Entomological Society of Alberta

57th Annual Meeting

Lakeland College, Vermilion
November 5th – 7th, 2009

PROGRAM

Entomological Society of Alberta

Executive 2009

President	Brian Van Hezewijk
Vice-President	Greg Pohl
Past President	Rose De Clerck-Floate
Secretary	Ken Fry
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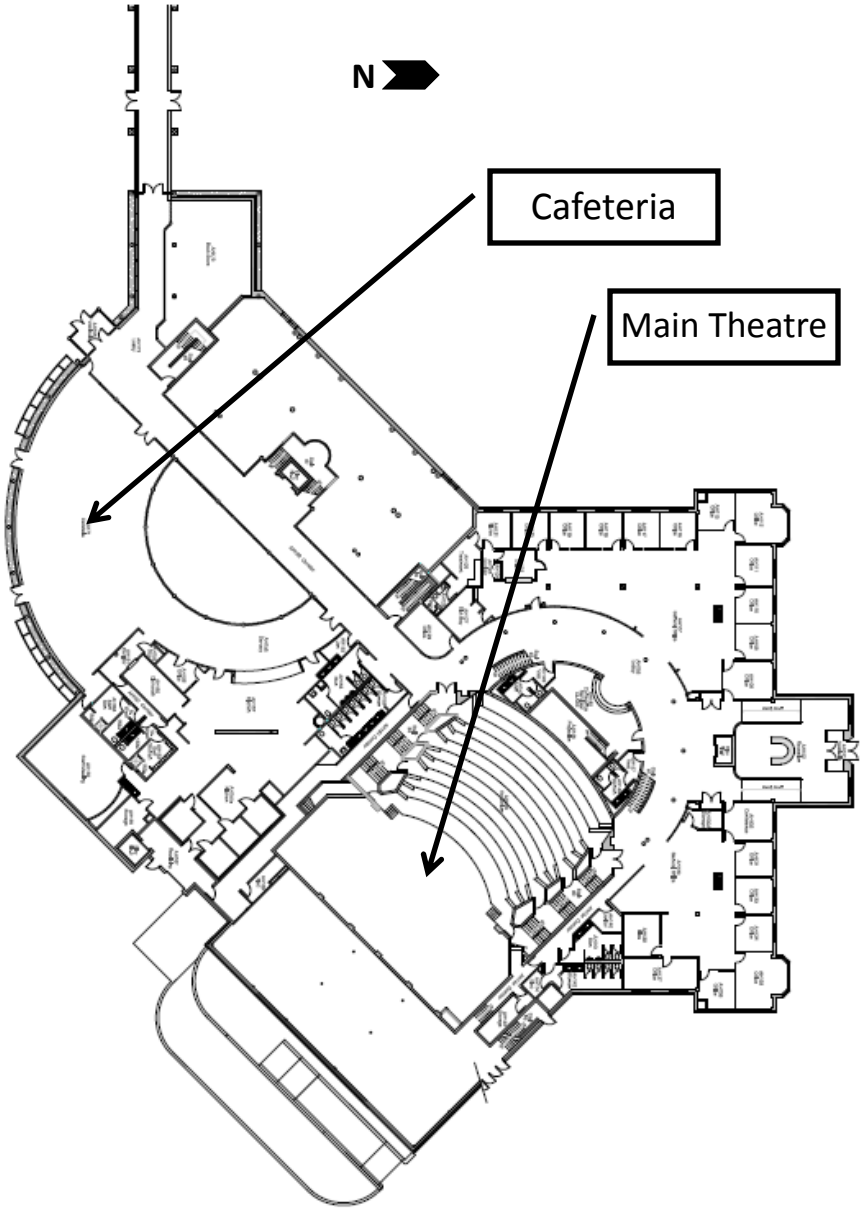
Proceedings Editor	Emily Barnewall

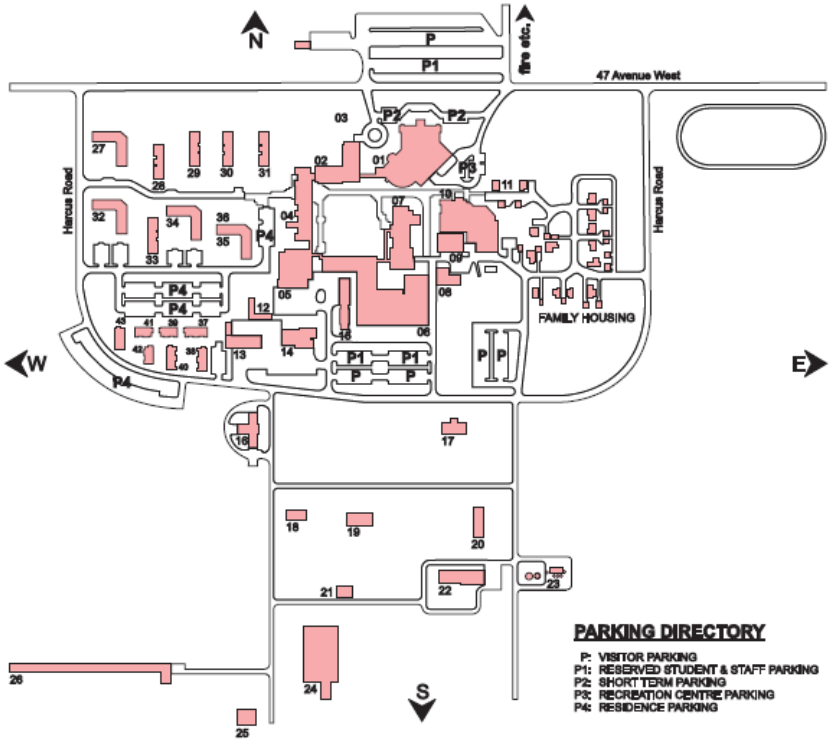
Annual Meeting 2009

Local Arrangements	Peter Walsh, Michael Crowe
Scientific Program Committee	Lloyd Dosdall, Alec McClay
Registration and Finance	Kimberly Rondeau

MAIN FLOOR, ALUMNI HALL



VERMILION CAMPUS



PARKING DIRECTORY

P: VISITOR PARKING
P1: RESERVED STUDENT & STAFF PARKING
P2: SHORT TERM PARKING
P3: RECREATION CENTRE PARKING
P4: RESIDENCE PARKING

BUILDING DIRECTORY

01 ALUMNI HALL
- Administration
- Alumni Hall Theatre
- Bookstore
- Cafeteria
- Library
- Student Services

02 NEWCOMBE N. BENTLEY BUILDING
03 ARBORETUM
04 ACADEMIC LINK
05 APPLIED ENGINEERING BUILDING
06 TRADES CENTRE
07 ANIMAL SCIENCE CENTRE (W.H.T. MEAD)
08 SMALL ANIMAL CLINIC
09 CENTRAL HEATING PLANT
10 RECREATION CENTRE (COL. CORMACK CENTRE
11 ALUMNI HOUSE
12 STUDENTS' CENTRE (THE SHACK)
13 SHIPPING / RECEIVING / PRINTING
14 SERVICE CENTRE
15 HORTICULTURE
16 HOG BARN
17 SHEEP BARN
18 FARM OFFICE / SHOP
19 FARM MACHINERY STORAGE
20 ARTIFICIAL INSEMINATION CENTRE (OSCAR PEDERSON CENTRE)
21 HORSE BARN
22 DAIRY BARN
23 FEED MILL
24 INDOOR RIDING ARENA
25 RODEO CLUB BARN
26 BULL TEST CENTRE (JONATHAN POX BULL TEST CENTRE)

RESIDENCE VILLAGE
27 THETA
28 ZETA
29 GAMMA
30 BETA
31 ALPHA
32 KAPPA
33 SIGMA
34 OMEGA
35 LAMBDA
36 RESIDENCE OFFICE
37-43 DELTA VILLAGE

Vermilion Campus
LAKELAND COLLEGE

Thursday, November 5

16:30 Executive Meeting (Room 256, Alumni Hall)

18:30 Registration open (Cafeteria, Alumni Hall)

19:00 – 22:00 Reception (Cafeteria, Alumni Hall)

All Friday and Saturday sessions will be held in the Main Theatre, Alumni Hall

Friday, November 6

08:00 Registration open (Hallway, Alumni Hall)

08:30 Opening and Welcome

Brian Van Hezewijk, President, ESA
Glenn Charlesworth, President, Lakeland College
Josie Van Lent , Associate Dean, Lakeland College

SYMPOSIUM: INSECTS IN AGRICULTURE

08:40 Lloyd Dosdall (Moderator)
Introduction to the Symposium

08:45 Maya Evenden, R. Gries, M. Aurelian, L.M. Dosdall, G. Judd, C. Miluch, A. Wins-Purdy
Pheromone-based Management of Agricultural Pests: Current Research and Future Needs

09:05 Alec McClay, A. Gassmann, and V.C. Wolf
European Insects as Potential Biological Control Agents for Common Tansy (*Tanacetum vulgare*) in Canada and the United States

09:25 Ross M. Weiss and Owen Olfert
Bio-climatic Approaches to Assess the Potential Impact of Climate Change on Insect Populations in Agroecosystems

09:45 Jeffrey Newton and Heather Proctor
Climate Change Effects on Rangeland Soil Microarthropods

10:05 **COFFEE**

10:35 Héctor A. Cárcamo and Owen Olfert
Biodiversity in Agroecosystems: New Developments and Research Needs

10:55 Lloyd Dosdall, H.A. Cárcamo, O. Olfert, S. Meers, S. Hartley, and J. Gavloski
Invasions of Insects in Agroecosystems in the Western Canadian Prairies: Case Histories and Patterns

11:15 Short Break

11:30 **Lakeland College Student Activity:** "Insect Jeopardy"

12:30 **LUNCH** (on your own)

CONTRIBUTED PAPERS SESSION 1
Moderator – Kateryn Rochon

13:30 Mori, B.A., Gries, G., Otani, J., Yoder, C. and Evenden, M.L.
Development of a pheromone-based monitoring tool for the red clover casebearer (*Coleophora deauratella)* in Alberta

13:45 Aurelian, V.M., Evenden, M.L., and Judd, G.J.R.
Semiochemical-based mass trapping of the apple clearwing moth (Lepidoptera: Sesiidae)

14:00 Vankosky, M.A.,Cárcamo, H.A., Dosdall, L.M.
The effects of soil nitrogen, *Rhizobium* inoculation and insecticide seed coatings on yield loss and nitrogen fixation in field peas under *Sitona lineatus* attack

14:15 Subramaniam, R., Dosdall, L. M., O'Donovan, J.T., and Harker, K.N.
Identifying Agronomic Practices that Conserve and Enhance Natural Enemies of Root Maggots (*Delia* spp.) (Diptera: Anthomyiidae) in Canola

Does *Bracon cephi* reduce stem mining by wheat stem sawfly?
Wu, X.[1,2], Hector Carcamo[1], Brian Beres[1]
[1]AAFC, Lethbridge Research Centre, Lethbridge
[2]Lab of Entomology, College of Agriculture, Inner Mongolia Agricultural University, China

The wheat stem sawfly has been a major pest of spring wheat in the southern prairies of Canada and the adjoining parts of the United States. *Bracon cephi* (Gahan) is an important endemic ectoparatoid of the wheat stem sawfly that can reach very high levels of parasitism. The objectives of this study were to determine the effect of *B.cephi* on the feeding damage (stem mining) caused by sawfly and consequences on grain wheat yield. The cultivars studied included solid and hollow stem wheat. This study was conducted at Coalhurst, west of Lethbridge in 2003-2005, and 2008. Our results showed that stems not infested by the wheat stem sawfly tended to have lighter grain heads than those infested. There was no consistent difference in grain head weights among the various stem classes that were infested by sawfly. In 2008, the length of the feeding tunnel was significantly shorter in parasitized stems than those cut or with dead sawfly larvae; in other years the differences were not significant. We concluded that although *B. cephi* reduced stem mining by the wheat stem sawfly it did not affect the seed weight in our study. Nevertheless, reduction in stem lodging during the growing season and lower sawfly populations in following years are important reasons to conserve this parasitoid.

temperate insect populations by increasing growth and development rates, shorting generation times, extending the growing season, reducing overwintering mortality, altering timing of emergence from overwintering sites, and changing their geographic distribution. Predictive bio-climatic modelling approaches have been used to quantify species – environment interactions, in relation to changes in climate. Once bio-climatic models have been validated and vetted through peer-review, future climate scenarios can be applied either through a) incrementally adjusting climate variables (e.g. +1, +2, +3 °C) in order to study the sensitivity of a specific system's response to a range of potential climatic changes, or b) through application of comprehensive climate scenarios taken from Global Climate Models (GCMs). These two approaches are useful in studying the behaviour or responsiveness of a species to projected climate changes, and the impacts this may have on issues of interest (e.g., agriculture and biodiversity). Case studies of insect pests are used to illustrate the utility of these approaches, and to draw out the general patterns of response.

Beetle species of fallen trembling aspen deadwood

Wood, C. M.[1], Spence, J.R.[1], and Langor, D.W.[2]
[1]Department of Renewable Resources, 751 General Services Building, University of Alberta, Edmonton Alberta T6G 2H1
[2]Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre, 5320-122 Street Edmonton, Alberta T6H 3S5

As trees die and decay, they provide heterogeneous habitats which are anything but devoid of life. Deadwood supports a large number and diversity of forest dwelling arthropods, many of which are "saproxylic" (i.e. entirely dependent on dead or dying wood). Although saproxylic arthropods are important in providing crucial ecosystem services (decomposition, nutrient cycling), our knowledge of the fauna and their required habitats is limited. To determine the deadwood-associated beetle species and their habitat requirements in northwestern Alberta, we hand collected and reared beetles from various decay states and sizes of fallen trembling aspen (*Populus tremuloides*) deadwood. The communities of saproxylic beetles in various deadwood habitats will be presented and implications for forest management practices will be discussed. The conservation of our forest dwelling species is critical to maintain ecosystem function, resilience and resistance.

14:30 Tansey, J.A., Dosdall, L.M., and Keddie, A.
Host plant glucosinolate profiles and the cabbage seedpod weevil

14:45 Blake, A. J., Dosdall, L. M., Keddie B. A..
The influence of canola nutrition on the oviposition choice and larval development of the cabbage seedpod weevil

15:00 **COFFEE AND POSTER VIEWING**

POSTER PRESENTATIONS

Pinzón, J., Spence, J.R. and Langor, D.
Diversity Patterns of Spiders in White Spruce Stands

Floate, K.D., and Tiberg, K.
What happened to the coprophilous insects associated with bison?

De Clerck-Floate, R., Floate, K.D., and Saunders, P.
A test of containment efficacy using living insects in a release and recapture study

Floate, K.D., and Watson, W.
Introduction of exotic dung beetles into Canada to accelerate degradation of cattle dung

Olivier, C., Galka, B., and Floate, K.D.
Prevalence of *Arsenophonus* in leafhopper vectors of phytoplasma

Waller, J.L.
Parasitoid competition? or Can parasitoids distinguish previously parasitized hosts?

Xiuhua Wu, Hector Cárcamo, Brian Beres
Does *Bracon cephi* reduce stem mining by wheat stem sawfly?

CONTRIBUTED PAPERS SESSION 2
Moderator – Emily Barnewall

15:30 Larson, D.G. and Drozdiak, R.
The foraging activity of the leaf cutter ant, *Acromyrmex echinator*, in dry tropical forest patches in Guanacaste, Costa Rica

15:45 Esch, E.D., Spence, J.R., Langor, D.
Mountain pine beetle phenology, survival, and condition in whitebark pine

16:00 Schwarzfeld, M., Sperling, F.
Patterns of ichneumonid (Insecta: Hymenoptera) diversity in a boreal forest ecosystem

16:15 Wood, C. M., Spence, J.R., and Langor, D.W.
Beetle species of fallen trembling aspen deadwood

16:30 Lee, S.-I., Langor, D.W., and Spence, J.R.
Influence of various retention patches on saproxylic beetles in white spruce stands

16:45 Amanda Van Haga, B. Andrew Keddie, Stephen F. Pernal
From Eggs to Riches: The Use of Hen Egg White Lysozyme to Control Chalkbrood Disease in Honey Bee Colonies

18:30 **BANQUET** (Cafeteria, Alumni Hall)
Cocktails at 18:30
Dinner at 19:00

Awards Presentations
(Rose De Clerck-Floate, Chair, Awards Committee):
Student Travel Grants, Undergraduate Award in Entomology, F.S. Carr Award

area, but this area was not fixed in space. Over the course of the season, the pattern of beetle emergence resembled a circular wave, travelling outward from a central focus. It is thought that this pattern represents the signature of dispersal and oviposition patterns from the previous year(s) and has important implications for the long-term persistence of these populations.

Parasitoid competition? or Can parasitoids distinguish previously parasitized hosts?
Waller, J.L.
Department of Biological Sciences, University of Alberta, Edmonton, AB.

Parasitoids are believed to influence the population dynamics of the forest tent caterpillar (FTC), *Malacosoma disstria* (Lepidoptera: Lasiocampidae). Therefore, I am investigating the FTC parasitoid community in northern Alberta. Over 10,000 FTC larvae and pupae were collected in 2008, from which approximately 3500 parasitoids were reared. The majority of parasitoids were flies, with the two most common being *Arachnidomyia aldrichi* (Parker) (Diptera: Sarcophagidae) and *Carcelia malacosomae* (Sellers) (Diptera: Tachinidae). *C. malacosomae* attacks FTC larvae and emerges from FTC pupae, while *A. aldrichi* attacks FTC in the pupal stage. Interspecific competition was observed and investigated between these two parasitoids. In 2008 fewer FTC than expected were found to contain both *A. aldrichi* and *C. malacosomae* indicating that either one parasitoid was outcompeting the other or *A. aldrichi* was choosing unparasitized FTC hosts. The 2008 data suggests that *A. aldrichi* may not be outcompeting *C. malacosomae* since FTC pupal parasitism by *C. malacosomae* was higher than FTC larval parasitism by *C. malacosomae,* the opposite of what would be expected if *A. aldrichi* was outcompeting *C. malacosomae* inside the host. Field tests conducted in 2009 supported the suggestion that *A. aldrichi* selects unparasitized FTC hosts. This could lead to a better chance of survival for both parasitoid species, resulting in a greater overall rate of FTC parasitism which may have important implications for FTC population dynamics.

Bio-climatic approaches to assess the potential impact of climate change on insect populations in agroecosystems
Weiss, R.M. and Olfert, O.
Agriculture and Agri-Food Canada, Saskatoon Research Centre. 107 Science Place, Saskatoon, SK. Canada. S7N 0X2. E-mail: Ross.Weiss@agr.gc.ca

The role of climate in determining the geographical distribution of plants, arthropods and pathogens is well documented. There has been considerable concern in recent years about climatic changes caused by human activities and their effects on agriculture. Global warming conditions may impact

From Eggs to Riches: The Use of Hen Egg White Lysozyme to Control Chalkbrood Disease in Honey Bee Colonies

Amanda Van Haga[1,2], B. Andrew Keddie[2], Stephen F. Pernal[1]
[1]Agriculture and Agri-food Canada, Beaverlodge Research Farm, Beaverlodge, AB Canada, T0H 0C0; [2]Department of Biology, University of Alberta, Edmonton, AB Canada, T6G 2E9.

Chalkbrood, caused by *Ascosphaera apis* (Maassen ex Claussen) Spiltoir and Olive (1955), is a cosmopolitan fungal disease of honey bee larvae (*Apis mellifera* L.) for which there is no registered chemotherapeutic control. Previously, it was determined that lysozyme-HCl, a broad spectrum antimicrobial extracted from hen egg albumen, was effective at controlling chalkbrood *in vitro*. A field trial was conducted in which 40 artificially-infected package colonies were inoculated with pollen containing homogenized black and white chalkbrood mummies and administered three treatments of 600, 3000, or 6000 mg lysozyme-HCl in 50% (w/v) sucrose syrup. Colonies were evaluated for disease severity, brood and adult bee populations and honey production over spring and summer months. Lysozyme-HCl did not affect adult bee survival or brood production and did effectively suppress the development of chalkbrood disease. Daily chalkbrood mummy production decreased by a factor of 10 in colonies treated with three applications of 6000 mg of lysozyme-HCl when compared with infected, untreated controls and reduced disease symptoms to levels observed in uninfected colonies. Honey production was significantly negatively correlated with increased disease severity. Lysozyme-HCl shows promise as a new, food-grade therapy for the control of chalkbrood disease in honey bee colonies.

Halos, Ripples, and Ghosts of Dispersal Past

Van Hezewijk, B.H.[1] and Bourchier, R.S.[1]
[1]Agriculture & Agri-Food Canada, Lethbridge Research Centre, Lethbridge, Alberta

It has been previously observed that in the years following a point release, the weed biocontrol insect, *Aphthona lacertosa*, can have an approximately circular region of impact on its host plant leafy spurge. In subsequent years, adult beetles are highly aggregated on healthy plants at the edge of this expanding 'halo' of dead plants. We hypothesized that the cause of this spatial pattern resulted from one of two processes: outward dispersal of adults with arrestment behaviour at the edge of the halo, or, higher rates of reproduction and emergence at the edge of the halo. Using a grid of 140 emergence traps to monitor the spatio-temporal patterns of emergence, and weekly sweep-net samples to monitor adult distributions, we discovered an unexpected pattern. Adult beetles did diffuse outward from an emergence

Saturday, November 7

CONTRIBUTED PAPERS SESSION 3
Moderator – Meghan Vankosky

08:30 Lysyk, T.J., and Rochon, K.
Seasonal Activity of Rocky Mountain Wood Ticks, *Dermacentor andersoni*, in Southern Alberta

08:45 Janet Sperling, Danny Shpeley, Sarah Leo , Mike Jenkins, Felix Sperling
***Ixodes scapularis* and *I. pacificus* ticks in Alberta**

09:00 Leech, R.E.
The Continuing Saga of Introduced Spiders to Alberta

09:15 Barnewall, E.C., De Clerck-Floate, R.
Quarantine assessment of *Rhinusa pilosa* as a potential biological control agent for *Linaria vulgaris*

09:30 Van Hezewijk, B.H. and Bourchier, R.S.
Halos, Ripples, and Ghosts of Dispersal Past

09:45 Dombroskie, J. J.
Quantifying Gestalt: Towards an Interactive Matrix-based Key to Canadian Lepidopteran Subfamilies

10:00 **ENTOMOLOGICAL SOCIETY OF ALBERTA ANNUAL GENERAL MEETING**

Coffee will be served concurrently with the AGM.

ORAL AND POSTER PRESENTATION ABSTRACTS
(Alphabetically by presenting author)

Semiochemical-based mass trapping of the apple clearwing moth (Lepidoptera: Sesiidae)

Aurelian, V.M.[1], Evenden, M.L.[1], and Judd, G.J.R. [2].
[1]Department of Biological Sciences, CW405 Biological Sciences Bldg, University of Alberta, Edmonton, AB, T6G 2E9.
[2]Agriculture and Agri-food Canada, Pacific Agri-food Research Centre, Summerland, BC, V0H 1Z0.

Infestations of apple clearwing moth, *Synanthedon myopaeformis*, a European pest of apples, were recently discovered in several areas of Canada. Cambium-feeding larvae girdle bark at the rootstock-scion union, which weakens dwarfing apple trees and reduces their yields. Absence of natural enemies and effective pesticides has resulted in extremely high populations, especially in organic apples in southern B.C. Our goal is to develop a semiochemical-based mass-trapping program targeting male and female moths. In this study we compare pheromone-and kairomone-based mass trapping at three different trap densities relative to untreated control plots. In kairomone-baited traps, we use commercial grape juice, known to be highly attractive to both sexes. Mass trapping with grape juice removed large numbers of both males and females. Interference among pheromone traps occurred at very high trap densities (100 traps/ha under high moth densities and 50 traps/ha under lower moth densities). In contrast, no trap interference was detected with juice-baited traps. A combination of male confusion by ambient levels of pheromone and removal from the population through capture in traps may operate in pheromone-based mass-trapping plots. The mechanisms behind the significant decrease in the number of females captured in assessment traps in control plots versus pheromone baited mass trapping plots remain unknown. We predict that high-capacity traps baited with kairomones that target both sexes may be a good alternative to pesticides for decreasing moth densities in organic orchards.

Quarantine assessment of *Rhinusa pilosa* as a potential biological control agent for *Linaria vulgaris*

Barnewall, E.C.[1,2], De Clerck-Floate, R.[1]
[1] University of Lethbridge, Lethbridge AB
[2] Lethbridge Research Centre, Agriculture & Agri-food Canada, Lethbridge AB

Yellow toadflax, *Linaria vulgaris*, is a non-native, invasive plant of agricultural and natural areas in Canada. Multiple introductions of this plant to North America are suspected, hence, any insects used for biocontrol of *L. vulgaris* will be encountering multiple host genotypes upon release. A pre-release

alba x *B. napus* and the parental genotypes, *B. napus* and *S. alba.* We also examined adult weevil feeding and oviposition preferences for and larval development times and weights associated with resistant and susceptible germplasm. These results and comparison with previous chemical analyses of these genotypes suggest the attractive effects of 2-phenylethyl glucosinolate and potential antifeedant or toxic effects of 1-methoxy-3-indolylmethyl glucosinolate.

The effects of soil nitrogen, *Rhizobium* inoculation and insecticide seed coatings on yield loss and nitrogen fixation in field peas under *Sitona lineatus* attack

Vankosky, M.A.[1,2],Cárcamo, H.A.[2], Dosdall, L.M.[1]
[1] University of Alberta, Department of Agricultural, Food and Nutritional Science, 4-10 Agriculture-Forestry Centre, Edmonton, Alberta, Canada, T6G 2P5.
[2] Agriculture and Agri-Food Canada, Lethbridge Research Centre, 5403 - 1 Avenue South, Lethbridge, Alberta, Canada, T1J 4B1.

The pea leaf weevil (*Sitona lineatus* L., Coleoptera: Curculionidae) is an exotic pest of field pea (*Pisum sativum* L., Fabales: Fabaceae) in southern Alberta. Yield loss results from adult feeding on plant foliage and larval feeding on root nodules, which reduces the protein content of seeds and the amount of nitrogen returned to the soil due to consumption of *Rhizobium leguminosa-rum* bacteria. In 2008 and 2009, we investigated the impacts of soil nitrogen (N), *Rhizobium leguminosarum* inoculation (INOC) and insecticide seed coating (CRUISER), in various combinations, on *S. lineatus* herbivory and pea yield at Lethbridge and Vauxhall. In 2008, above and belowground damage differed among treatments at Vauxhall, with no differences in yield. Foliar damage, determined by counting leaf notches, was significantly lower on CRUISER plots than on plots with no insecticide application. At Lethbridge, only yield and pea protein differed among treatments, with the greatest yield occurring on plots treated with INOC+N, followed by CRUISER+INOC+N and INOC. Protein content was greatest on plots treated with CRUISER+INOC+N, followed by INOC+N and INOC. In 2009, preliminary results show that foliar damage varied among treatments at Vauxhall and Lethbridge. CRUISER plots generally had less foliar damage and plots with N or INOC+N had more foliar damage. Our results suggest that yield will be protected when peas are grown in soil with recommended nutrient levels and sufficient *Rhizobium* populations. Incorporating an insecticidal product, such as Cruiser, in an integrated pest management program for *S. lineatus* will also protect yield.

Identifying Agronomic Practices that Conserve and Enhance Natural Enemies of Root Maggots (*Delia* spp.) (Diptera: Anthomyiidae) in Canola

Subramaniam, R.[1], Dosdall, L. M.[1], O'Donovan, J.T.[2], and Harker, K.N.[2]
[1]Department of Agricultural, Food and Nutritional Sciences, University of Alberta, Edmonton, AB, [2]Agriculture and Agri-Food Canada, Lacombe Research Centre, 6000 C & E Trail, Lacombe, AB

Root maggots (*Delia* spp.) (Diptera: Anthomyiidae) are serious pests of canola in western Canada. Studies were undertaken in central Alberta to identify agronomic practices that can affect the survival and abundance of *Aleochara bilineata* (Coleoptera: Staphylinidae), which is an important natural enemy of root maggots. Adults of *A*. *bilineata* feed on eggs and larvae of root maggots, and *A*. *bilineata* larvae parasitize *Delia* spp. puparia. Although *A. bilineata* occurs commonly in canola in western Canada, we have no knowledge of strategies that can enhance its effectiveness as a predator and parasitoid. Our research aims to enable farmers to increase populations of this beneficial insect by modifying current production practices without incurring major input costs. Our study involved manipulation of tillage regime (conventional versus zero tillage), row spacing, and seeding rate, to assess effects on *A. bilineata* populations. We observed greater root maggot damage to plants grown in conventional tillage than in zero tillage, and increases in plant density generally resulted in a decline in root maggot damage to canola taproots. Activity density of *A. bilineata* was greater in plots tilled conventionally than in zero-till plots. Parasitism was generally greater in zero-till plots than in plots tilled conventionally; however, no consistent effects were observed on *A. bilineata* parasitism in relation to seeding rate and row spacing. The appropriate combination of agronomic practices that enhance *A*. *bilineata* populations has yet to be identified through our ongoing further research involving an additional site-year of data.

Host plant glucosinolate profiles and the cabbage seedpod weevil

Tansey, J.A.[1], Dosdall, L.M.[1], and Keddie, A[2].
Department of Agricultural, Food and Nutritional Science, 4-10 Agriculture/ Forestry Centre, University of Alberta, Edmonton, AB, Canada T6G 2P5
Department of Biological Sciences, CW 405 Biological Sciences Centre, University of Alberta, Edmonton, AB, Canada T6G 2E9

Compounds associated with Brassicaceae have electrophysiological and behavioural effects on the cabbage seedpod weevil, *Ceutorhynchus obstrictus* (Marsham) (syn. *C. assimilis* (Paykull)) (Coleoptera: Curculionidae). These substances include glucosinolates and their hydrolysis products. We present results of a laboratory olfactometer study examining the attractiveness of odours from resistant and susceptible novel germplasm developed from *S.*

impact assessment of a European weevil, *Rhinusa pilosa,* was conducted in quarantine using Canada-wide *L. vulgaris* populations to help determine the potential efficacy of this candidate biocontrol agent. Impacts were examined by comparing intra- and inter-population plant responses to weevil gall induction and development. Impacts were determined by assessing stem height and growth rate, flower production, and above and below ground biomass. Preliminary analyses show that galled stems were 21% smaller and produced 68% fewer flowers than control stems ($F_{2,39} = 3.54$, $p = 0.039$; $F_{2,39} = 7.10$, $p < 0.01$, respectively). However, above ground biomass was 24% higher in galled plants than in control plants but this difference was not significant ($F_{1,21} = 1.14$, $p = 0.30$). The results from this study will help determine the suitability of *R. pilosa* to different populations (and potentially different genotypes) of yellow toadflax and select non-targets and the impact of any attack. This experiment will contribute valuable information to assist an evaluation of the suitability of *R. pilosa* for release.

The influence of canola nutrition on the oviposition choice and larval development of the cabbage seedpod weevil

Blake, A. J.[1], Dosdall, L. M.[2], Keddie B. A.[1].
[1]Department of Biological Sciences, University of Alberta, Edmonton, AB, [2]Department of Agricultural Food and Nutritional Science, University of Alberta, Edmonton, AB

The cabbage seedpod weevil, *Ceutorhynchus obstrictus* (Marsham) (Coleoptera: Curculionidae), is a serious introduced pest of canola, Brassica napus L. In an effort to better understand the relationship between host plant nutrition and *C. obstrictus* preferences and its larval developmental biology, we exposed gravid females to host plants grown under differing regimes of nitrogen and sulfur. Results from pod choice arena experiments indicate that plants grown with a higher supply of sulfur were preferred as hosts but only in plants that were grown in at a low nitrogen level. In contrast, larval development experiments show higher development times with increasing nitrogen levels. This increase in development time was not associated with a similar increase in larval weight. These changes in larval development time may or may not represent a significant fitness cost for larval and adult *C. obstrictus*.

Biodiversity in Agroecosystems: New Developments and Research Needs

Cárcamo, H.A.[1] and Olfert, O.[2]
[1]AAFC, 403 – 1 Ave S. Lethbridge AB T1J 4B1
[2]AAFC, 106 Science Place, Saskatoon SK S7N 0X2

Biodiversity studies attempt to quantify the number of species in a given

assemblage and their relative dominance at a defined spatiotemporal scale. In cultivated or grazed ecosystems of the Canadian prairies, few such studies have been conducted and most have focused on carabid beetles. A cursory literature search using the terms "Carabidae" and the name of the prairie province in Agricola, supplemented by our own records, revealed 9 studies of carabids in relation to agricultural practice in Alberta. Four studies include sites from the short and mixed moist grasslands and the rest were conducted in the Parkland eco-region; the vast agricultural Peace River region in the Boreal Plains has not been studied. Spiders, and staphylinid beetles, despite their co-occurrence with carabids in pitfall catches have not received the same attention. For example, no studies of spider diversity were found for agroecoystems in Alberta but two were done in Saskatchewan. We could not find biodiversity studies of these taxa from cultivated fields in Manitoba. Also there are no direct comparisons of cultivated fields and nearby grasslands reserves. Future challenges include filling these geographic gaps and include other key guilds such as herbivores, soil arthropods, foliage dwelling predators, parasitoids and pollinators. Yet a larger challenge is to tackle the functional studies to elucidate the linkages between bioversity and ecosystem function. This information is needed to answer the perennial questions farmers and policy makers ask: what are the environmental and economic implications of biodiversity and how do we protect it?

A test of containment efficacy using living insects in a release and recapture study

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North American regulatory standards for the containment of arthropods in quarantine stipulate that such facilities be specially designed to prevent arthropod escapes. They are to be equipped with a vestibule light lock containing a UV or regular light trap, and inner rooms with negative air pressure. To test the efficacy of various containment methods, a release and recapture study was conducted within an operational quarantine using three insect species; *Aphodius distinctus*, *Musca domestica*, *Urolepis rufipes*. The optimum method for escape prevention varied with species. A combination UV/incandescent light trap, a pan/water trap, and negative air pressure are all recommended.

Quantifying Gestalt: Towards an Interactive Matrix-based Key to Canadian Lepidopteran Subfamilies

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Patterns of ichneumonid (Insecta: Hymenoptera) diversity in a boreal forest ecosystem

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Ichneumonidae, the largest family of Hymenoptera, are parasitoids of other arthropods, particularly among the Lepidoptera and Symphyta. As such, they play an important role in forest ecosystems, including limiting populations of potential pest species. However because of their specialized life histories, they may also be particularly vulnerable to ecological disturbances. To determine baseline Ichneumonidae community data for Alberta's boreal forest, I used Malaise traps in various habitats during 2007. In 2008, I collected ichneumonids from four treatments (uncut, 50% retention, 20% retention, clearcut) in deciduous-dominated stands to assess the impact of variable retention harvesting on the ichneumonid community. This work was performed at the EMEND (Ecosystem Management Emulating Natural Disturbance) site, approximately 90 km northwest of Peace River, AB. Twenty -four subfamilies have been collected, with over 70% of specimens belonging to the four most abundant subfamilies. One subfamily, the Pimplinae, has been further identified to species, with at least 46 species in 22 genera present. I will discuss the seasonal, geographical and habitat patterns of Alberta's boreal ichneumonid community.

***Ixodes scapularis* and *I. pacificus* ticks in Alberta**

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Recent reports have documented the distribution of *Ixodes scapularis* and *I. pacificus* throughout southern Canada - except for Alberta. As these two tick species are recognized as the primary vectors for Lyme disease, this gap implies a low risk of Lyme disease for Alberta. However, over the last decades in the Edmonton area we have received for identification a number of ticks of these two species. Although the recent travel history of the human and other hosts of these ticks is incompletely documented, it is important to note that the putative vectors of Lyme disease have been consistently present in central Alberta.

Diversity Patterns of Spiders in White Spruce Stands

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Spiders were collected at the Ecological Management by Emulating Natural Disturbances (EMEND) project landbase, located in the mixedwood boreal forest of NW Alberta. Eight trees within three uncut white spruce stands were selected and spiders collected from 12 height classes. Ground spiders (H0) were collected using pitfall traps; spiders from the shrub layer (H1) were collected by beating on a 1 x 1 m canvas sheet within 5 m radius from selected trees; spiders from the remaining height classes (H2-H11) were collected from tree branches that were accessed using aluminum sectional ladders, branches were cut up to 12 m high and dropped to the ground onto a 20 x 15 feet plastic tarp. Species diversity was calculated for each height class by tree and averaged using Shannon's (H') and Simpson's (1-D) diversity measures. Species turnover, based on pair-wise comparisons between shared, gained and lost species between height classes, was calculated. A cluster analysis, based on Jaccard distance, was carried out to assess vertical patterns in species composition. Diversity showed a clear decreasing pattern from the ground to higher layers. A layering effect was observed in terms of vertical species turnover, revealing three main strata: ground, understory and overstory; thus, spiders in white spruce show a marked vertical stratification in lower layers and a weak pattern within higher layers. These results show the relevance of spider assemblages within a vertical gradient and the importance of preserving structural features in the forest to better maintain spider biodiversity in old-growth forests.

Seasonal Activity of Rocky Mountain Wood Ticks, *Dermacentor andersoni*, in Southern Alberta

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Tick populations were sampled at various locations in southern Alberta over a three-year period. The same transects were sampled by dragging weekly from early spring until mid- to late summer when no further tick activity was detected. Tick activity peaked in early spring, immediately following loss of snow cover, and declined thereafter. This surprising result gives new insight on Rocky Mountain Wood Tick population dynamics.

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Identifying Lepidoptera to subfamily or tribe using dichotomous keys is difficult as existing keys cover only distinctive families or rely on difficult characters. A matrix-based key shows great promise as a way to identify Lepidoptera to family because non-discrete characters can be used. I constructed a key using 73 external characters (266 states) that are visible with a dissecting microscope, examined from 1454 specimens in 221 taxon groups. This key will likely become a valuable tool in lepidopteran identifications.

Invasions of Insects in Agroecosystems in the Western Canadian Prairies: Case Histories and Patterns

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The Northern Great Plains of North America has been invaded by alien insect species that have caused extensive economic damage to agricultural production. In the last 25 years, invasions of Russian wheat aphid (*Diuraphis noxia* (Mordvilko)), cabbage seedpod weevil (*Ceutorhynchus obstrictus* (Marsham), pea leaf weevil (*Sitona lineatus* L.), diamondback moth (*Plutella xylostella* (L.)), and cereal leaf beetle (*Oulema melanopus* L.) have occurred, and most have established. Most invading species are believed to have originated from source populations to the south, but orange wheat blossom midge (*Sitodiplosis mosellana* (Géhin)) and swede midge (*Contarinia nasturtii* (Keiffer)) apparently invaded from eastern North America. Biological and chemical control comprise key management strategies for invasive insect pests in agroecosystems. Invasions have affected ecosystem functioning by providing vast resources of herbivorous insects that have been exploited by some predators and parasitoids through expanding their normal host ranges. Further effects on ecosystem functioning resulted from negative impacts of insecticide sprays on indigenous and beneficial species.

Mountain pine beetle phenology, survival, and condition in whitebark pine

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Whitebark pine (*Pinus albicaulis*), an endangered keystone of Western North America's sub-alpine forests is threatened by an invasive pathogen, *Cronartium ribicola*, and a native pest, the mountain pine beetle (MPB), *Dendroctonus ponderosae*. MPB phenology, survival, and condition are little known for this host, especially at the northern extent of the tree's range (West Central Alberta). Field experiments at the northern limit of the tree's range show MPB development and survival are inferior in whitebark compared to lodgepole pine, the MPB's primary host. Despite this, MPBs were capable of completing their development in one year, even at high elevations. Differences in survival and development could not be related to the host's phloem thickness or susceptibility to the blue stain fungi. Laboratory experiments on beetle condition indicate relationships between tree diameter and beetle condition differ between whitebark and lodgepole pine. These results suggest verbanone protection may be the most effective means of controlling MPB population in sub-alpine forests containing whitebark pine.

Pheromone-based management of agricultural pests: current research and future needs

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The reliance of moths on sex pheromones for mate finding makes their chemical communication system an ideal target for integrated pest management. Research in my laboratory focuses on the ecology of chemically -mediated interactions of insects (primarily moths) considered to be pests of

The red clover casebearer (RCC), *Coleophora deauratella*, (Lepidoptera: Coleophoridae) is an introduced pest in the Peace River Region of Alberta. Infestations of RCC in clover can cause up to 99.5% seed loss. Components of the female sex pheromone were identified as (*Z*)-7-dodecenyl acetate and (*Z*)-5-dodecenyl acetate, both of which are necessary to attract male RCC. Here we further develop this pheromone-based tool to determine the most attractive dose of the pheromone blend to male RCC, and the trap type with the greatest efficacy for RCC capture. This will produce an optimized monitoring system which can be incorporated into an integrated pest management program to monitor this pest throughout the Prairie Provinces.

Climate change effects on rangeland soil microarthropods

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Canada contains 22,000,000 ha of land dedicated to range and forage production. To mitigate potential impacts of climate change on biodiversity and sustainable production of Canada's rangelands, it is essential to gain an understanding of links between temperature, precipitation, grazing and their effects on soil chemistry and biota. We have conducted a three year study at the Kinsella Research Ranch. Using a factorial design we tested effects of warming, two different precipitation and two defoliation regimes on carbon and nitrogen cycling, forage quality, plant assemblages, soil microbial activity and soil microarthropod assemblages. The data presented are from the first (2007) and third (2009) years of the project. To date, 69 arthropod taxa have been identified, most of them mites (Arachnida: Acari). This includes 8 orders of macro-invertebrates, 3 families of Collembola, 2 families of Astigmata, 2 families of Endeostigmata, 15 families of Prostigmata (including 4 families of Heterostigmata) and 16 families of Oribatida (consisting of 25 genus- or species-level taxa). The microarthropod assemblage was numerically dominated by Collembola and mites (Acari), the latter mainly consisting of prostigmatid mites. The effects of treatments have been validated, but preliminary results suggest that only lowered precipitation significantly affects microarthropod numbers. 2007 results show that mites of the family Tydeidae along with juvenile Oribatida are positively associated with drought. I will also discuss the extraction methods used in this study, by comparing results between the rarely used kerosene floatation method and the more conventional Tullgren extractions.

phalangioides (Fuesslin, 1775); SALTICIDAE: *Salticus scenicus* (Clerck, 1757); SICARIIDAE: *Loxosceles blanda* Gertsch & Ennik, 1983; SPARASSIDAE: *Heteropoda venatoria* (Linnaeus, 1767); THERIDIIDAE: *Latrodectus hesperus* Chamberlin & Ivie, 1935, *Latrodectus mactans* (Fabricius, 1775); THERAPHOSIDAE: several unidentified genera on fruits from Central and South America.

Studies on European insects as potential biological control agents for common tansy (*Tanacetum vulgare*) in Canada and the United States

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Common tansy (*Tanacetum vulgare* L., Asteraceae) is an invasive herbaceous perennial native to Europe, and was introduced into North America as a culinary and medicinal herb. Now widely naturalized in pastures, roadsides, waste places, and riparian areas across Canada and the northern USA, tansy is also spreading in forested areas. It contains several compounds toxic to humans and livestock if consumed, particularly α-thujone. Tansy is listed as a noxious weed in several states and provinces. Common tansy is a good target for biological control, as it is a perennial plant growing in stable habitats, and has few native North American congeners. A biological control program for common tansy started in 2006, funded and coordinated by a Canadian-US consortium led by the Alberta Invasive Plant Council and the Minnesota Department of Agriculture. CABI Switzerland Centre is identifying and testing potential agents for efficacy and host specificity. Potential agents under study include a stem-mining weevil *Microplontus millefolii*, a leaf-feeding beetle *Cassida stigmatica*, a flower- and stem-mining moth *Isophrictis striatella*, a stem-boring cerambycid beetle *Phytoecia nigricornis*, and a root-feeding flea beetle *Longitarsus noricus*. Studies are in progress to understand the effects of chemical diversity in the essential oils of *T. vulgare* on host selection by insects.

Development of a pheromone-based monitoring tool for the red clover casebearer (*Coleophora deauratella)* in Alberta

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agricultural, horticultural, and forestry systems and how these interactions might be exploited in pest management. This type of work is highly collaborative and involves basic discovery of chemical signalling systems and their application to monitoring and control of pest populations. The emphasis of this research is on understanding the mechanisms by which moth behaviour is affected by pheromone-based management strategies. Examples of the use of synthetic pheromone for monitoring and control of agricultural pest populations through attract and kill, mass trapping and mating disruption will be presented. Recommended future research directions will be discussed.

What happened to the coprophilous insects associated with bison?

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There is speculation that the virtual eradication of bison (*Bison bison*) from North America may have caused the extinction of coprophilous insect species that bred in bison dung. Alternatively, these insects may now breed in cattle dung. To our knowledge, the suitability of cattle dung as a substitute for bison dung has not been experimentally addressed for dung breeding insects. In Part 1 of a two-part study, we compared captures of coprophilous beetles (Scarabaeidae, Staphylinidae, Histeridae, Hydrophilidae) in pitall traps baited with: (B) dung of bison fed a diet of mixed natural grass and hay, (C) dung of cattle fed a hay diet with ca. 10% grain, or (CS) dung of cattle fed barley silage. Analyses were performed on nine taxa that comprised 99.2% of the 21 369 beetles recovered. No native or non-native taxa preferred bison dung over that of cattle. Four taxa preferred CS to C dung, and two taxa preferred C to CS dung. These results support the hypothesis that native species of insects originally breeding only in bison dung would have been able breed in cattle dung once it became available. In Part 2 of this study, we compare the richness and abundance of insect species that completed egg-to-adult development in B, C and CS dung. These latter results are not yet available.

Introduction of exotic dung beetles into Canada to accelerate degradation of cattle dung

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Dung-fouled pastures are poorly used by cattle, which avoid feeding on contaminated grasses. The resulting patchy grazing pattern causes economic

losses for the industry such that rapid dung degradation is desired. Efforts now are underway in southern Alberta to establish populations of the coprophagous beetles, *Digitonthophagus gazella* and *Onthophagus taurus* (Coleoptera: Scarabaeidae), which are recognized for efficiently burying dung. Establishment of *O. taurus* is considered likely, given reports of populations within 300 km of the Canada/USA border. Establishment of *D. gazella* is unlikely, but is being studied to test predictions of climatic models under field conditions.

Prevalence of *Arsenophonus* in leafhopper vectors of phytoplasma

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Is the ability of leafhoppers to vector plant pathogens (e.g., phytoplasmas) affected by coinfections of symbiotic bacteria? We examined this question in a survey of four leafhopper populations (*n* = 66 species) collected in vineyards and crops in Canada. Genetic markers identified infections of the species '*Candidatus phytoplasma asteris*' in 15 species and infections of *Arseno-phonus* and/or *Wolbachia* bacteria in 40 species. The correlation between infections of symbionts, phytoplasma and leafhopper population location is discussed.

The foraging activity of the leaf cutter ant, *Acromyrmex echinator*, in dry tropical forest patches in Guanacaste, Costa Rica

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The foraging activity and efficiency of the fungus rearing *Acromyrmex* leaf cutter ants, a readily recognized insect herbivore in the dry tropical forest patches of the Rio Tempesque watershed in Guanacaste, Costa Rica, was the focus of one of the Augustana undergraduate studies carried out in the February 2009 Tropical Field Course. The pattern of the daily foraging activity period, the rate of travel of laden and unladen ants, the size and types of botanical loads being carried back to the fungal gardens, length of major foraging trails, estimates of daily harvest mass and estimates of colony size were determined for small, medium and large *A. echinator* nests.

Influence of various retention patches on saproxylic beetles in white spruce stands

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Sustainable forest management requires intimate knowledge of how forest biota responds to forestry practices. Saproxylic beetles (i.e. beetles that depend on dead or dying wood during some part of their lifecycle) are a diverse group of organisms that provide essential ecosystem functions. Green tree retention has been proposed as a way of conserving biodiversity because retention patches can act as 'life boats', providing source populations for re-colonization of harvested landscapes. To understand the effect of harvest intensity and retention patch size on saproxylic beetle assemblages in boreal white spruce stands, we investigated saproxylic beetles using window and emergence traps among two sizes of clumped retention patches (0.20 and 0.46 ha) within different harvest intensity at the EMEND (Ecosystem Management Emulating Natural Disturbance) landscape.

The Continuing Saga of Introduced Spiders to Alberta

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Since the early 70s, 16 species in 11 families have been, or are being, recorded in this paper as introduced to Alberta. These introductions include species that do exist naturally in Alberta, and also individuals of species that do not exist naturally in Alberta. These spider species have been brought in unintentionally by commerce (equipment, crushed rock, fruit and vegetables) and even in packed clothing by unsuspecting holidayers from the U.S.A. and other Canadian provinces. Not considered here are tarantula and other spider species brought in for pet shops and museums. To date, there have not been formal records kept of spider species introduced to Alberta. The following spider families and species of spiders have been introduced to Alberta, and this paper constitutes the first formal record for several of the families and species: AGELENIDAE: *?Hololena sp.?* imm., *Tegenaria agrestis* (Walckenaer, 1802), *Tegenaria domestica* (Clerck, 1758), *Tegenaria duellica* Simon, 1875; AMPHINECTIDAE: *Metaltella simoni* (Keyserling, 1878); CTENIDAE: *Cupiennius salei* (Keyserling, 1877), *Cupiennius coccineus* F.O. Picard-Cambridge, 1901; MITURGIDAE: *Cheiracanthium inclusum* (Hentz, 1847); PHOLCIDAE: *Pholcus*