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T.D. Galloway

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The Entomological Society of Manitoba was formed in 1945 “to foster the advancement, exchange and dissemination of Entomological knowledge”. This is a professional society that invites any person interested in entomology to become a member by application in writing to the Secretary. The Society produces the Newsletter, the *Proceedings*, and hosts a variety of meetings, seminars and social activities.

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72nd Annual Meeting Entomological Society of Manitoba, Inc.

Friday, October 28, 2016

Freshwater Institute

501 University Crescent

and

Saturday, October 29, 2016

Room 219 Animal Science/Entomology Building

University of Manitoba

Abstracts

KEYNOTE ADDRESS

IMPACTS OF LANDUSE CHANGE ON INSECT FOOD WEBS: IMPLICATIONS FOR CONSERVATION AND AGRICULTURE.

Tatyana A. Rand, USDA-ARS Northern Plains, Agricultural Research Laboratory, Sydney, Montana, United States of America, 59270.

Natural habitat loss and land use intensification can alter the magnitude and direction of food web interactions with important implications for conservation and agriculture.

Theory suggests that habitat loss can either disrupt trophic interactions via the loss of specialist natural enemies, or enhance them via the spillover of generalists, that benefit from human land uses, into adjacent natural systems. I will discuss studies examining the importance of these two processes in driving consumer pressure in natural habitats, and the potential implications of land use intensification for insect invasions. This work suggests that spillover processes can be problematic from a conservation perspective, by increasing consumer pressure and invasive dominance in natural habitat remnants.

However, these same processes can actually benefit agriculture by augmenting biological control of important crop pests. I will end with a discussion of current work examining the importance of spillover processes for conservation biological control, which suggests an important role of increasing crop diversity and natural habitat area as strategies to reduce pest pressure in crops. Overall the discussed studies highlight the importance of landscape change as a key driver of shifts in insect community structure and interactions in both natural and agricultural systems.

SYMPOSIUM

Molecular Approaches to Fundamental and Applied Entomology

BIOLOGICAL CONTROL OF PRAIRIE CROP PESTS WITH PARASITOIDS AND PREDATORS?

Héctor Cárcamo, Lethbridge Research and Development Centre, Lethbridge, Alberta, Canada, T1J 4B1.

In the Canadian Prairies, there are a few examples of successful biological control of field crop pests involving parasitoids, or at least playing an important role in reducing their populations below pest levels. For example, *Bracon cephi* is recognized as a key mortality factor of wheat stem sawfly and there are some agronomic recommendations to enhance its effectiveness as a support management strategy along with host plant resistance. A similar situation occurs for the integrated pest management of wheat midge. For cereal leaf beetle, however, a tiny wasp by the name of *T. julis* is the primary management tool credited with keeping populations below pest status. Another potential pest target for biological control in the prairies, though using a more risky neoclassical strategy, is lygus bugs. These pests are managed with *Peristenus* (Braconidae) wasps in some areas of the USA. All these examples involve parasitoids, and so far producers lack the tools on how to take advantage of the largest pool of natural enemies present in every field: generalist predators. In this presentation I provide examples of biological control from my research with wheat stem sawfly, cereal leaf beetle and lygus bugs, and then reflect on the path forward to integrate conservation biocontrol with predators to help growers manage insect pests in a more sustainable manner.

FINDING DINNER BY SIGHT OR SCENT: STUDIES OF SENSORY CUE USE BY PREDATORY INSECTS.

Neil J. Holliday, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

In a Darwinian world, one might expect that the use of sensory cues by predators would result in higher predation success and hence higher fitness. Three laboratory studies of predator (in the broad ecological sense) responses will be reviewed to examine whether this expectation is met. Responses of immature grasshoppers, *Melanoplus bivittatus* (Orthoptera: Acrididae), to food-related visual cues appear to conform to adaptationist expectations. Host-selection behaviour of females of the parasitoid *Microplitis mediator* (Hymenoptera: Braconidae) at first seems unlikely to maximize fitness. Responses of larval *Aleochara* (Coleoptera: Staphylinidae) to chemical cues seem likely to enhance host-finding success, whereas some of those of adult *Aleochara* are difficult to interpret.

The talk will conclude with a discussion of what can be inferred from these studies about adaptation and responses of predators operating in complex environments.

THE STORY OF THE CEREAL APHID DYNAMIC ACTION THRESHOLD (dat) PROJECT.

Tyler Wist, Saskatoon Research and Development Centre, Agriculture and Agri-Food Canada, Saskatoon, Saskatchewan, Canada, S7N 0X2.

The cereal aphid dynamic action threshold project began as a priority of the Pest Management Centre's Pesticide Risk Reduction Program and is still continuing under their funding. It brought together and kick-started AAFC Dr. Wist's Field Crop Entomology programme at the Saskatoon Research and Development Centre and a diverse set of talents that has led us up to now. This is the story of how an entomological project begins as a thought and finishes as a deliverable, all the while carrying forward the careers of a multitude of workers...with a lot of entomology thrown in for good measure.

TWO STEPS FORWARD, ONE STEP BACK: CHALLENGES FOR IPM IN PRAIRIE AGRICULTURE.

John Gavloski, Manitoba Agriculture, Box 1149, Carman, Manitoba, Canada, R0G 0J0.

Integrated pest management (IPM) involves using the best mix of control methods for a given pest. Chemical insecticides are a component of IPM, but according to the original definition of IPM, are to be used in the manner least disruptive to biological control. Conservation of natural enemies of potential pests is one of the basic components of IPM. Many aspects of the way crops are produced and protected have changed in recent decades. Advances in crop breeding, our knowledge of beneficial organisms, and in some instances insecticide selectivity have in many ways made it easier to conserve natural enemies of crop pests. Other changes to cropping systems, such as field sizes, improved weed control, the use of tank mixes of pesticides, and the marketing of pesticide bundles have improved some aspects of crop production, but at times inadvertently reduce the ability of natural enemies of pests to thrive. Challenges to effective IPM include: encouraging the use of economic thresholds where available, improving the ability of farmers and crop scouts to identify beneficial organisms, conserving or improving habitat for natural enemies on farms, and having access to affordable selective insecticides that are of minimal harm to natural enemies.

SUBMITTED PAPERS

SPECIES-SPECIFIC INSECT CONTROL USING RNA INTERFERENCE.

Aditi D. Singh, Sylvia Wong, Calen P. Ryan, Suresh Desai, and Steve Whyard, Department of Biological Sciences, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

The gene silencing mechanism RNA interference (RNAi) uses double-stranded RNA (dsRNA) to target and prevent translation of specific genes' mRNA transcripts within an organism. DsRNA reduces the expression of tubulin and vATPase genes when fed to several insect species, such as fruit flies, aphids and moths. Similarly, when larvae of the dengue vector mosquito, *Aedes aegypti* (L.) are soaked for a relatively short period of time in a dsRNA solution targeting β -tubulin, they subsequently showed reduced gene expression and increased mortality. RNAi may be used to reduce populations of disease vectors, as well as populations of agricultural pests, and the technology is currently being tested on pest insects of canola. Using various delivery methods for dsRNA, and targeting genes specific to insects, RNAi has potential as a species-specific insect control method, reducing or eliminating the use of broad spectrum chemical pesticides that may harm the environment and kill beneficial species.

LOUSY OLD COOTS: CHEWING LICE (PHTHIRAPTERA: AMBLYCERA, ISCHNOCERA) INFESTING AMERICAN COOT, *FULICA AMERICANA* (GRUIFORMES: RALLIDAE), IN MANITOBA.

Terry D. Galloway, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

Forty-five American coots, *Fulica americana* Gmelin, were examined for chewing lice during 1995–2016. Five species of lice were collected: *Pseudomenopon pilosum* (Scopoli), *Laemobothrion atrum* (Nitzsch) (Amblycera: Menoponidae and Laemobothriidae, respectively), *Fulicoffula longipila* (Kellogg), *Incidifrons transpositus* (Kellogg) and *Rallicola advenus* (Kellogg) (Ischnocera: Philopteridae). Prevalence of infestation (95% confidence interval, Sterne's exact method) by at least one species of louse was 97.8% (88.17–99.88), while infestation by individual species, from greatest to least prevalence, was *R. advenus* (97.8%, 88.17–99.88), *P. pilosum* (93.3%, 81.46–98.15), *F. longipila* (84.4%, 71.26–92.54), *I. transpositus* (73.3%, 58.90–84.79) and *L. atrum* (17.8%, 8.33–32.04). Overall mean intensity (95% bootstrap confidence limits, 200 replicates) of infestation by chewing lice was 604.7 (484.30–770.59), while mean infestation for each species of louse, greatest to least, was *P. pilosum* (281.7, 206.88–407.17), *R. advenus* (275.7, 220.91–342.43), *F. longipila* (39.6, 30.89–49.71), *I. transpositus* (33.0, 23.21–59.58) and *L. atrum* (5.9, 0.38–14.13). A total of 26,605 lice was collected during this study. Generally speaking, female lice most often outnumber males, and this was the case for *I. transpositus* ($\chi^2=6.1$, $p\leq 0.01$) and *L. atrum* ($\chi^2=5.8$, $p\leq 0.02$). There were no significant differences in sex ratio for *F. longipila* ($\chi^2=1.1$, $p\leq 0.30$) and *R. advenus* ($\chi^2=0.8$, $p\leq 0.39$). Male *P. pilosum* significantly outnumbered

females ($\chi^2=98.0$, $p\leq 0.0001$). Ratios of nymphs to females for each species, from highest to lowest: *I. transpositus* (5.1), *P. pilosum* (4.8), *R. advenus* (3.4), *F. longipila* (3.2) and *L. atrum* (1.6).

CAN MOSQUITOES FROM SOUTHERN MANITOBA TRANSMIT ZIKA VIRUS?

Mahmood Iranpour^{1,2}, A. Dibernardo¹, L.R. Lindsay^{1,2}, ¹Zoonotic Diseases and Special Pathogens, National Microbiology Laboratory, Public Health Agency of Canada, 1015 Arlington St., Winnipeg, Manitoba, Canada, R3E 3R2; ²Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

Zika virus (ZIKV) is transmitted primarily by *Aedes aegypti* and *Ae. albopictus*. The role other species of mosquitoes may play as vectors is unknown. The objective of this study is to determine the ability of mosquito species from Manitoba, Canada to amplify and transmit ZIKV. Adult mosquitoes were collected from southern Manitoba during the summer of 2016. Mosquitoes were infected with the Thailand or Puerto Rico strains of ZIKV either orally through infected blood or directly by needle inoculation. After incubation at 25C for 10 to 14 days, RNA was extracted from the bodies, legs and saliva of experimentally infected mosquitoes and tested for ZIKV by real-time PCR. More than 15 species of mosquitoes were collected and tested. ZIKV was detected in bodies of most needle-inoculated species, but not all. Likewise, ZIKV was recovered in the saliva of needle-inoculated *Ae. vexans* (16.7%) and *Culex restuans* (3.8%); however, 1.6% (n=129) of samples of *Ae. vexans* saliva from orally-infected mosquitoes were positive. This preliminary data suggest that growth of ZIKV occurs in some species but in most individuals, the midgut or salivary gland barriers likely prevent transmission when mosquitoes are orally infected. To date, most mosquitoes species collected from southern Manitoba do not appear to be competent vectors for ZIKV in the laboratory. Further studies are planned to determine the capacity of a broader range of mosquito species to acquire and transmit ZIKV.

MY LOVE-HATE RELATIONSHIP WITH DNA BARCODES, THE Y2K PROBLEM, AND THE SEARCH FOR SOMETHING BETTER

Jeffrey M. Marcus, Department of Biological Sciences, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

DNA barcodes are indisputably useful for rapidly identifying many species of organisms. In many cases, DNA barcodes also provide insights regarding the phylogeny of organisms. However, the short stretches of DNA that make up barcodes fail to discriminate between species correctly in about 30% of cases. In addition, there are instances when phylogenies generated from barcode sequences are demonstrably incorrect. These barcode-based phylogenies do not correctly reconstruct the evolutionary history of the mitochondrial genome, let alone the evolutionary history of the organisms.

There are two causes for this phenomenon. First, the Cytochrome oxidase I (COI) gene used for animal DNA barcoding is the most highly evolutionarily constrained coding sequence in the mitochondrial genome. A consequence of this is that the variable sites in COI that can change without negative fitness consequences reach saturation more quickly than other parts of the mitochondrial genome, causing phylogenetic ambiguity among distantly related organisms. Second, because DNA barcode sequences are short, the number of variable sites is very small, causing phylogenetic ambiguity especially among closely related organisms. This is a biological analogue of the Y2K problem in computer science: the ambiguity that arises when legacy identifiers contain insufficient information for new demands being placed on an information storage and retrieval system. Using some examples from my own research programme, I will present some alternatives to the current conventional barcodes that will help resolve these issues, while maintaining much of the convenience and low-cost of conventional barcode approaches.

EVALUATION OF DELTAMETHRIN FOR ULV MOSQUITO CONTROL APPLICATIONS IN WINNIPEG, MANITOBA.

Ken Nawolsky and David Wade, Insect Control Branch, City of Winnipeg, Winnipeg, Manitoba, Canada, R3P 3P1.

Winnipeg, Manitoba has the largest mosquito control programme in Canada. In addition to larviciding, the Insect Control Branch utilizes ultra-low volume applications (ULV) for both nuisance and vector adult mosquito control. For over 30 years, malathion has been the only adult mosquito control insecticide used in Winnipeg because of the limited number of products registered in Canada. Although malathion provides control of adult mosquitoes, the City of Winnipeg's Insect Control Branch is searching for alternative products. DeltaGard® which contains deltamethrin was recently registered in the United States as a reduced risk product by the Environmental Protection Agency. Data provided by the manufacturer indicate that it provides effective control of adult mosquitoes in numerous field trials conducted in the United States. The City of Winnipeg obtained a research permit to evaluate the efficacy of deltamethrin. In this study, we examined the impact of ULV applications of deltamethrin against caged sentinel mosquitoes in the field. Applications at 1 g deltamethrin per hectare provide effective control of adult mosquitoes at distances up to 90 meters compared to the control.

APHIDS AND THEIR ADAPTATIONS TO A CHANGING ENVIRONMENT.

Aldo Rios-Martinez and Alejandro C. Costamagna, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

Aphids constitute a prime example of the adaptability of a genotype to a changing environment. The large diversity of aphid species and the complexity of their life cycles provide evidence of the ability of aphids to shape numerous traits as a function of their environment. Aphids show several adaptations to reduce their risk of predation, including

behavioural responses such as dropping from the host plant, adopting defensive spatial distributions along the host plant, and releasing alarm pheromone. Adaptations to predation also occur phenotypically and are best represented by the production of morphs specialized in defense and dispersal. In addition, aphids are highly specialized plant-feeders able to synchronize their life cycles with the physiology of their host plants. A large variety of adaptations allow aphids to exploit their food resources successfully. These adaptations include the enhancement of host plant nutritional quality through chemicals, gall formation, and the use of symbiotic microbes. We focus on the importance of these adaptations in the biology of aphids and their interspecific relationships. Using the soybean aphid (*Aphis glycines*) as a study model, we integrate some of these adaptations and discuss their implications from an ecological perspective.

CONTROL OF FLEA BEETLES USING RNA INTERFERENCE TECHNOLOGIES.

Aditi D. Singh. Suresh Desai, Lisa Flaten, Emily Garcia, Michael Becker, Mark Belmonte, Steve Whyard, Biological Sciences, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

Flea beetles (*Phyllotreta* spp.) are the most economically damaging pests of canola in Canada. With canola being one of Canada's major exports, the need to control insect damage to crops is of main concern. Chemical insecticides are traditionally used to kill insects, but they have several negative impacts on the environment, including their effects on non-target organisms. It has been established that RNA interference (RNAi) has the ability to kill specific insects by the ingestion of double-stranded RNA (dsRNA) targeting genes essential for growth and development. Here, we show that certain mass-produced, topically-applied dsRNAs can be effective at killing flea beetles feeding on canola leaf disks. Recent bioinformatic analyses conducted on transcriptomes from *Phyllotreta* species will also increase the number of dsRNA targets identified and aid in the development of highly effective, species-specific RNAi insecticides against flea beetles.

SPECIES COMPOSITION AND SEASONAL PATTERN OF OCCURRENCE OF FLEA BEETLES IN THE PRAIRIES.

T. Nagalingam¹, T. F. S. Guimarães¹, J. Otani², H. A. Cárcamo³, T. Wist⁴, J. Gavloski⁵, and A. C. Costamagna¹, ¹Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2; ²Agriculture and Agri-Food Canada, Beaverlodge Research Farm, P.O. Box 29, Beaverlodge, Alberta, Canada, T0H 0C0; ³Agriculture and Agri-Food Canada, Lethbridge Research and Development Centre, 5403-1 Avenue, Lethbridge, Alberta, Canada, T1J 4P4; ⁴Agriculture and Agri-Food Canada, Saskatoon Research and Development Centre, 107 Science Place, Saskatoon, Saskatchewan, Canada, T1J 4P4; ⁵Manitoba Agriculture, Carman, Manitoba, Canada, R0G 0J0.

Flea beetle populations were sampled in 29 commercial canola fields in Alberta, Manitoba and Saskatchewan, during 2015. Sampling consisted of five doubled-sided sticky cards per field located at 25 m from one field border and replaced weekly during the susceptible period of canola (Lethbridge and Saskatoon areas) or during the whole season (Peace River area and Manitoba). The species composition of flea beetles in the Prairies include *Phyllotreta cruciferae* (Goeze), *P. striolata* (F.), *P. robusta* Lec., *P. bipustulata* (Fabricius), *Psylliodes punctulata* Melsh, *Chaetocnema irregularis* J.L. Leconte, *C. protensa* (J.L. Leconte) and *Crepidodera nana* (Say). Either crucifer flea beetles (*P. cruciferae*) or striped flea beetles (*P. striolata*) were the most abundant species sampled in all three provinces. In Lethbridge (Alberta), crucifer flea beetle comprised 86.9% of total flea beetle adults and striped flea beetles comprised 12.8% of the adult assemblages. By contrast, striped flea beetles were the dominating species in the Peace River area (Alberta) (99%) and in Saskatoon (Saskatchewan) (90%). In Manitoba, 50.1% of the adults were striped flea beetles and 49% were crucifer flea beetles. Seasonal patterns of occurrence of the two most important flea beetle species reveal a change in flea beetle populations compared to previous studies, which now appears to be two generations occurring over the summer in the Peace River area and in Manitoba.

ASSESSING RURAL TO URBAN DISPERSION AND AGGREGATION PATTERNS OF ADULT MOSQUITOES IN WINNIPEG, MANITOBA.

M.E. Balcaen and A.R. Westwood, Department of Biology, University of Winnipeg, 515 Portage Ave, Winnipeg, Manitoba, Canada, R3B 2E9.

Insect Control Branch of Winnipeg, MB implements population control measures to reduce nuisance adult mosquito populations within the City of Winnipeg. Adult mosquitoes are suspected to undermine these measures by migrating into the city from untreated adjacent rural areas and may use certain landscape features to facilitate this migration. In order to assess these movement and subsequent aggregation patterns, mark-release-recapture techniques were used to mark cage-reared adult mosquitoes at emergence. Over five days, an estimated 50,000 mosquitoes were released and subsequently captured in traps within the urban Winnipeg area for six weeks following release. Over 122,000 mosquitoes (primarily *Aedes vexans*), were collected from traps, including 78 marked mosquitoes within 22 km of the release site.

DOES LANDSCAPE STRUCTURE INFLUENCE CEREAL LEAF BEETLE ABUNDANCE THROUGH INCREASING THE PARASITISM RATE OF ITS SPECIFIC PARASITOID *TETRASTICHUS JULIS*.

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The cereal leaf beetle is an invasive pest currently increasing its abundance in southern Alberta and expanding its range in the Canadian Prairies. A specialist parasitoid, *Tetrastichus julis* (Hymenoptera: Eulophidae) from Europe was released in eastern USA to control this pest and relocated throughout western North America, including the Canadian Prairies. In this study we assessed, for the first time, the role of landscape complexity in the success of this parasitoid as a biocontrol agent of cereal leaf beetles in Canada. The abundance and percentage parasitism of cereal leaf beetle was assessed in 30 wheat fields (13 spring wheat and 17 winter wheat fields) in southern Alberta from June 15 to July 30, 2014. Fields were located within a wide range of agricultural landscapes ranging from simple to highly complex. Landscapes were characterized based on the percentage of the semi natural habitats (including pasture, native and cultivated grassland, and riparian vegetation) and percentage of cultivated area in proximity with the wheat fields sampled. Per cent parasitism decreased with higher proportion of barley, and increased with higher proportion of grass, pasture, canola and other crops at the 1000 m scale. CLB abundance decreased, as the proportion of urban increased in the landscape. As the proportion of semi-natural, canola and other crops increased in the landscape, the number of CLB increased in the wheat fields. Surprisingly, CLB abundance was not affected by the proportion of wheat area in the landscape.

RNAI-MEDIATED KNOCKDOWN OF MALE FERTILITY GENES IN THE QUEENSLAND FRUIT FLY, *BACTROCERA TRYONI* (DIPTERA: TEPHRITIDAE).

Carlos A. Cruz Lopez and Steve Whyard, Department of Biological Sciences, University of Manitoba, Winnipeg Manitoba, Canada, R3T 2N2.

The Sterile Insect Technique (SIT) involves the release of large numbers of radiation-sterilized males that will mate with females to reduce the population. However, radiation treatments can weaken males, reducing their competitiveness. RNA interference (RNAi) technologies have been suggested as an effective approach with potential applications in pest insect control, based on a sequence-specific post-transcriptional gene silencing process elicited by double-stranded RNA (dsRNA). The present study aims to develop sterile males of *Bactrocera tryoni* suitable for SIT by silencing genes involved in spermatogenesis and male fertility using RNAi. Nine putative male fertility genes were selected from the *B. tryoni* genome and qRT-PCR confirmed that seven of the nine genes

are testis-specific. DsRNAs targeting some of these genes were synthesised and delivered to the insects by haemocoel injections or feeding. Injections into adult males of dsRNA targeting the testis-specific serine/threonine-protein kinase 1 (tssk-1) gene caused no significant knockdown at three days post-injection, possibly because the dsRNA was delivered too early to affect sperm maturation. Feeding dsRNA to adults resulted in significant knockdown of the tssk-1 transcripts in older (10 day old) males, but not in younger (3 and 7 day old) males. These findings confirm that ingestion of dsRNA in this insect can result in systemic RNAi, with dsRNA affecting tissues beyond the gut. The impact of this knockdown on male fertility will be assessed to determine whether any of the selected dsRNAs can produce sterile males for a SIT-mediated approach to Queensland fruit fly control.

NOVEL TRANSMISSION ROUTES OF EUROPEAN HONEY BEE VIRUSES (*APIS MELLIFERA*) IN VITRO.

Megan J. Colwell¹, R.W. Currie¹, and S.F. Pernal², ¹Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2; ²Agriculture & Agri-Food Canada, Beaverlodge, Alberta, Canada, T0H 0C0.

Although there are many insect pollinators, European honey bees (*Apis mellifera*) are arguably the most economically important and recognizable pollinators; however, higher than normal losses in the past decade have put the honey bee industry at risk. Viruses are likely one of the key factors in honey bee health. Little work has been done to explore the possible role of wax, the substrate on which all hive activities take place, as an element in virus transmission. This study explores various routes of transmission of viruses between honey bees and wax. Bees used in experiments originated from two sources, high *Varroa* (high virus, n=8) and low *Varroa* (low virus, n=8) colonies. Bees were homogenized together based on treatment and then 300 introduced into each cage. There were eight cages per treatment, which were maintained at 75% RH and 30°C in incubators for six days. Wax was washed to extract RNA, and RT-qPCR was used for absolute quantification of viruses. Transmission routes examined included worker to wax through contact and aerosolization.

ENTOMOLOGICAL TIME TRAVEL: RECONSTRUCTING THE INVASION HISTORY OF THE BUCKEYE BUTTERFLIES (GENUS *JUNONIA*) FROM FLORIDA, USA.

Melanie M.L. Lalonde and Jeffrey M. Marcus, Department of Biological Sciences, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

Invasion biology focuses on the process by which non-native species integrate into new habitats. This includes dispersal events, the creation of secondary contact zones, and possible hybridization with resident organisms. Three species of buckeye butterflies

(genus *Junonia*) currently reside in Florida, USA, including *Junonia coenia* (polyphagous and widely distributed), *J. neildi* (monophagous mangrove-feeding species that is restricted to coastal areas) and *J. zonalis* (a polyphagous tropical species that is restricted to frost-free south Florida where its larval hosts occur). Two species have long been resident in Florida, while *J. zonalis*, colonized Florida from the Caribbean in the mid-20th century, but was undetected until 1981. Hybridization between *Junonia* species occurs readily in the laboratory, and occurs naturally at some frequency in the wild. Diagnostic morphological and molecular markers exist for determining *Junonia* with Caribbean ancestry, allowing us to observe the invasion and creation of a secondary contact zone over space and time. We developed techniques to determine mitochondrial genotypes quickly, inexpensively, and unambiguously from legs removed from museum specimens of *Junonia* collected in Florida and the Caribbean over the last 150 years. Using biogeography and population genetics, we reconstructed the invasion of *J. zonalis* as it colonized Florida using more than 800 museum specimens from 1865 to 2015. The data are consistent with an invasion that began in the 1930s, followed by hybridization with resident species. Although *Junonia* is not an agricultural pest, our time series can be used as a model for understanding the behavior of other insect invasion events.

HUMAN PATHOGENS IN BLACKLEGGED TICKS AND THEIR SMALL MAMMAL HOSTS AT TWO MANITOBA PROVINCIAL PARKS.

Zack C. Polk and Kateryn Rochon, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

The first established population of blacklegged tick, *Ixodes scapularis* (Say), was detected in the southeast corner of Manitoba in 2006. This species has since expanded its range north and westward, while also expanding the ranges of numerous zoonotic diseases. In Manitoba, the causative agents of human anaplasmosis (*Anaplasma phagocytophilum*), babesiosis (*Babesia microti*), and Lyme borreliosis (*Borrelia burgdorferi*) have been detected in blacklegged ticks. To gain a better understanding of the seasonal tick-host-pathogen dynamics, we conducted a small mammal trapping study at Birds Hill Provincial Park and Beaudry Provincial Park, where established blacklegged tick populations are present. Each park was sampled on an alternating biweekly basis from mid-June to mid-October in 2015, and from mid-April to mid-September in 2016. We have also sampled questing adult ticks at both parks, on a weekly basis, using drag sheets during snow-free periods since August 2014. We present here the seasonal patterns of blacklegged ticks in Manitoba, and prevalence data for three human pathogens in ticks and their trapped hosts.

THE EFFECTS OF LIVESTOCK GRAZING THE DIVERSITY OF LEPIDOPTERA IN IMPERILED ALVAR SITES IN MANITOBA'S INTERLAKE.

Jesse L. Rodgers and A.R. Westwood, Department of Bioscience, Technology and Public Policy, University of Winnipeg, Winnipeg, Manitoba, Canada, R3B 2E9.

Alvars are globally rare, diverse, unique ecosystems that are listed under Manitoba's Endangered Species and Ecosystems Act as endangered. No specific alvar sites have been designated in Manitoba, so economic activities, such as grazing or mining, are not regulated in these areas. Alvar soils are characteristically thin and can be damaged by livestock grazing activities, and this may affect the vegetation and pollinator communities adversely. The objective of our study is to determine if grazing negatively impacts lepidopteran diversity in these alvars. We conducted surveys of physical characteristics, vegetation and lepidopterans (moths and butterflies) in six alvar sites, three of each treatment (grazed and ungrazed) in the Interlake Region of central Manitoba. Vegetation was sampled using a nested quadrat method. Moths and butterflies were sampled using different methods based on the nocturnal and diurnal tendencies of these groups of animals. The purpose of this study is to produce information on the effects of grazing in alvars to assist in determining the best management practices for preserving pollinators as part of a long-term alvar management strategy. This study is being partially sponsored by Manitoba Department of Sustainable Development (Wildlife Branch) and the results will be presented directly to policy makers, to aid their decision making process regarding the protection and management of alvars.

POSTERS

REVISITING THE ECONOMIC THRESHOLDS FOR LYGUS BUGS IN CANOLA.

H. Cárcamo¹, H., J. Otani², S. Daniels¹, K.N. Harker³, P. Reid³, J. Broatch⁴ and R. Laird⁵.

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In the Canadian Prairies, four species of lygus bugs (*Lygus lineolaris*, *L. keltoni*, *L. elisus*, *L. borealis*) colonize various crops and may reach densities that require insecticide spraying to prevent yield losses. *Lygus lineolaris* is the main pest in central and northern humid regions, but *L. keltoni* is dominant in the dry regions of southern Alberta. Economic thresholds were developed for lygus in the late 1980's using a conventional

cultivar (Westar) in southern Manitoba. However, high yielding herbicide-tolerant hybrids have replaced conventional cultivars. The objective of this study was to validate the current threshold for lygus bugs using a commonly planted modern hybrid cultivar. From 2012 to 2015, we conducted cage studies at Lacombe (central) and Lethbridge (south). Densities of lygus bugs were manipulated by adding 0, 10, 20, 50 (or 40 in Lacombe) and 80 lygus adults to 1 m square cages that confined 75 canola plants. In most years there were no consistent statistically significant yield differences among treatments, though cages with lygus had on average about 15-20% less yield than those without lygus. Regression analysis revealed low slope coefficients that resulted in thresholds slightly higher (2-3/sweep) than those reported earlier (1-2/ sweep).

USING CHITOSAN- AND CELLULOSE-BASED NANOPARTICLES FOR DS-RNA DELIVERY IN THE MOSQUITO, *Aedes aegypti* (DIPTERA: CULICIDAE).

Parker Lachance and Steve Whyard, Department of Biological Sciences, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

RNA interference (RNAi)-mediated knockdown of gene expression can be used as a molecular biology tool to characterize genes functionally or as a novel method of pest insect control by knocking down genes essential for insect development. Soaking of *Aedes aegypti* larvae in double-stranded RNA (ds-RNA) can induce RNAi in the insects, but transcript knockdown appears to be dependent on many factors that can influence ds-RNA uptake. Here, we demonstrate that nanoparticle-mediated delivery of ds-RNA can provide more consistent gene knockdown using low doses of ds-RNA. Using both chitosan- and cellulose-based nanoparticles, we could knock down both yellow and HSP90 transcripts in feeding larvae. Insects that fed on chitosan nanoparticles showed significant knockdown in the gut, but not other tissues. In contrast, cellulose nanoparticles induced RNAi in both the gut and in the carcass of insects. Cellulose nanoparticles provided five-fold improvement in transcript knockdown, relative to insects fed dsRNA without nanoparticles, and resulted in a two-fold reduction in melanin content in yellow-ds-RNA-treated larvae. Different formulations of the nanoparticle were investigated and an optimal mass ratio of PEG-based cross-linker to nanoparticles was established that induced maximal RNAi effects. We are currently investigating whether the nanoparticles are able to improve ds-RNA stability, improve uptake of the ds-RNA by insect cells, or improve the ability of larvae to ingest the ds-RNAs. Regardless of how they function, nanoparticles may help us treat larger numbers of mosquitoes with less ds-RNA for either our gene validation studies or for our mosquito control technologies.

VARIATION IN THE NUMBER OF MATURE OVARIOLES IN *COCCINELLA SEPTEMPUNCTATA* (COLEOPTERA: COCCINELLIDAE) IN RELATION TO HABITAT TYPE.

Crystal Almdal, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

The objective of this study was to determine if the fecundity of female lady beetles varies among different habitat types in the landscape, measured by the number of mature ovarioles in the ovaries. The aphidophagous lady beetle, *Coccinella septempunctata*, was chosen as the study organism, as it was most abundant species throughout the study sites. Habitats that had higher aphid abundance were expected to contain the most fecund lady beetles. Sweep net, beating tray, and handpicking sampling methods were conducted, and sampling occurred in alfalfa, winter wheat, canola, spring wheat, and natural vegetation. Aphids and lady beetles were counted, and lady beetles were identified to species. Female *C. septempunctata* were measured and weighed before later being dissected, where the numbers of ovarioles and mature ovarioles were counted. Weight was positively correlated with the number of mature ovarioles. Body size did not differ among habitats, but weight did. Numbers of mature ovarioles were observed to differ among habitat types, even when controlling for weight. Therefore, there are better habitats for lady beetles, with alfalfa and winter wheat deemed as the best habitats in the current study for aphidophagous lady beetles in the landscape. Future studies should look at sampling a greater diversity of habitat types, with multiple study sites for a habitat, with multiple sampling dates.

RNA INTERFERENCE IN TWO AEDINE MOSQUITO SPECIES: IS VARIATION IN DICER AND DOUBLESEX RESPONSIBLE FOR DIFFERENCES IN KNOCKDOWN FOLLOWING INGESTION OF DSRNA?

D.J. Giesbrecht, D.A Boguski, and S. Whyard, Department of Biological Sciences, University of Manitoba, Winnipeg Manitoba, Canada, R3T 2N2.

Aedes aegypti and *Ae. albopictus* are important vectors of human disease, including Dengue, Chikungunya and Zika viruses. Novel control methods are needed, especially methods not dependent on genetic transformation or insecticides. RNA interference by ingestion of dsRNA has previously been used to knock down genes in *Ae. aegypti* to produce a range of phenotypes, including lethality, sterility, and female-specific lethality. When applied to *Ae. albopictus*, dsRNAs against homologous genes did not result in consistent transcript knockdown or phenotype. One possible explanation is that elements of the RNA interference pathway are genetically different in *Ae. albopictus*. The genes *dicer-1* and *dicer-2* are initiators of the silencing pathway, and cells deficient in *dicer-2* are unable to normally process dsRNA. Between the two species, *dicer-1* is 81% similar at the nucleotide level but that the *Ae. albopictus* homologue contains a 141nt insertion. This insertion is found immediately downstream of a highly conserved region and its sequence has no homology to any other sequence in the databases. *Dicer-2* is 79% similar

at the nucleotide level between the two species with no evidence of insertion events. When this approach was applied to the sex-determining gene *doublesex*, we found that the putative homologue in *Ae. aegypti* does not contain introns necessary for alternative splicing of male and female isoforms. Genetic differences in *dicer-1* and *dicer-2* could alter efficiency of the first step in gene silencing. Similarly, variation in *doublesex* between these species could point to fundamental differences in these two species' sex-determination pathways.

SOYBEAN APHID CONTROL AND PREDATOR MOVEMENTS IN AGRICULTURAL LANDSCAPES IN MANITOBA.

K.G.L.I. Samaranayake and Alejandro C. Costamagna, Department of Entomology, Faculty of Agricultural and Food Sciences, University of Manitoba, Canada, R3T 2N2.

Predators provide high levels of control of the soybean aphid, *Aphis glycines* (Hemiptera: Aphididae) in North America. We assessed how agricultural landscape complexity and between-fields patterns of predator movement affected soybean aphid suppression in 27 soybean fields in Manitoba over a two-year period. We quantified soybean aphid suppression using predator exclusion cages and landscape complexity in a 2-km radius from focal soybean fields using digital maps. Predator movement was quantified using bi-directional Malaise traps and mark-release-recapture experiments. We observed strong to moderate suppression of soybean aphids during both years. The proportion of cereal crops in the landscape, and the between-field movement of green lacewings and lady beetles had negative relationships with aphid abundance, suggesting that aphids in soybeans are subject to high levels of predation in landscapes dominated by cereal crops. Malaise traps indicate significant movement of predators from woodland to soybean, and mark-recapture experiments suggest that lady beetles can move rapidly between soybean and alfalfa, suggesting that woodland and alfalfa may be sources of predators in agricultural landscapes. Our results show effective and widespread pest control services provided by predators in soybeans.

LANDSCAPE EFFECTS ON FLEA BEETLES IN THE CANADIAN PRAIRIES.

T.F.S. Guimarães¹, T. Nagalingam¹, J. Otani², H. A. Cárcamo³, T. Wist⁴, J. Gavloski⁵, and A. C. Costamagna¹, ¹Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada R3T 2N2; ²Agriculture and Agri-Food Canada, Beaverlodge Research Farm, P.O. Box 29, Beaverlodge, Alberta, Canada, T0H 0C0; ³Agriculture and Agri-Food Canada, Lethbridge Research Centre, 5403-1 Avenue, Lethbridge, Alberta, Canada, T1J 4P4; ⁴Agriculture and Agri-Food Canada, Saskatoon Research Centre, 107 Science Place, Saskatoon, Saskatchewan, Canada, T1J 4P4; ⁵Manitoba Agriculture, Food and Rural Development, Carman, Manitoba, Canada, R0G 0J0.

Flea beetles (Coleoptera: Chrysomelidae) are important pests of canola in North America. The major species of flea beetles in Canada are the crucifer flea beetle, *Phyllotreta cruciferae*, and the striped flea beetle, *P. striolata*. Economic damage is caused by

defoliation by adults when the canola is between the cotyledon and the two-leaf stage. Currently producers rely on insecticide seed treatments and foliar sprays to control this pest. Although flea beetle outbreaks are very variable in spatial and temporal occurrence, there have been no studies done exploring how landscape complexity mediates the interactions among canola, flea beetles, and natural enemies. In 2015, we sampled 10 commercial canola fields in three Prairie Provinces of Canada (Manitoba, Alberta, and Saskatchewan) to assess levels of defoliation, flea beetle abundance, and landscape structure during the susceptible stages of the crop. We used multiple regression to identify landscape variables that best predict flea beetle abundance and damage in canola fields. This information can be used to identify habitats that function as a source of flea beetles, and to develop maps of risky flea beetle landscapes.

***The Entomological Society of Manitoba gratefully
acknowledges the following organizations which
provided financial support for the***

72nd Annual Meeting

Abell Pest Control, Inc.

Bayer Cropscience Canada Co.

Canadian Centre for Mosquito Management

Canadian Grain Commission

Canola Council of Canada

City of Winnipeg Insect Control Branch

Dow Agro Sciences Canada, Inc.

Gilles Lambert Pest Control

Metro Pest Control

North South Consultants

Orkin PCO Services

Poulin's Pest Control

The Entomological Society of Manitoba
72nd Annual Business Meeting

29 October, 2016

Department of Entomology, University of Manitoba

Attendance

President-elect	John Gavloski
Past President	Richard Westwood
Secretary	Sarah Semmler
<i>Proceedings</i> Editor	Terry Galloway
Regional Director	Rob Currie
Treasurer	Kathy Cano
Member-at-large	Randy Gadawski
Social Committee	Lisa Capar
Scientific Programme	Alejandro Costamanga
Newsletter	Jordan Bannerman
	Marjorie Smith
Youth Encouragement	Arash Kheirodin
Robert Lamb	Tharshi Nagalingam
Megan Colwell	Robbin Lindsay
Steve Whyard	Tyler Wist
Kateryn Rochon	Ishan Samaranyake
Neil Holliday	Ahmed Abdelghany
Erica Smith	Robert Wrigley
Thais Silva	Pat MacKay

Regrets

President	Paul Fields
Membership	Désirée Vanderwel
Scrutineer	Colin Demianyk
Fundraising	Joel Gosselin
Past Secretary	David Wade

1 Acceptance of Agenda

Motion: to accept the Agenda (**Appendix A**)

Galloway/Holliday.....Carried

2 Acceptance of Minutes of the Last Annual Business Meeting (1 November, 2015)

Motion: to accept previous Minutes of the 71st Business Meeting

Lamb/Galloway.....Carried

3 Business Arising from the Minutes

a) Bylaw revisions ongoing.

Gavloski – The changes to the bylaws will continue to be discussed at the next executive meeting.

Currie – Reminder that amendments to the bylaws are required to be provided to the membership at least two months before they are voted on.

4 Reports – Executive

Motion: to receive the reports - Lamb/Rochon Carried

Appendix B – President

Report submitted by Fields, and read by Gavloski.

Gavloski thanked David Wade for his many years serving as secretary for the Entomological Society of Manitoba, and welcomed Sarah Semmler as the new secretary for the ESM.

Appendix C – Treasurer

Presented by Cano. Finances were reviewed between Fields and Cano without an auditor. Cano will meet with Gavloski in two weeks to review. There is still only one account (Expenses) for all transactions, which is why we can see the Fairmont Winnipeg fee and the ESC start-up loan. There were no expenses for the *Proceedings* this year (now electronic rather than printed). Kheirodin applied for a Public Encouragement Grant from the Entomological Society of Canada and has yet to hear back. A GIC was reinvested at 2% for five years.

M. Smith – Doesn't the treasurer require approval for increasing a GIC over \$1000?

Cano – Believed there was approval in past meeting, will check the minutes.

Appendix D – Regional Director to the ESC

Presented by Currie. Reminder to check on your membership status with ESC – no more mail-outs, only emails.

Appendix E – Editor of the *Proceedings*

Presented by Galloway. The electronic format for the *Proceedings* has provided more flexibility for submitted papers.

Bannerman – Can you share the updated email contacts?

Galloway – Yes, will share with you and Semmler.

Appendix F – Endowment Fund Board

Presented by Cano. The report will be broken down and made available in the meeting minutes. The fund was within budget amounts for this year.

Gavloski – We all appreciate Kathy's work. She fills many roles.

5 Reports – Committees

Finance

This was covered by Cano in Appendix C and F.

Appendix G – Publicity/Newsletter

Presented by Bannerman and M. Smith.

Appendix H – Social

Presented by Capar. The Social Committee is seeking someone to take over, and Capar is happy assist with the transition.

Appendix I – Youth Encouragement/Public Education

Presented by Kheirodin.

Holliday – Did not see the application for ESC Public Encouragement Grant come through. Suggests following up with Fiona to see that it made it.

Kheirodin – Will follow up.

Lamb – Attended the Nature MB presentation by Zhang and is sure there were 50-60 people in the audience, not 10.

E. Smith – Agreed that it was closer to 50 people.

Appendix J – Archives and Website

Presented by Currie. The committee has approved combining Archives and Website. Will be scanning items in file cabinets – plan on getting better equipment to speed it up. Looking to see if library will hold the items. Bannerman is running the JAM website, and will be linking information between JAM and ESM pages.

Holliday – MB archives may be a better place for the material. Doesn't trust the UM library will keep the files safe.

Currie – The UM library does have an archives programme, but can check with MB archives. Also, all members encouraged to provide interesting photos for archives.

Rochon – Has gone through this process in AB. When moving files, the order is important. They don't want anything rearranged, as the sorting order can also provide information. May not want the materials if sorting has occurred.

Gavloski – Photos and articles are important for preserving the society's heritage.

Appendix K – Common Names

Presented by Galloway. Changes were made on the ESC common names database regarding changing the Order name Homoptera to Hemiptera. Common names for *Bombus* spp. are to be added. The common name for *Rhopalosiphum padi* differs between the ESC and ESA common names databases, but no decision regarding updating this has been made.

Appendix L – Scholarship and Awards

Presented by Westwood.

Currie – We couldn't find the names of previous poster and paper winners. Have been lost from the Proceedings over several years. Need to find a new place for them.

Westwood – The Awards committee isn't associated with other committees, but the names could be forwarded.

Currie – Easier to find them in Awards section.

Holliday – The names should be in the newsletter.

Bannerman – Yes, they will be. Will add that the names be forwarded to Awards committee in the instructional package for judges.

Currie – They should go on the website as well.

Lamb – Will forward the photos of the winners to M. Smith.

Appendix M – Fundraising

Presented by Gavloski. Will be preparing a letter of thanks for Gosselin.

Appendix N – Scientific Programme

Presented by Costamanga. There were three out-of-province and two within-province keynote speakers. A very successful event. Thanks go out to Jordan, Ahmed, and all the volunteers.

Cano – about 55 attendees this year.

Gavloski – Thank you on behalf of the society.

Appendix O – Membership

Presented by Currie. Technical difficulties prevented Vanderwel from providing specific numbers (computer issue) but she estimates 101 members at present. Cano will be working with Bannerman to take on membership responsibilities.

MacKay – Membership list should be updated once a year, with the list sent to the newsletter. Could the names be posted on the ESM website? Organize some way to send to members?

Bannerman – We do maintain a membership list.

M. Smith – A list of members has to be separate from the newsletter to be allowed.

Holliday – Who will hold the definitive list?

Westwood – Should be the secretary that holds the list.

M. Smith and Holliday – Reminder that correspondence to membership must be through bcc.

Semmler – Aware of privacy rules for email communication. Must use bcc when sending mass emails to membership.
Bannerman – Direct all membership lists to Semmler.

6 **Election Results**

Presented by Semmler.

President ElectMahmood Iranpour

Member-at-large.....Megan Colwell

Motion: to destroy the ballots - MacKay/HollidayCarried

7 **New Business**

There was no new business to discuss.

8 **Moment of Silence for Deceased Members This Year**

There was a moment of silence for H. Glenn Wylie and George H. Gerber.

9 **Transfer of Office** –Paul Fields to John Gavloski.

10 **Other Business**

MacKay – Propose that ESM fund an ESM Meets the Board mixer at the MacKay-Lamb residence during the 2017 JAM. ESC board would be the honoured guests. Could hold it on Saturday night. ESM would need to give permission to hold the expanded mixer, and the ESC board would need to be invited.

Holliday – There’s usually already a dinner on Saturday. The board has a strategic plan meeting on Friday so would be available.

MacKay – Board had come after Saturday dinner in the past. Could do that as well.

Holliday – Last dinner took quite a while...maybe?

Motion: The ESM will host a mixer for members to meet the ESC board at the home of MacKay and Lamb at a time agreeable to the board.

MacKay/Currie.....Carried

Vote: All voted in favour of the motion.

Costamanga – Thanks to MacKay and Lamb for once again hosting the Meet the Speakers mixer.

11 **Adjournment** – 1:03 p.m.

Motion: to adjourn the meeting - Lamb/ColwellCarried

APPENDIX A

**The Entomological Society of Manitoba, Inc.
Agenda of the Entomological Society of Manitoba
72nd Annual Business Meeting**

29 October 2016

1. Acceptance of Agenda
2. Acceptance of the Minutes of the Last Annual Meeting (1 November 2015)
3. Business Arising from the Minutes
4. Reports – Executive
 - President** – Paul Fields (John Gavloski)
 - Treasurer** – Kathy Cano
 - Regional Director to the ESC** – Rob Currie
 - Editor of the *Proceedings*** – Terry Galloway
 - Endowment Fund Board** – Kathy Cano
5. Reports – Committees
 - Finance** – Kathy Cano
 - Publicity/Newsletter** – Marjorie Smith/Jordan Bannerman
 - Social** – Lisa Capar
 - Youth Encouragement/Public Education** – Arash Kheirodin
 - Archives** – Rob Currie
 - Common Names** – Terry Galloway
 - Scholarship and Awards** – Richard Westwood
 - Fund-Raising** – Joel Gosselin (John Gavloski)
 - Scientific Programme** – Alejandro Costamagna
 - Membership** – Désirée Vanderwel (Rob Currie)
 - Web Page** – Rob Currie
6. Election Results – Scrutineer, Colin Demianyk (Sarah Semmler)
7. New Business – Pat MacKay
8. Moment of Silence for Deceased Members This Year
 - a. H. Glenn Wylie
 - b. George H. Gerber
9. Transfer of Office
10. Other Business
11. Adjournment

APPENDIX B

Entomological Society of Manitoba President's Report – Annual Business Meeting 29 October 2016

President's Report – Annual Business Meeting 29 October, 2016

Thank you to all the members of the Executive, the trustees and all the volunteers that helped with the running of the ESM this year. A special word of thanks goes out to David Wade, our Secretary who is stepping down after several years. He will be replaced by Sarah Semmler. Joel Gosselin is stepping down as Fund Raising Chair after serving in this position for as long as I can remember. Joel's work over the years has enabled the society to bring in outside speakers to our AGM. The society appreciates your years of service.

The Executive met three times during the 2015/16. There were several issues discussed: the 2016 ESM Scientific meeting organized by Ale Costamagna: the 2017 ESC-ESM JAM with Rhéal Lafrenière as General Chair and Paul Fields as Scientific Chair. The meeting will be held at the Winnipeg Fairmont from 22-25 October, 2017. The key symposia have been selected and full details of the meeting are available at the meeting website. The changes to the bylaws were discussed but further consultation is needed before putting the final text to the membership. These will be finalized and sent out by mail with the Newsletter. The Archivist and Web Page Committees have been combined.

The finances of the Society are solid, the membership numbers stable, the scientific meeting is well attended, the ESM continues to be a vibrant part of entomology in Manitoba and Canada.

Paul Fields
President, Entomological Society of Manitoba

APPENDIX C

Report of the Treasurer ENTOMOLOGICAL SOCIETY OF MANITOBA

Financial Statements
Year Ended August 31, 2016

Note: These Financial Statements have not been audited. The Accounts, Bank Statements and Receipts were provided by the Treasurer and will be reviewed by the incoming President in November.

Treasurer: Kathy Cano
Date: 29 October 2016

ENTOMOLOGICAL SOCIETY OF MANITOBA INC.
Statement of Financial Position August 31, 2016

	<u>2016</u>	<u>2015</u>
ASSETS CURRENT		
Cash	\$ 10,229	6,145
Money market fund	<u>3,761</u>	<u>3,755</u>
	13,990	9,900
TERM DEPOSITS	\$ <u>45,000</u>	\$ <u>45,000</u>
	\$ <u>58,990</u>	\$ <u>54,900</u>
 LIABILITIES		
CURRENT	\$ NIL	\$ NIL
 NET ASSETS		
Unrestricted net assets	13,990	9,900
Internally restricted	<u>45,000</u>	<u>45,000</u>
	\$ <u>58,990</u>	\$ <u>54,900</u>

ENTOMOLOGICAL SOCIETY OF MANITOBA INC.
Statement of Financial Position
August 31, 2016

	2016	2015
REVENUES		
Annual meeting	\$ 1,130	900
Donations	1,550	1,616
ESC	4,000	
Interest income	909	984
Membership fees	1,250	1,564
Miscellaneous	81	82
Proceedings	75	82
Youth Encouragement & Public Education	<u>0</u>	<u>425</u>
	<u>\$ 8,995</u>	<u>5,653</u>
EXPENDITURES		
Awards and scholarships	1,600	2,600
Donations	0	0
General	192	362
Meetings	930	1,868
ESC/ESM	1,500	0
Newsletter	0	0
Proceedings	0	651
Social committee	190	307
Youth Encouragement & Public Education	<u>107</u>	<u>0</u>
	<u>4,519</u>	<u>5,788</u>
EXCESS (DEFICIENCY) OF REVENUES OVER EXPENDITURES	<u>\$ 4,476</u>	<u>(135)</u>

ENTOMOLOGICAL SOCIETY OF MANITOBA INC.
Statement of Financial Position
August 31, 2016

	<u>Unrestricted</u> <u>net assets</u>	<u>Internally</u> <u>restricted</u>	2016	2015
NET ASSETS – BEGINNING OF YEAR	\$9,900	\$45,000	\$55,034	\$55,034
Excess of revenues over expenditures	4,476		4,476	(135)
Fund transfer	0	0	-	-
NET ASSETS – END OF YEAR	<u>\$13,990</u>	<u>\$45,000</u>	<u>\$58,990</u>	<u>\$54,900</u>

APPENDIX D

Entomological Society of Manitoba Report of the ESC Regional Director

Rob Currie was nominated for the position of regional director to act as a replacement for Barb Sharanowski and has been appointed by ESC to serve until 2017 (the remainder of Barb's term). The Annual Meeting of the Entomological Society of Canada was held in conjunction with ESA and ICE in Orlando in September 2016. The conference was well attended with a record number of 6,682 delegates from 102 countries and 5,396 presentations. An insect expo was attended by over 2,500 children.

The current President is Neil Holliday. The next meeting of the ESC will be held in Winnipeg with Paul Fields as the Scientific Programme Committee Chair and Rhéal Lafrenière as the local arrangements chair. The new Winnipeg-based management committee, Straus, is now in place and among other duties they will assist in some components of running the AGM.

The board is encouraging all members of local societies to consider membership and check to see if their membership has lapsed. Methods to attract and retain new members are being considered.

Rob Currie
Regional Director

APPENDIX E

Entomological Society of Manitoba Report of the *Proceedings* Editor

Volume 71 (2015) of the *Proceedings of the Entomological Society of Manitoba* was produced exclusively in electronic format again this year. It has been sent to all members of the ESM and posted on the ESM website. Printed, unbound copies will be sent to members of the society who do not have e-mail. Volume 71 exceeded the length of last year's issue by 14 pages, consisting of 73 pages, with two obituaries, two Scientific Papers, the abstracts from the Annual Meeting of the Entomological Society of Manitoba held at the Freshwater Institute and in the Department of Entomology on 23–24 October, 2015, and the Minutes of the 71st Annual Business Meeting of the Entomological Society of Manitoba held on 24 October, in the Department of Entomology.

Scientific Notes as well as full Scientific Papers are welcome. I think the *Proceedings* is an excellent place to publish new distribution records and faunal lists for insects and related arthropods in Manitoba. All submitted manuscripts are peer-reviewed; all published papers are available as PDF reprints on the web. Thanks very much to Rob Currie who posts the *Proceedings* so efficiently. Issues of the *Proceedings* are fully accessible using on-line search engines. There are no page charges to authors for published manuscripts, and with our electronic format, colour images can be included in manuscript, and there should be no practical limits on manuscript length. All issues of the *Proceedings* are freely available to entomologists around the world, so if you have a manuscript of relevance to entomology in Manitoba, or if you are just looking for a place for that outstanding manuscript on your desk, I encourage you to consider submitting it to the *Proceedings*.

Terry Galloway
Proceedings Editor

APPENDIX F

ENTOMOLOGICAL SOCIETY OF MANITOBA Report of the Endowment Fund Board for 2015-2016

A summary of investments and projected interest income for the fiscal year is attached below (Table 1). Interest generated by the Endowment Fund provides a basis for funding the Society activities. The Endowment Fund principal was \$45,000.

Kathy Cano, Chair

Endowment Fund Guaranteed Investment Certificates

Table 1: Account information as of August 31, 2016. Interest generated during the 2015-2016 fiscal year.

Certificate No.	Principal	Interest Rate (%)	Maturity Date (Purchase Date)	Annual Interest
900055611-0014	9,000.00	1.85	Nov 16, 2016 (Nov 16, 2011)	166.50
900055611-0015	9,000.00	2.05	Nov 9, 2017 (Nov 9 2012)	184.50
900055611-0016	9,000.00	2.10	Dec 12, 2019 (Dec 12 2012)	189.00
900055611-0017	9,000.00	2.00	Nov 17, 2019 (Nov 17, 2014)	180.00
900055611-0018	9,000.00	2.00	Nov 19, 2020 (Nov 19, 2015)	180.00
Total	\$45,000.00			\$900.00

APPENDIX G

ENTOMOLOGICAL SOCIETY OF MANITOBA Report of the Finance Committee for 2014-2015

The Finance committee will be meeting in November 2016. The financial statement and the budgets for the current and next fiscal years are attached. The Society continues to be in good financial shape.

Kathy Cano, Chair

Income and expenses for fiscal year ending 31 August 2015

BUDGET ITEMS	2013-2014	2014-2015	2015-2016	2016-2017
REVISED 31 August 2015	Actual	Actual	Actual and Projected	Projected
ASSETS				
Cash	7,294	6,145	7,500	7,500
Money Market fund	3,740	3,755	3,500	3,500
TOTAL (Cash + Money Market Fund)	11,034	9,900	11,000	11,000
Term Deposits (Endowment fund)	44,000	45,000	45,000	45,000
NET ASSETS (Cash+ Money Market fund + Term)	55,034	54,900	56,000	56,000
REVENUE				
Membership Fees	1,554	1,564	1,500	1,500
Proceedings	152	100	100	100
Social Committee	0	0	0	0
Youth Encouragement & Public Education Committee	70	425	500	500
Donations	1,600	1,616	1,600	1,600
Meetings: ESM/AGM	845	900	800	800
Interest income:	991	984	1,100	1,100
Miscellaneous	68	82	500	500
TOTALS	5,280	5,653	6,100	6,100

EXPENSES				
General Society Expenses	395	362	1,000	1,000
Proceedings	969	651	500	500
Newsletter	385	0	100	100
Social Committee	191	307	200	200
Youth Encouragement & Public Education Committee	0	0	200	200
Fundraising Committee	0	0	0	0
Student Awards and Scholarships	1,500	2,600	1,500	1,500
Meetings: ESM/AGM	2,025	1,868	1,700	1,700
Donations	0	0	0	0
Representation at ESC	0	0	600	600
TOTALS	5,465	5,788	5,800	5,800
Net gain (loss), year ending Aug. 31	(185)	(135)	300	300

APPENDIX H

Entomological Society of Manitoba Report of the Newsletter Committee

The Newsletter Committee produced two issues of Volume 42 of the ESM Newsletter in the past fiscal year. Issue 42.1 was published in January 2016, and issue 42.2/3 in September 2016. The issues were distributed via e-mail. Three members who have not provided an e-mail address received their Newsletter by regular mail. These issues were mailed through the Department of Entomology.

The budget of the ESM Newsletter committee is expected to be minimal in future fiscal years due to the use of e-mail to distribute issues.

Thank you to those members who have contributed articles to the Newsletter. We encourage all ESM Members to contribute items of interest to the membership.

Marjorie Smith
Jordan Bannerman
Co-Editors, ESM Newsletter Committee

APPENDIX I

Entomological Society of Manitoba Report of the Social Committee

On April 27th, this year's ESM New Members Social luncheon was held at Richmond Kings Community Centre on Silverstone Ave in Winnipeg. We tried a new format this year of ordering pizza followed by a presentation. There was a large turnout of 31 ESM members in attendance. New Members present at the luncheon were: Derek Micholson and Thais Silva. New members unable to attend were: Alison Tayler (Partridge) and Roman Kryuchkov.

After our pizza lunch, Terry Galloway gave a talk entitled "What's eating you? The 40-year spin-off as a veterinary entomologist" based on all his interesting experiences and adventures as an entomologist before his retirement. Terry shared several photographs and stories about small organisms that like to find their way onto or into mammals, including humans.

Thank you to the presenters and all those that attended. If anyone has any ideas for future ESM social events, please let someone on the ESM committee know.

Discounts were given to students and new members attending this year’s New Members Social. Students and new members had free lunches, all others paid \$10 for pizza and pop. I will be stepping down as Social Committee this year. Is anyone interested in filling the position?

Lisa Capar
Chair, Social Committee

APPENDIX J

Entomological Society of Manitoba Youth Encouragement and Public Education Committee

For another year, the Youth Encouragement Programme has delivered off-campus presentations and visits to U of M's Department of Entomology to increase the general public's understanding of insects. With the help from students in the Department, this year we achieved an outreach of more than 1,500 people throughout different events. Collaboration with the Manitoba Conservation Districts Association for the annual Water Day Festival events drew great attention from the public and the media including CBC, CJOB and Global News Winnipeg.

Youth Encouragement activities 2015-2016

Date	Presenter(s)	Event	Audience
September 25, 2015	Cole Robson and Arash Kheirodin	Visit to Neil Campbell School	55
October 26, 2015	Miles Zhang	Presentation Nature Manitoba	10
February 06, 2016	-	Specimen loan	-
March 04, 2016	Aldo Rios & Arash Kheirodin	International Baccalaureate “Great Escape”	22
March 29, 2016	Megan Colwell	Water festival @ St. Vital Centre	~1,000
April 27, 2016	Arash Kheirodin & Aldo Rios	English Ukrainian Bilingual Language Camp	47
May 07, 2016	-	Specimen Loan - Science Rendezvous	~400
August 04, 2016	Arash Kheirodin & Aldo Rios	Panda Bear Daycare	42
September 05, 2016	Tharshi Nagalingam	Univillage preschool and infant centre	40
Upcoming Activities:			
TBA	Arash Kheirodin	Student visit to the Department’s Museum and insect room	45
Total outreach - ~1,616			

Arash Kheirodin, Chair, Youth Encouragement and Public Education Committee

APPENDIX K

Entomological Society of Manitoba Report of the Common Names Committee

Two requests came to the committee in 2015-2016, both from John Gavloski.

- 1) In the ESC list of common names, Homoptera was still being used, rather than the more currently accepted, Hemiptera. This discrepancy was reported to the chair of the ESC Common Names Committee. Changes have been made to the ESC list.
- 2) John also pointed out that there were no common names for *Bombus* spp. in the ESC list. This observation was forwarded to Laurence Packer, who directed the request to Sheila Colla, a bumble bee expert, and to Hume Douglas, chair of the ESC Common Names Committee. Common names for bumble bees generally follow those proposed by Liz Day in the Bumblebees of North America (2014), and these common names will be entered into the ESC list.

Terry Galloway, Chair
Common Names Committee

APPENDIX L

Entomological Society of Manitoba Report of the ESM Student Awards and ESM Scholarship Committee

Student Achievement Award: Awarded to a student who is in a Bachelor's degree programme or recently completed a programme. This award recognizes students who have shown exceptional interest in entomology as evidenced by their insect collections, insect photography, published articles of entomological interest, insect experiments and/or outstanding contributions during summer employment.

This year's winner of the Entomological Society of Manitoba Student Achievement award is Mr. Justis Henault, a fourth undergraduate Honours student in the Dept. of Biology at the University of Winnipeg. Justis has worked for several summers assisting graduate students on insect related research projects in both forest and prairie ecosystems as a summer technician. Justis has shown an exceptional interest in entomology through developing a collection and a special interest in taxonomy. He has an excellent academic record and intends to pursue graduate studies in Entomology.

Orkin Student Award: This award is designed to foster and encourage student interest in general Entomology including natural methods of insect pest control and the proper use of insecticides. Candidates must have a demonstrated interest in entomology, superior scholastic ability, high research potential, originality and industriousness in their university courses and/or summer work.

This year's winner of the Orkin award is Ms. Crystal Almdal. Crystal is a Bachelor of Science, Biological Sciences Major (Co-op Option), with a major Concentration in Ecology and Environmental Biology and a Minor in Entomology. Crystal has worked both as a summer technician and part time during the school year in the Dept. of Entomology at the University of Manitoba on various entomology projects including research on flea beetle management. In addition to maintaining excellent academic standards in her studies, Crystal has been a teaching assistant and has been involved in other activities within the Department.

The ESM Graduate Scholarship: This scholarship is awarded to students in a M.Sc. or Ph.D. programme related to entomology at the University of Manitoba, University of Winnipeg or University of Brandon. Students must be enrolled in their graduate programme for at least 12 months prior to Oct 1 of the award year. This award recognizes superior scholastic ability, high research potential as evidenced by industriousness, good judgment, originality, a conscientious attitude and organizational ability, and excellent communication skills.

The 2016 Scholarship winners are:

Ms. Jesse Rodgers. Jesse is enrolled as a MSc. candidate in the Department of Biology in the Bioscience and Technology Programme at the University of Winnipeg and is supervised by Mr. W. Watkins and Dr. R. Westwood. Jesse received her B.Sc. in Biology from the University of Winnipeg in 2015. Jesse's M.Sc. research focuses on the impact of livestock grazing on the vegetative and insect diversity of alvar habitats in central Manitoba. Jesse is investigating the diversity of Lepidoptera in grazed and grazed sites in relation to vegetative and edaphic factors.

Mr. Arash Kheirodin. Arash is enrolled as a Ph.D. candidate in the Department of Entomology at the University of Manitoba and is being supervised by Drs A. Costamagna and H. Cárcamo. Arash received his B.Sc. in Plant Protection from the University of Mazandaran in Iran and his M.Sc. from Gorgan Agricultural University in Iran. Arash's Ph.D. research focuses on the effect of agricultural landscape structure on the abundance of cereal leaf beetle and its natural enemies. Arash is investigating the role of features in the landscape that govern the effectiveness and abundance of cereal leaf beetle parasitoids and predators.

Désirée Vanderwel, Lara Toews, Taz Stuart and Joel Gosslin
Richard Westwood, Chair, October 28, 2016.

APPENDIX M

Entomological Society of Manitoba Fundraising Committee

The Fundraising Committee raised a total of \$1,350.00 from 11 donors to cover some of the costs of the AGM, such as bringing in the speakers from out of town. Orkin PCO Services provided an additional \$200 for the Orkin Student Award.

The Fundraising Committee acknowledges the continued support of our sponsors in making the AGM successful in providing quality speakers for this very educational event.

The Fundraising Committee would appreciate leads from its members for parties who are using the valuable services entomologists provide, so the Committee could solicit them for financial support.

Joel Gosselin, Chair,
Fundraising Committee

APPENDIX N

Entomological Society of Manitoba Report of the Scientific Programme Committee

The 72nd Annual Meeting of the Entomological Society of Manitoba was held in Winnipeg MB at the Freshwater Institute, Fisheries and Oceans Canada on 28 October, 2016 and in Room 219, Department of Entomology, University of Manitoba on 29 October, 2016. The theme of the meeting was “Harnessing the benefits of natural enemies in agroecosystems”. The invited speakers were:

Keynote Speaker:

Impacts of land use change on insect food webs: implications for conservation and agriculture. **Tatyana Rand**, USDA-ARS Northern Plains, Agricultural Research Laboratory, Sydney, MT, USA.

Saturday Symposium:

- Biological control of Prairie crop pests with parasitoids; and predators? **Héctor Cárcamo**, Lethbridge Research and Development Centre, Agriculture and Agri-Food Canada, AB, Canada.
- Finding dinner by sight or scent: studies of sensory cue use by predatory insects. **Neil Holliday**, Department of Entomology, University of Manitoba, Winnipeg, MB, Canada.
- The story of the cereal aphid dynamic action threshold (DAT) project. **Tyler Wist**, Saskatoon Research and Development Centre, Agriculture and Agri-Food Canada, Saskatoon, SK, Canada.

- Two steps forward, one step back: challenges for IPM in Prairie agriculture.
John Gavloski, Manitoba Agriculture, Carman, MB, Canada.

There was a full programme with: 1 keynote talk, 4 symposium papers, 14 submitted oral papers, 6 submitted posters (4 student competition entries), 8 student oral papers (7 in the student competition). The best paper competition winner was **Jesse Rodgers** with her talk “The effects of livestock grazing on the diversity of Lepidoptera in imperiled alvar sites in Manitoba’s Interlake”. The best poster competition winner was **Thais Silva Guimarães** with her poster “Landscape effects on flea beetles in the Canadian prairies”.

The meeting organizers thank our generous sponsors for their support: *Abell Pest Control, Inc., Bayer Cropscience Canada Co., Canadian Centre for Mosquito Management, Canadian Grain Commission, Canola Council of Canada, City of Winnipeg Insect Control Branch, Dow Agro Sciences Canada, Inc., Gilles Lambert Pest Control, Metro Pest Control, North South Consultants, Orkin PCO Services and Poulin’s Pest Control.*

There were 54 paid attendees, of whom 37 were regular registrations (one was a one day registration), and 17 were student registrations. A total of \$1,550 was received in donations and \$825 in registration fees were generated from the meeting. As in other years, the ESM Annual General Meeting was held after the symposium on the Saturday and the mixer was held at Pat McKay and Bob Lamb’s house on the Friday evening.

Submitted with respect and honour:

Chair: Alejandro Costamagna

Past Chair: Steve Whyard

Members: Ahmed Abdelghany, Jordan Bannerman

Fund Raising: Joel Gosselin

Social/Refreshments: Ahmed Abdelghany

Venue: Cheryl Podemski

Registration: Kathy Cano, Sheila Wolfe

APPENDIX O

Entomological Society of Manitoba Report of the ESM Membership Committee

No written report. A verbal report was given by Rob Currie.

APPENDIX P

Entomological Society of Manitoba Web Site Report

The Entomological Society of Manitoba operates a website that is currently hosted through the public access portion of Paul Field's personal University of Manitoba web page. The website contains information about the Society and its committees, dates of meetings, programmes for meetings, and provides links to other sources of entomological resources on the web. This year links have been added to integrate with the Entomological Society of Canada and ESM Joint annual meeting and those components are being managed by Jordan Bannerman.

The ESM site is currently kept up to date with regular updates of newsletters, proceedings, reprints of papers from the proceedings and announcements for the annual general meeting. Copies of all issues of the Proceedings of the Entomological Society of Manitoba and the former journal the "Manitoba Entomologist", and the historical publication of the ESC, "Entomologists of Manitoba" can now be found on the site. A major redesign of the look and organization of the site was done by Jonathan Veilleux in 2011. Discussion continues with respect to converting the website to a more "mobile friendly" platform but changes were not implemented in the past year.

The website committee and archivist committee have been officially merged. Much archival material is already scanned and available on the site. Files of the former archive have been located and material of interest will be documented and some scanned and added to the web site in the future in public or private areas.

Any suggestions for additions or changes to the website should be forwarded to Rob Currie, Department of Entomology, University of Manitoba (rob_currie@UManitoba.ca).

Rob Currie, ESM Webmaster

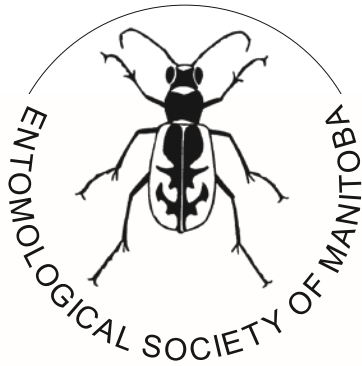
APPENDIX Q

Entomological Society of Manitoba Election Report

Elections closed October 2, 2016 for the Entomological Society of Manitoba offices of President-Elect and Member-at-Large. The successful candidate for President-Elect is **Mahmood Iranpour**, for Member-at-Large is **Megan Colwell**. We thank all candidates for their willingness to participate in the election. Formal announcement and commencement of terms will be at and after the ESM Annual Business Meeting, respectively.

Colin Demianyk, Chair, Scrutineer Committee

Noel White, Witness



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