoid wasps and viruses are complex and diverse. Understanding these associations is critical to an understanding of the evolutionary arms race that has driven the specialization of parasitoid species and the evolution of host defence strategies. Typically the interaction between parasitoids and viruses exploiting the same lepidopteran host is a competitive one and the survival of the parasitoid larvae is dependent on the timing of parasitization and/or infection. However, we recently identified and characterized a new protein family, Parasitoid Killing Factor (PKF), that is expressed in some invertebrate DNA viruses and have also been identified in a number of noctuid host species. *In vivo* and *ex vivo* assays demonstrated that PKF proteins from Mamestra configurata alphabaculovirus, Mythimna separata entomopoxvirus and Heliothis virescens ascovirus 3j inhibit the development of and kill parasitoid wasp larvae of specific species from the Microgastrinae family. Interestingly, PKFs identified in *Spodoptera exigua* have conserved function and specificity against specific microgastrine parasitoids suggesting that PKFs play a role in host defences against parasitoids and thus parasitoid- host specificity. Phylogenetic and genomic analyses revealed evidence for *pkf* gene flow between viruses as well as viruses and lepidopteran hosts. The present work is significant as it provides

new insights into the dynamic interactions among natural enemies of insect hosts, specifically the evolutionary path of insect and virus interactions.

Preliminary results from a province-wide wild bee monitoring program in Alberta. Evans, M.M,[1] Cartar, R.V.,[2] and Prescott, D.R.C.[3] [1]Alberta Native Bee Council. [2]University of Calgary. [3]Alberta Environment and Parks.

Despite an interest in the potential decline of wild bee species, there was no province-wide monitoring of these important pollinators in Alberta. The Alberta Native Bee Council oversaw a collaborative effort among numerous government organizations, researchers and volunteers to implement a province-wide, repeatable sampling of wild bees at 100 locations throughout Alberta with blue vane traps in the summer of 2018. Our efforts yielded over 20,000 *Bombus* specimens. Within these we added a bumble bee species to the record for Alberta (*Bombus sandersoni*), confirmed records of *Bombus bohemicus* a SARA listed species (the first since 1997), and mapped out the distribution of *Bombus occidentalis* and *Bombus terricola* (both species of conservation concern). The work will result in the compilation of a comprehensive bee species inventory for Alberta. We anticipate that sampling will be repeated every five years, to assess changes in populations over time.

Launch of the Massive Open Online Course: Bugs 101, Insect-Human Interactions. Evenden, M.L., and Domnich I. Dept. Biological Sciences, University of Alberta, Edmonton, AB.

Bugs 101 is a Massive Open Online Course (MOOC) that was launched on the Coursera platform in June 2019. The course content focuses on insect-human interactions, and also introduces learners to insect evolution, biology and ecology. The course has 12 modules each containing several lessons and culminating in a quiz at the end. The first four modules introduce insect diversity, morphology, biology and locomotion. The next four modules focus on ecosystem functions provided by insects including decomposition, herbivory, pollination and disease vectors. The final group of four modules focuses on ways that humans directly interact with insects through sustainable management of insect pests, conservation of threatened insect populations, and insects as inspiration in music, art, science and literature. Throughout the course, there are 26 interviews with experts on a range of topics from forensic entomology to insects in art. Several interactive learning objects are incorporated into the course so that students can engage with the course material. The course is available for free to a wide range of learners from around the world. There were 5688 students enrolled in the class with over 3752 active learners 2 months after its launch.

Ants in Alberta, and Canada: An Update. Glasier, J.R.N. Fish and Wildlife Specialist MNA.

Knowledge of ants in Alberta and Canada has been on the increase in the past several years. More people are paying attention to ants species are running around our feet and more are looking at their ecology. Here I present an update on the ant species of Alberta, with a few new discoveries, the first records of introduced species outside of buildings, and a quick overview of the ants found in the province. I also present some information on the ants species of Canada. Finally I conclude with small projects I am working on, and ask some open ended questions that need further study.

Distribution and infestation parameters of the quill mite *Betasyringophiloidus seiuri* in flight feathers of the Ovenbird (*Seiurus aurocapilla*). Grossi, A. and Proctor, H. Department of Biological Sciences, University of Alberta, Edmonton, AB.

Quill mites (Acariformes: Syringophilidae) are permanent parasites that live and reproduce inside the hollow calamus of feathers. They feed by using their long chelicerae to pierce the wall of the quill to reach the living tissues surrounding the base of the feather. Ovenbirds are host to the quill mite *Betasyringophiloidus seiuri* (Clark), which has been reported to inhabit 'flight feathers', but there is currently no information on the prevalence of infestation of individual flight feathers and if quill parameters influence which feathers become infested. We exhaustively examined the flight feathers from the wings and tail of 21 dead Ovenbirds. Nine birds had at least one feather infested with mites. Of these, seven had only wing feathers infested, one had both wing and a single tail feather infested, and one had a single tail feather infested. Intensities of mites ranged from 2 – 135.6 in a single feather with a mean of 28.4. There was a strong positive correlation between quill volume and mean mite intensity. Feathers that had quill walls thicker in some areas than the mites' extended chelicerae had lower prevalences then feathers with walls consistently thinner than the length of the chelicerae.

Moth biodiversity survey of southeastern Alberta. Jackson, L., and Sperling, F. University of Alberta, Department of Biological Sciences, Edmonton, AB.

The great abundance and attractiveness of Lepidoptera has meant that their biodiversity is frequently used to assess ecosystem health. Previous work has disproportionately focused on macro moths, but has documented micro moths less fully. The aim of my study is to build a baseline and current species list for macro and micro moths that will subsequently allow an evaluation of anthropogenic effects on species diversity of prairie habitats. I will identify recently collected specimens to assess the species richness of southeastern Alberta, and ask whether it differs from historical moth diversity documented in museum collections. Throughout the 2019 season, adult moths were collected at the Dunmore Vehicle Enforcement Branch along the TransCanada highway east of Medicine Hat, mainly at diffused light-emitting diode balloon lights and also with occasional aerial netting. A nearby residential area in Medicine Hat as well as Cypress Hills Provincial Park was also sampled using aerial nets and light traps. Changes in agriculture and infrastructure, the spread of invasive species and climate will be considered in the analysis. Assessment of Alberta's unique prairie biodiversity can shed light on the conservation efforts needed to preserve this valuable ecosystem.

Effect of landscape structure on abundance, infestation and parasitism rate of cabbage seedpod weevil in Canola in the Prairies. Jegatheeswaran, P.[1], Carcamo, H.[2], Johnson, D.[1], Meers, S.[3], Vankosky, M.[2], and Tansey, J.[4] [1]Department of Geography, University of Lethbridge, 4401 University drive W., Lethbridge, AB. [2]Agriculture and Agri-Food Canada, Lethbridge Research center, PO Box 3000, Lethbridge, AB. [3]Alberta Agriculture and Forestry, Crop Diversification Centre South, Brooks, AB. [4]Production Technology, Ministry of Agriculture, 125-3085 Albert Street, Regina, SK.

Cabbage seedpod weevil (*Ceutorhynchus obstrictus*) is an important invasive pest of Canola. Larvae and adult cause serious damage to canola. Biological control is being researched as an option to manage this weevil. Parasitism rates in southern Alberta are very low compared to records in Europe where *Trichomalus perfectus* is considered the most effective parasitoid. This parasitoid has been reported from Quebec where it seems to reduce pest levels. Hence, it could be a potential classical biocontrol agent of cabbage seedpod weevil in the Prairies. Several studies have shown that efficacy of parasitoids in biological control is linked with landscape structure. For example, non-crop habitats surrounding fields may affect the abundance of pest, natural enemies and efficacy of natural pest control as demonstrated in Europe. Thus our research aims to understand the effects of landscape structure on the abundance of cabbage seedpod weevil, crop damage and its parasitism. To assess this effect, variable landscapes (simple to complex) have been selected and their structure and configuration is being documented by surveys, then digital maps will be constructed. The proportion and diversity of land covers will be related to cabbage seedpod weevil abundance from sweep net sampling and parasitism rates and weevil damage from pod collections. The results will elucidate the effect of landscape structure on the abundance of cabbage seedpod weevil, crop damage and its parasitism and improve sustainable management of this pest.

Discovery of the *Culicoides sonorensis*, a vector of Bluetongue virus, in Ontario. Jewiss-Gaines, A., 445B Halifax St, Regina, SK.

In 2013 and 2014, insect trapping at sheep farms throughout Ontario using standard CDC light traps yielded high numbers of biting midges (Diptera: Ceratopogonidae). Many of these midges were taxonomically identified as *Culicoides sonorensis*, the primary North American vector insect for Bluetongue virus (BTV) and Epizootic Hemorrhagic Disease virus (EHDV). Molecular analysis was performed on specimens, confirming this identification. Prior to this, *Culicoides sonorensis* was not suspected to occur in Ontario and was largely associated with the western provinces of British Columbia and Alberta. Shortly after this discovery, both BTV and EHDV had their first reported occurrences in Ontario. As this species is notably difficult to identify from its close sister species, *Culicoides variipennis*, three gene regions (CO1, ITS1, and EF1α) were analyzed from specimens of both species for comparison in hopes of finding a useful genetic marker. Results showed that CO1 and ITS1 were nearly identical between both species, but an analysis of EF1α revealed significant differences within introns. This information may be used to assist with proper molecular determination between these two species in the future and allow us to further understand the true geographic range they inhabit.

Surveying for potato psyllid (*Bactericera cockerelli*) in southern Alberta, Saskatchewan, and Manitoba, and detection of *Candidatus* Liberibacter solanacearum, zebra chip pathogen of potatoes. Johnson, D.[1], Kawchuk, L.[2], Meers, S.[3], Henrickson, A.[2], Kalischuk, M.[2], Lynn, J.[2], Bisht, V.[4] and Wahab, J.[5] [1]University of Lethbridge, Lethbridge, AB. [2]Agriculture and Agri-Food Canada, Lethbridge, AB. [3]Alberta Agriculture and Rural Development, Brooks, AB. [4]Manitoba Agriculture, Food & Rural Development, Carman, MB. [5]Agriculture and Agri-Food Canada, Saskatoon, SK.

The potato psyllid, *Bactericera cockerelli* (Hemiptera: Triozidae) feeds on plants in the family Solanaceace. It can transmit the pathogenic bacterium '*Candidatus* Liberibacter solanacearum' (Lso), which presents as zebra chip disease of potato. Zebra chip has been documented in commercial fields in the United States,

Mexico, Central America, and New Zealand. We surveyed southern Alberta, Saskatchewan, and Manitoba, during 2014-2017, at typically about 40-60 locations per year, with reduced sampling in 2018. No potato psyllids were found in 2014. We found small numbers in Alberta during 2015, 2016, and 2017, in Saskatchewan and Manitoba beginning in 2016. In southern Alberta, the range expanded throughout the potato growing area to 70% of 45 sampled fields. Sequence analysis of cytochrome oxidase from individual potato psyllids confirmed the presence of Central and Western haplotypes. Lso-positive potato psyllids were detected from four locations in Alberta in 2017. Sequence of the Lso 16S rDNA indicated the Canadian pathogen closely resembles hapA from WA, ID, and OR. Best management practices are being developed to prevent occurrence of ZC in Canada. A single Lso positive postharvest Russet Burbank potato tuber exhibiting necrotic symptoms was recovered beside a field in southern Alberta, with no further detections.

Plenty of fish? Mate choice depends on perceived mating opportunities in mountain pine beetles. Kavanagh, M. and Reid, M. Biological Sciences, University of Calgary, Calgary, AB.

When mating opportunities are more abundant, animals are expected to be more selective in choosing mates. We tested whether choosiness of male mountain pine beetles, *Dendroctonus ponderosae*, increased with perceived mating opportunities signaled by exposure to different pheromone blends and by the male's own body condition. Choosiness was measured as the time taken to enter the breeding gallery of an unmated female and the amount of time a male stayed in the gallery. We found that males in better body condition and those exposed to pheromones signaling an abundance of unmated females tended to be slower to join an unmated females and faster to depart. Male mountain pine beetles appeared to exhibit opportunity-dependent mate choice.

Functional response of two generalist predators *Pterostichus melanarius* Illiger (Crabaidae) and *Coccinella septumpunctata* (Coccinellidae) on Diamondback moth. Kulkarni, S.S.[1], Cárcamo H.A.[2] and Evenden, M. L.[3] [1]B217 Biological Sciences Building University of Alberta, Edmonton AB. [2]Agriculture and Agri-Food Canada, Lethbridge, AB.. [3]CW405 Biological Sciences Building University of Alberta, Edmonton AB.

Diamondback moth (DBM), *Plutella xylostella* L. is a serious pest of cruciferous crops globally. In western Canada, moth influx with wind currents from the United States can result in significant economic damage to canola. This study aims to evaluate the functional response of two common generalist predator species found in canola fields, *Pterostichus melanarius* which feeds on DBM larvae and *Coccinela septumpunctata* that preys on eggs of DBM. Predation of fourth instar DBM by field-collected *P. melanarius* was observed at 5 different larval densities $(5,10,20,30,40)$ for 24 h. Similarly, predation on DBM eggs by field collected adult *C. septumpuctata* was observed at 5 different densities (5,10, 20, 40, 60). The preliminary results of predation and functional response will be discussed.

Effects of insect pests and diseases in short rotation hybrid willow plantations. Lee, S.I; Pohl, G.; Myrholm, C.; Tomm, B.; Ramsfield, T.; and Krygier, R.. Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre, Edmonton, AB.

Short-rotation tree plantations show great promise for use in land reclamation, biosolid waste treatment, and biomass and biofuel production. Willows (*Salix* spp.) are one of the commonly used trees for the biomass production because they are fast-growing and rapidly resprout from coppices after harvest. Despite the popularity of hybrid willow plantations, the effects of insects and diseases on various willow hybrids are not well studied. We investigated insects and disease occurrence in 15 different hybrid willow clones in plantations near Calgary and Camrose, Alberta. The purposes of the study were 1) to identify insect pests and diseases associated with genetically diverse willow clones; 2) to compare incidence and severity of pests; and 3) to provide a recommendation of willow clones that are more resistant to pests. The willow hybrid clone 'Owasco (*Salix viminalis* × *S. miyabeana*)' was observed to be a suitable host for the largest number of pest species, while 'Vim5027 (*S. viminalis*)' was severely defoliated by *Calligrapha verrucosa* (Coleoptera: Chrysomelidae).

Will the 'real' *Dentizetes rudentiger* Hammer 1952 please wave a leg? Lumley, L., Royal Alberta Museum, 9810 103a Ave NW, Edmonton, AB.

One female specimen of a new genus and species, *Dentizetes rudentiger*, was first discovered by Marie Hammer on August 13, 1948 at the railway station in Jasper, Alberta. Hammer described the species in 1952, and included in the descriptors are that the species is "dark brown, the length 0.56 mm, the breadth 0.40 mm". Valerie Behan-Pelletier redescribed *D. rudentiger* in 1986 from additional specimens collected in subarctic western North America, including specimens from Jasper National Park. Behan-Pelletier noted that the holotype cannot be located and that the specimens she examined were smaller. Recent alpine collections by the Alberta Biodiversity Monitoring Institute have revealed two morphotypes that differ in colour and size, and that key to *D. rudentiger*. Upon close examination, it appears that the larger, dark brown specimens (morphotype 1) most closely match the original description, and the smaller, lighter yellow specimens (morphotype 2) most closely match the redescription. However, are the limited recorded differences sufficient to deem that *Dentizetes* morphotype 1 is *D. rudentiger*, and the redescribed *D. rudentiger* is a new species?

The abundance and diversity of ground beetles (Coleoptera: Carabidae) captured in semiochemical-baited traps targeting the pea leaf weevil, *Sitona lineatus* L. (Coleoptera: Curculionidae*)* in pulse crops on the Canadian Prairies. MacDonald, M. and Evenden, M. University of Alberta, 116 St & 85 Ave, Edmonton, AB.

The pea leaf weevil (PLW), *Sitona lineatus* L. (Coleoptera: Curculionidae), is a significant pest of field pea, *Pisum sativum* L. (Fabaceae), and faba bean, *Vicia faba* L. (Fabaceae), that has recently invaded the Canadian Prairie Provinces. Semiochemical-based monitoring can detect population spread and local movements of PLW in the Prairie Provinces but results in significant carabid bycatch including capture of the invasive *Pterostichus melanarius* Ill. (Coleoptera: Carabidae) that is native to Europe. *Pterostichus melanarius* was first recorded in Edmonton and is now widespread throughout Alberta and has dominated most habitat types. Dispersal by flight promotes high proportions of macropterous *P. melanarius* in newly colonized populations compared to high proportions of brachypterous individuals in established populations. The objective of this study is to survey carabid diversity and abundance of bycatch in monitoring traps that target PLW, and compare differences in carabid assemblages between crop type, trap bait, and region. We further examine the morphology of *P. melanarius* from different regions in

Alberta to determine the proportion of long and short wing morphs and make inferences about spread and dispersal of this invasive species.

Investigating swede midge, *Contarinia nasturtii*, host plant interactions: a multi-pronged approach. Mori, B.A.[1]*, Hladun, S.[1], Soroka, J.S.[1], Olfert, O.O.[1], Nambara, E.[2], Hegedus, D.D.[1], and Erlandson, M.A.[1] [1]Agriculture and Agri-food Canada, Saskatoon Research and Development Centre, 107 Science Place, Saskatoon, SK. [2]University of Toronto, Department of Cell and Systems Biology, 25 Willcocks St., Toronto, ON. *Present Address: University of Alberta, Department of Agricultural, Food and Nutritional Science, Edmonton, AB.

The swede midge (SM), *Contarinia nasturtii* (Diptera: Cecidomyiidae), is a serious pest of cruciferous vegetable and canola crops in Europe and eastern North America. It poses a significant threat to canola production in the Canadian prairies. Larval feeding results in swollen and distorted leaves, shoots, and buds, and reduces yield. Crop yield losses due to SM infestations have been as high as 85% in Canada. Efficient control strategies are lacking for SM. Control using insecticides is difficult due to their short residual activity, multiple overlapping SM generations, and the internal feeding nature of the larvae. Host plant resistance presents itself as a possible alternative control strategy. Here, we take a multi-pronged approach to investigate SM host plant resistance with a focus on interactions at the insect-plant interface which include: i) laboratory bioassays of cruciferous weeds and a nested-association mapping population of *B. napus* to identify the degree of SM susceptibility/resistance; ii) transcriptomic analyses of SM larvae; and iii) transcriptomic and plant hormone analyses of *B. napus* following SM infestation. The results of these experiments will offer insight into the plant defense system in response to SM infestation and may aid in the search for alternative sources for resistance to SM.

A Survey of Pollinators Contributing to Fava Success in Saskatchewan. Morrice, S. and Prager, S. Department of Plant Sciences, College of Agriculture and Bioresources, University of Saskatchewan, Saskatoon, SK.

Pollination by, and community structure of, native bees in fava bean (*Vicia fava L.*) fields is poorly studied. Studies relating pollinators to yield in fava beans are rather limited, and there are no published studies in Canadian cropping systems. While some literature suggests that honey bees (*Apis mellifera*) and long tongued bumble bees (*Bombus* spp.) are the prominent pollinators in fava fields, other studies have shown them to be less effective. To date, no studies have been conducted on the community structure of native bee populations in fava fields. There have also been no studies on fava bean pollination by native bees in North America. As a first step to determine and manage pollination in Canadian fava bean crops, a survey of the bee community in Saskatchewan fava bean fields was conducted. In this study, I investigated changes in bee community structure over the course of time in fava fields in three sampling periods. Data presented will highlight trends in bee diversity within Saskatchewan fava fields.

Mass attack threshold and optimal attack density of mountain pine beetle (*Dendroctonus ponderosae* Hopkins) in Alberta pines. Musso, A.E.[1]., Shegelski, V[1]., Carroll A.L.[2], and Evenden, M.L.[3] [1]CW 312 Biological Sciences Building University of Alberta, Edmonton AB. [2]3034 – 2424 Main Mall University of British Columbia, Vancouver BC. [3]CW405 Biological Sciences Building University of Alberta, Edmonton AB.

Mountain pine beetle (MPB), *Dendroctonus ponderosae* Hopkins (Coleoptera: Curculionidae; Scolytinae), has expanded its range into Alberta where it has attacked evolutionarily naïve lodgepole (*Pinus controrta*) and jack pines (*Pinus banksiana*). Using pheromone-mediated mass attack during an epidemic, MPB are capable of overwhelming vigorously defended trees. If too many beetles attack a tree, brood success diminishes as there is competition for under-bark resources. Current understanding of MPB mass attack dynamics originates from studies performed in the historic range, where the mass attack threshold is ≈40 beetles/m^2 and optimal attack density is ≈60 beetles/m^2. Evolutionarily naïve lodgepole and jack pines have different defences compared to lodgepole in the historic range. We manipulated attack densities in lodgepole and jack pines in the field to describe mass attack dynamics in Alberta by measuring the number of parental and larval galleries formed by MPB at various densities. Mass attack threshold and optimal attack densities appear to be lower in Alberta lodgepole pine and jack pine compared to the historic range, however this varied by year in lodgepole pine. Understanding mass attack dynamics of MPB in Alberta will allow us to predict the long-term population dynamics of MPB in its expanded range.

Pea aphid fecundity and biosis on wild and cultivated lentil species. Patel, I. Prager, S. and Vandenberg, A. Department of Plant Sciences, University of Saskatchewan, Saskatoon, SK.

Lentil (Lens culinaris) is a valuable crop for Western Canada. It provides ecological benefits through crop rotations and also improves soil quality due to its ability to fix nitrogen. Pea aphid (Acyrthosiphon pisum) causes significant yield loss in lentil both directly by feeding and indirectly by being viral disease vectors. Although cultivated lentil is grown commercially worldwide, its wild relatives are native to the Mediterranean region and have a wide range of morphological characteristics that are potentially useful in the cultivated lentil. Notably, some wild lentil species have their leaves and pods covered with trichomes, while in cultivated lentil trichomes are significantly reduced on the leaf surface and are absent on the pods. This experiment examined if trichomes influence pea aphid fecundity and biosis by comparing its growth on the wild lentil species, L. tomentosus (LT), and cultivated lentil (LC). It was found that although the time taken to reach reproductive maturity remained similar on both lentil species, more adult aphids produced nymphs on hairy pods of LT. On LC, most adults produced nymphs elsewhere on the plant. Additionally, aphid mortality was higher on LC. These results suggest that lentil trichomes might not deter pea aphids, and that cultivated lentil might have characteristics that negatively influence aphid fecundity.

Influence of larval diet on disease prevalence in the forest tent caterpillar, *Malacosoma disstria* (Lepidoptera: Lasiocampidae). Preti, F.[1] and Evenden, M.[2] [1]Biological Sciences Building B205, University of Alberta, Edmonton, AB. [2]Biological Sciences Building CW405, University of Alberta, Edmonton, AB.

Forest tent caterpillar (FTC), *Malacosoma disstria* Hübner (Lepidoptera: Lasiocampidae), is an important ecological disturbance factor affecting deciduous hardwood trees in North America. Disturbance is greater during outbreaks; a cyclical phenomenon in which large numbers of FTC larvae cause extensive defoliation to host trees. Variation in FTC larval diet is known to affect resource allocation to flight and reproduction in adult moths. Furthermore, differences in phytochemistry among host plants can alter insect resistance to pathogens. It is unknown, however, whether larval diet of FTC can alter insect susceptibility to the microsporidium *Nosema disstriae*. We are testing for differences in resistance to microsporidia infection due to variation in larval diet. FTC egg masses were collected from populations in Ontario and Alberta.

Four feeding treatments were used to rear larvae under laboratory conditions. Feeding treatments included: 1) a synthetic diet (Addy 1969) (SD); 2) a reduced amount of synthetic Addy diet (SD-); synthetic diet with 1% lyphosized trembling aspen (*Populus tremuloides* Michx, family Salicaceae) foliage (SDA); or a reduced amount of synthetic diet with 1% lyphosized trembling aspen (SDA-). Both healthy larvae and larvae infected with microsporidia (+) were reared on identical diets (SD+, SD-+, SDA+, SDA-+). Microsporidia-infected larvae were fed *Nosema disstriae* spores at the third instar. Larval survival, time to pupation, time to eclosion, cocoon weight, moth weight, and sex were determined and compared among treatments. An interaction between pathogens and larval diet may inform control efforts of FTC. Results will be discussed.

Are differences in genitalia, ornamentation and seta length in males and female *Trouessartia* feather mites the product of sexually antagonistic coevolution? Proctor, H.[1] and Byers, K.[2] [1]Department of Biological Sciences, University of Alberta, Edmonton, AB. [2]Department of Zoology, University of British Columbia, Vancouver, BC.

Mating behaviour that benefits one sex doesn't always benefit the other. Males may achieve higher reproductive success by compelling females to mate sooner, longer or more often than is in their own best interest. In such cases, females may evolve counter-adaptations to thwart males. Features that make it more difficult for males to hold onto or inseminate females have arisen repeatedly in insects (e.g., gerrids, dytiscids, bedbugs). Here we describe sexually dimorphic structures in feather mites of the genus *Trouessartia* (Analgoidea: Trouessartiidae) and test for evidence that they are the product of sexually antagonistic selection. We used light and scanning electron microscopy to examine *Trouessartia* from 52 spp. of avian hosts. We found that females had more pronounced dorsal ornamentation and longer dorsal *h1* setae than conspecific males. Female external spermaduct length was positively correlated with the massiveness of the male's genitalia. Degree of dorsal ornamentation and dorsal 'spininess' were not positively correlated with male sucker size, and so these features may not be involved in making impeding the male's grip on females. We conclude that there is some evidence for sexually antagonistic coevolution in genitalia in *Trouessartia*, but not in dorsal ornamentation or *h1* seta size.

Of leafhoppers and phytoplasmas: host-choice behaviour of *Macrosteles quadrilineatus* in the Canadian Prairies. Romero, B. and Prager, S. Department of Plant Sciences, University of Saskatchewan, Saskatoon, SK.

Phytoplasmas are fastidious bacteria associated with several diseases in plants, affecting crop yield and resulting in important economic losses in Canadian agriculture. The phytoplasma subgroup responsible for causing Aster Yellows disease is primarily transmitted by migratory populations of Aster leafhoppers (*Macrosteles quadrilineatus* Forbes). Despite having a low incidence in canola fields in the Prairies (<0.01%). Aster Yellows outbreaks have been recorded in 2001, 2007, and 2012, with the 2012 outbreak being much more severe than the previous ones. In addition, other crops have been found to be infected with phytoplasmas. Yet little is known about the host choice behaviour of Aster leafhoppers and whether this can be affected by infection with phytoplasmas. To address this problem, two-choice bioassays with Aster leafhoppers will be conducted under various experimental conditions, using crops and weeds commonly found in Saskatchewan.

Antennal length of male Caloptilia fraxinella (Lepidoptera: Gracillariidae) captured in pheromone-baited traps in Edmonton, Alberta. Schulze, K.[1], Santos, M.[2] and Evenden, M.[1] [1]Department of Biological Sciences, University of Alberta Edmonton, AB. [2]Faculdade de Tecnologia e Ciências: Salvador, Bahia, Brazil.

Caloptilia fraxinella (Lepidoptera: Gracillariidae) is a nuisance and aesthetic pest of ornamental green ash, *Fraxinus pennsylvanica* (Oleaceae), that was first detected in Edmonton in 1999. These moths overwinter as adults and emerge to mate in early spring, at which time females produce and males respond to sex pheromones. Previous studies illustrate phenotypic plasticity in pheromone response of males that depends on physiological state. It is not known, however, if variation in pheromone responsiveness exists among reproductively active males. It is possible that males invest more in antennal length with presumably more pheromone receptors to better detect mates. The objective of this study is to determine if antennal length of male *Caloptilia fraxinella* varies among males captured in traps baited with different pheromone doses or with moth population density. Sex pheromone-baited unitraps, baited with 1μg, 10 μg, 100 μg and 1000 μg doses, were placed in horticultural green ash trees at 8 sites throughout southern Edmonton in the summer of 2018. A random sub sample (n=4) of males was removed from traps and their wings and antennae were dissected and measured. This study will provide further insight into the plasticity of pheromone communication of this long lived moth.

The development and refinement of bioclimatic and forecasting models for insect pests in Canadian agroecosystems. Sjolie, D.[1,2], Vankosky, M.[1] and Willenborg, C.[2] [1]Saskatoon Research and Development Centre, 107 Science Place, Saskatoon SK. [2]University of Saskatchewan, 51 Campus Drive, Saskatoon SK.

Bioclimatic and forecast models are important components of the integrated pest management toolbox. Unfortunately, rigorous, validated models are not available for key pests of field crops on the Canadian prairies. The objective of my proposed thesis project is to identify abiotic (soil moisture content, temperature) factors that affect the development and survivorship of several important insect pests in Canadian agroecosystems: cabbage seedpod weevil (*Ceutorhynchus obstrictus*), pea leaf weevil (*Sitona lineatus*), wheat stem sawfly (*Cephus cinctus*), and bertha armyworm (*Mamestra configurata*). New insights and interactions arising from my project will be incorporated into bioclimatic models and serve to increase the availability of forecasting tools for prairie producers. Here I present planned experimental designs and preliminary data for this project.

Population genetic structure of forest tent caterpillar in relation to larval host, forest zones and geography. Snape, K.[1,2], Roe, A.D.[2], and Sperling, F.A.H.[1] [1]Department of Biological Sciences, University of Alberta, Edmonton, AB. [2] Natural Resources Canada, Canadian Forest Service, Great Lakes Forestry Centre, Sault Ste. Marie, ON.

The forest tent caterpillar (FTC, *Malacosoma disstria*) is a major deciduous forest defoliator throughout Canada, but we lack a clear understanding of the relationship between population structure and regional variation in host use in this species. In Ontario, FTC is commonly associated with sugar maple and aspen. Earlier studies have shown fitness and life history differences between maple-feeding and aspen-feeding

FTC populations. We asked whether maple feeding populations of FTC differ genetically from aspen feeding populations, using ddRAD methods to survey genome-wide single nucleotide polymorphisms. We found no consistent differences between FTC feeding on different hosts within the same geographic region. However, FTC populations were genetically differentiated between boreal and deciduous forests, with even greater differences between eastern and western Canada.

Variability in the microbiome of Winter tick, *Dermacentor albipictus*. Sperling, J., Normandeau, J., MacDonald, Z., Merrill, E., Sperling, F. and Magor, K. Departments of Biological Sciences & Renewable Resources, University of Alberta. Edmonton, AB.

Tick microbiomes are usually considered to be highly diverse, but recent literature has questioned the basis for this diversity. Methodological artifacts are now suspected to be major contributors to such microbiome diversity measures. Our study aimed to assess the nature of bacterial diversity in a simplified system chosen for its reduced number of ecological variables. Winter ticks, *Dermacentor albipictus*, were collected from one host, elk, and a restricted geographic range at Ya Ha Tinda Ranch, in the foothills of Alberta. Despite our restricted sampling design, we found low species richness for the major components of the microbiome, but high within-population variability of the most common bacteria in the system. *Francisella*, and more generally Francisellaceae, dominated the bacterial microbiome of winter ticks, while *Pseudomonas*, *Ehrlichia* and *Asinibacteria* occurred in appreciable but variable numbers. A large number of other bacterial taxa were present in low and unpredictable numbers. This finding is consistent with other studies that describe high functional redundancy in tick microbiomes, which may result in enhanced ecological resilience and adaptability.

Seasonal migration of corixids (Hemiptera: Corixidae) as a linkage between wetland and river ecosystems. Srayko, S.[1], Jardine, T.[2], Phillips, I.[1,] and Chivers, D.[1]. [1] Department of Biology, 112 Science Place, University of Saskatchewan, Saskatoon, SK. [2]School of Environment and Sustainability, 117 Science Place, University of Saskatchewan, Saskatoon, SK.

Linkages between spatially separated water bodies in the form of migratory insects have the potential to greatly influence ecosystem functioning and food web dynamics. Migratory insects that act as food web subsidies can also be instrumental to fish production in lotic ecosystems. We have identified a potentially important subsidy in the form of migrating corixids (Hemiptera: Corixidae) that move from wetlands into the North and South Saskatchewan Rivers during the fall. Results from 2015 and 2016 indicate that corixid migration begins in late September, marked by tremendous increases in abundance in the rivers and decreased abundances of migratory corixid species in wetlands. A shift in species composition also occurs as wetland migrants arrive in the rivers. The stable isotope of sulphur was used to trace this migration between the two habitats. Gut content analyses show that goldeye (*Hiodon alosoides*), mooneye (*Hiodon tergisus*), longnose sucker (*Catostomus catostomus*) and white sucker (*Catostomus commersoni*), make heavy use this forage subsidy. This study could underscore a need for the integrated conservation of both wetland and river habitats by characterizing a linkage that exists between these spatially separated ecosystems.

Ebb and Flow: Tracking populations of the invasive weevils, *Ceutorhynchus obstrictus* and *Sitona lineatus* in Western Canada. Tansey, J.[1], Vankosky, M.[2], Meers, S.[3], Weiss, R.[2], Barkley, S.[3], and Peru, C.[1]. [1]Saskatchewan Ministry of Agriculture, [2]Agriculture and Agri-Food Canada, [3]Alberta Agriculture and Forestry.

Accidental introduction has led to established and spreading populations of the important canola pest, the cabbage seedpod weevil, *Ceutorhynchus obstrictus* (Marsham), and the important pea pest, the pea leaf weevil, *Sitona lineatus* L. in Western Canada. Population dispersal and prevalence are monitored through collaboration of multiple Provincial and Federal agencies. Recent surveys have indicated continued spread, but reduced numbers of both insects. We describe survey and sampling efforts and suggest some factors that could be contributing to reduced numbers.

Toxicity and Effects of *Cannabis sativa* Oils on *Bombus impatiens*. Verhallen, J., and Prager, S. Department of Plant Sciences, University of Saskatchewan, Saskatoon, SK.

Cannabis sativa (Hemp) is wind pollinated crop known to produce volatile terpenes as well as cannabinoids such as Δ9-tetrahydrocannabinol (THC) and cannabidiol (CBD). These cannabinoids are known to cause behavioural effects in many animals including humans and these effects haven been well studied. However, while insects are known to not have the same cannabinoid receptors as mammals, the effects of cannabinoids on insect behavior have not been greatly explored. As a first step to performing behavioral analyses, it is necessary to determine relative levels of toxicity. A dose response curve was constructed using *Bombus impatiens*and three *Cannabis*oils containing varying levels of CBD and THC. Oils that contained less CBD were found to be highly toxic compared to oils with higher levels of CBD and control. Based on the dose-response curve, a sublethal dose was also found and used to evaluate the amount of movement *B. impatiens*exhibited an hour after being dosed with oils or control. The more toxic oils were also found to make the insects less active while the less toxic oil caused the insects to become hyperactive. Further research on the toxicity and effects of cannabis oils on other insects is needed to determine if there are potential practical applications of cannabis oils in pest management or they may pose a threat to pollinators when grown in large scale field production.

Effects of overwintering length and temperature on pea leaf weevil (Coleoptera: Curculionidae) survival and oviposition. Wijerathna, A[1]., Evenden, M.L.[1], and Càrcamo, H.A.[2] [1]Department of Biological Sciences, University of Alberta, Edmonton, AB. [2]Agriculture and Agri-Food Canada, Lethbridge, AB.

The pea leaf weevil (PLW), *Sitona lineatus* L. is an invasive pest of field pea and faba bean. Cold hardiness is an essential component for winter survival as it expands its range in North America. Pea leaf weevil does not undergo obligatory diapause but resumes feeding on perennial legumes if conditions are suitable. Here, we investigate the effects of overwintering duration and temperature on PLW survival and oviposition in the laboratory. Reproductively inactive weevils collected in the fall were overwintered in the dark at 5ºC and 10ººC during 10 or 20 weeks. Survival was recorded at the end of the overwintering period. Weevils that survived the various overwintering treatments were subsequently introduced in pairs to pots containing two faba bean plants. After 14 days, the number of feeding notches on plants and the number of eggs laid were counted in each pot. Weevil survival, oviposition and feeding are compared between the two different overwintering temperatures and the two overwintering periods. An

understanding of overwintering survival and effects that overwintering length and temperature have on oviposition will provide insight into the future invasion success of PLW in its expanding range.

Status of *Aphodius fimetarius/pedellus* complex in Canada. Wilches, D.[1], Coghlin, P.[1], Smith, A.[2] and Floate, K.[1]. [1] Agriculture & Agri-Food Canada, Lethbridge, AB. [2] Canadian Museum of Nature, Ottawa, ON.

Aphodius fimetarius (Coleoptera: Scarabaeidae) is a dung beetle native to Europe, Asia and northern Africa. Now common across southern Canada and the United States, subtle variation in colour and morphology hinted that this single species might actually comprise a complex of two co-occurring cryptic species. This suspicion was confirmed by Miraldo et al (2014) using a combination of COI gene sequences, chromosome number, and seasonal phenology. They concluded that the species previously recognized in Canada as *A. fimetarius* is actually *A. pedellus*, but had only morphological data and only from six Canadian specimens. To better confirm the status of this species complex in Canada, we undertook a more detailed examination of Canadian specimens using a combination of morphological characters and COI gene sequences. Our results support some of the key findings of Miraldo *et al.* (2014), but contrast in that we identify both *A. pedellus* and *A. fimetarius* in Canada. The sole reliance on morphological determinations may overlook the presence of *A. fimetarius*. In the future, we plan to use different primers and genes to further validate our findings.

Testing for Evidence of the Large-X Effect in Spruce Budworm and related *Choristoneura*. Wright, M.A. and Sperling, F.A.H. Department of Biological Sciences, University of Alberta, Edmonton, AB.

The large-X effect is the observation that genes that affect postzygotic isolation are disproportionately located on the X chromosome. Originally observed in *Drosophila*, evidence for this effect has been found in other animals, including Lepidoptera. Unlike *Drosophila* and many other model organisms, female Lepidoptera are heterogametic. Within Lepidoptera, the Tortricidae are of interest because of the fusion of the ancestral X chromosome with an autosome. The well-studied spruce budworm (SBW) species complex in Tortricidae is of economic interest, and some of the traits that separate species in this group are already known or suspected to be X-linked. Existing resources for the SBW complex include a draft genome assembly, ddRAD sequences from studies on population structure and phylogeny, and a recently published linkage map for *Choristoneura fumiferana*. Through bioinformatic analysis of these resources using sliding window comparisons of divergences in homologous genomic scaffolds at varying genetic distances, we can quantitatively examine the distribution of species differences across the chromosomes of these moths. Preliminary progress on these analyses will be presented.

The effectiveness of different Insecticides for controlling Pea Aphids in lentil and faba bean. Zhou, N.[1], Wist, T.[2], and Prager, S.M.[1] [1]Dept. of Plant Sciences, College of Agriculture and Bioresources, University of Saskatchewan, 51 Campus Dr. Saskatoon, SK. [2]Agriculture and Agri-Food Canada. Saskatoon, SK.

In pulse crops, aphids can result in both direct damage from feeding and indirect damage through transmission of viruses such as Pea Seed-borne Mosaic Virus (PSbMV). Saskatchewan lacks management tools required to control increasingly common aphid infestations. This project will test the efficiency of three insecticides, Matador (Lambda-cyhalothrin), Voliam Xpress (Lambda-cyhalothrin and

chlorantraniliprole) and Exirel (Cyantraniliprole) in controlling pea aphids on Faba bean (CDC Snowdrop) and lentil (CDC Maxim) under field conditions at two locations (Saskatoon Farm site and Llewelyn site). Three insecticides were sprayed at different pea aphid pressures throughout the season. The number of pea aphids were counted per sweep in lentil and per plant in faba bean. The counting was done before spray, two days and ten days after application of insecticides. Overall, both Matador and Voliam Xpress showed more effective control in pea aphids than Exirel.