

# 2014 CAPA Research Activities

## Prepared by:

Dr. Leonard Foster (Chair of the Research Committee)

Dr. Medhat Nasr (CAPA – President)

This is a list of research projects that are currently conducted by CAPA members across Canada. There are other researchers who are working on research projects related to bees but are not active members in CAPA. CAPA does not have access to these projects. CAPA Executives and the Chair of the research committee would like to acknowledge all researchers who contributed to this list and have been serving the beekeeping industry across Canada.

## A. Bee Health and Pest Management:

### 1. **Project Title: Next generation integrated pest management for beekeeping (2011-2014)**

**Researchers:** Leonard Foster, University of British Columbia (UBC) (PI); Stephen Pernal, AAFC AG (CO-PI); Rob Currie (Univ. of Manitoba), Katherine Baylis (Univ. of Illinois), Eric Jan (UBC), Ashebar Sewalem (AAFC), Marta Guarna (UBC), A. Melathopoulos (AAFC), Shelley Hoover (PDF-Breeding), Heather Higo (Langley, BC), Elizabeth Huxter (Grand Forks, BC), M. Bixby (PDF-Econ.)

**Objectives:** 1) To demonstrate the utility of using proteomic-based marker-assisted selection (MAS) to increase pathogen and mite- resistance in bee stocks, 2) To evaluate new RNAi reagents for controlling bee pathogens and parasites, and 3) To develop an economic model of current beekeeping management and production practices against which to evaluate the impacts of 'omic-based disease and pest management technologies

**Funding Sources:** Genome Canada; Genome BC; Genome AB (Cash); AAFC, UBC, USDA, U. Manitoba, BCHPA, and BC Blueberry Council.

### 2. **Project Title: Honey bee health sustainability: Developing alternative tools for an IPM for varroa and nosema (2014-2018)**

**Researchers:** Medhat Nasr (PI), Andrew Kiddy

**Objectives:** 1) Testing alternative synthetic acaricides for Varroa control, 2) Evaluate best management systems and treatments for Nosema treatment, and 3) Develop Varroa and virus best management systems for Alberta beekeepers

**Funding Sources:** Alberta Crop Industry Fund, Bee Maid, Beekeepers Commission of Alberta, Alberta Agriculture and Rural Development, and University of Alberta.

**3. Project Title: Honey bee health: Management of varroa mites and viruses (2014-2017)**

**Researchers:** Graham Parsons (SK Tech Adaptation Team) (PI), Medhat Nasr (CO-PI) (Alberta Agriculture and Rural Development), Rob Currie (University of Manitoba) (CO-PI), Stephen Martin (University of Salford - UK) (CO-PI)

**Objectives:** 1) Testing of new synthetic acaricides, 2) Testing of the DWV strain differences in colonies differently infected and treated for Varroa, 3) Varroa and virus levels in relation to different timing of Varroa treatment, and 4) Replacement of colonies with nucleus colonies and their performance differences due to size, season and type of varroa treatment.

**Funding Sources:** SK- Ministry of Agriculture - Growing Forward 2, Alberta Agriculture and Rural Development, University of Manitoba, University of Salford (UK), SK Beekeepers and Beekeepers Commission of Alberta

**4. Project Title: Honey Bee Health Surveillance in Canada (2014-2018)**

**Researchers:** Pernal, S (AAFC) and Castillo, C (Grande Prairie Regional College) (co-PI's)

**Objectives:** 1) Conduct a national survey to determine the incidence and distribution of the endemic pests, pathogens and parasites affecting honey bee stock, and 2) Provide surveillance for exotic organisms that constitute potential threats to the beekeeping industry.

**Funding Sources:** AAFC Agri-Marketing: Assurance Systems with Beekeeper Commission of Alberta as Applicants; Cash funding provided by Beekeepers Commission of Alberta, Manitoba Beekeepers, CropLife Canada and Syngenta Canada.

**5. Project Title: Health of Bee Pollinators in Canadian Agriculture (2014-2018)**

**Researchers:** Pernal S (AAFC) (PI), Cardinal S and Javorek S (AAFC), Currie R (U Manitoba), Hoover S (Alberta Agriculture and Rural Development)

**Objectives:** 1) Determine which of the multiple stressors identified as impacting bee health are the key determinants of honey bee survival in Canada, 2) Determine levels of agricultural pesticides associated with pollen collected by managed and native bee species, 3) Examine factors affecting honey bee viral transfer on comb and develop mitigation techniques, 4) Determine the interactive effects of landscape pattern, pesticide use, pathogen and gut microbiota on native bee abundance and species diversity in agricultural landscapes, 5) Benchmark the status of native bees in key agricultural systems in Canada, 6) Determine spill-over and phylogenetic associations of pathogens among honey bees and native bee species.

**Funding Sources:** AAFC Project Proposal Grant.

**6. Project Title: Development of designed drugs for bee viruses' treatment**

**Researchers:** Medhat Nasr (CO-PI); Michael James (CO-PI)

**Objectives:** 1) Develop effective RNAi based designed novel treatments for bee viruses, 2) Determine best system for integration of RNAi to field pest management systems, and 3) Evaluate field management recommendations for the use of RNAi

**Funding Sources:** Alberta Agriculture and Rural Development – GF2

**7. Project Title: Pre/probiotics to manage and prevent bee diseases**

**Researchers:** Shelley Hoover (Alberta Agriculture and Rural Development) (PI), Danica Baines (AAFC)

**Objectives:** 1) Develop cell lines of honey and leafcutter bees, 2) Challenge cells / pupae with pathogens, and 3) Evaluate pre/probiotics to enhance bee health

**Funding Sources:** Alberta Agriculture and Rural Development- GFII

**8. Project Title: Developing biosecurity field management practices for bee viral and nosema diseases in Alberta**

**Researchers:** Medhat Nasr (PI) (Alberta Agriculture and Rural Development), Ernesto Guzman (University of Guelph)

**Objectives:** 1) Identification and prevalence of bee viruses in commercial operations relevant to Varroa, 2) Assessment of the relative importance of sources and risk factors of infection, and 3) Development of a biosecurity outreach program to deliver research findings to beekeepers

**Funding Sources:** Alberta Agriculture and Rural Development –GF2

**9. Project Title: Bee Probio: Stratégie durable optimisant la santé des Abeilles mellifères / Bee Probio: Improving honey bee health with probiotics (2014-2016)**

**Researchers:** Pierre Giovenazzo (Centre de recherche en sciences animales de Deschambault) and Nicolas Derome (Université Laval)

**Research collaboration:** Pernal S (AAFC)

**Objectives:** To test efficiency of probiotic nutritional supplements on honey bee resistance to various pathogens.

**Funding Sources:** AAFC Agri-Science Project

**10. Project Title: Ozone disinfection of honey bee hive equipment**

**Researchers:** Les Eccles (PI), Ontario Bee Tech Transfer Program and Parker-Bee Apiaries

**Objectives:** 1) Testing the application of Ozone on dead-outs to see if the level of pesticides and nosema are decreased, and 2) To determine if bees introduced into disinfected equipment are productive.

**Funding Source:** Ontario Farm Innovation Program (OFIP)

**11. Project Title: The Small hive beetle (*Aethina tumida* Murray, Coleoptera : Nitidulidae) : surveillance and control (2012- 2015)**

**Researchers :** Pierre Giovenazzo (PI) (Centre de recherche en sciences animales de Deschambault)

**Objectives:** 1) To study propagation of the small hive beetle populations in southern Québec, and 2) To evaluate if quarantine and eradication are effective procedures to control the small hive beetle. .

**Funding Sources:** Ministère de l'agriculture des pêcheries et de l'alimentation du Québec et Centre de recherche en sciences animales de Deschambault

**12. Project Title: Developing a diagnostic assay for Africanized honey bees (AHB) and establishing a baseline dataset on the genetics of Canadian Honey Bees (2013-2014)**

**Researchers:** Amro Zayed, PhD (York University), Brock Harpur (All from York University)

**Objectives:** 1) Provide a proof-of-concept dataset showing that AHBs can be readily distinguished from European bees and managed bees in Canada using a small number of DNA markers, 2) Conduct a large-scale study of the genetics of Canadian bee stocks by genotyping 1,000 workers from across Canada at 96 DNA markers that can accurately identify European and African ancestry to provide the baseline genetics of Canadian honey bees, and 3) Develop a cost-effective and accurate diagnostic assay for AHBs.

**Funding Sources:** Canadian Bee Research Fund

**13. Project Title: Maintaining Healthy Honey Bees: Addressing Saskatchewan's Winter and Pest Challenges (2012-2014)**

**Researchers:** Graham Parsons (SK Tech Adaptation Team)

**Objectives:** 1) Evaluate the importance of timing and acaricide treatment type on the health, pest control and overwintering ability of honey bees

**Funding Sources:** Canadian Agriculture Adaptation Program (CAAP), Saskatchewan Beekeepers Association, Saskatchewan Beekeepers Development Commission

## **B. Bee Pollination**

**1. Project Title: Maximizing the value of bee pollination services delivered to canola in Alberta (2014-2017)**

**Researchers:** Shelley Hoover (PI) (Alberta Agriculture and Rural Development), Pernal S (AAFC) and Carter R (University of Calgary)

**Objectives:** 1) Examining the relationship between yield and bee abundance in seed and commodity canola, and 2) Determination of relative contributions of wind versus insect pollinators in commodity canola, 3) Evaluation of honey and leafcutter bee health in canola pollination versus alfalfa seed / honey production, and 4) Determination of differences between managing bees in singles versus doubles in pollination fields

**Funding Sources:** Alberta Crop Industry Fund, Canadian Bee Research Fund, Beekeepers Commission of Alberta, Alfalfa Seed Commission - Alberta, Canadian Canola Council

## C. Basic Biology and Genetics

### 1. Project Title: Genomic studies of complex behaviour: honey bee genes, behaviour, and adaptation (2010-2015)

**Researchers:** Amro Zayed, (PI), Brock Harpur, Nadia Tsvetkov, Daria Molodtsova, Alivia Dey (All from York University)

**Objectives:** 1) To determine how genetic variation affects physiology and brain gene expression to regulate behavior, B) To find changes in worker behaviour affect colony fitness, and C) To discover how genes controlling behaviour evolve

**Funding Sources:** NSERC Discovery Grant and Ontario Ministry of Research and Innovation.

### 2. Project Title: Honey bee stock evaluation, reproduction and genetic selection (2010-2014).

**Researchers:** Pierre Giovenazzo (Centre de recherche en sciences animales de Deschambault)

**Objectives:** 1) To scientifically evaluate and compare zootechnical performances of selected honey bee stock (Buckfast, VSH and Québec local); 2) To develop a breeding program aiming for a constant amelioration of the zootechnical performances of honey bee stock available in Québec via its Queen breeders. Inbreeding and character concentration will be insured by isolated reproduction and artificial insemination; and 3) To establish a provincial redistribution and an in situ evaluation of the selected honey bee stock with the collaboration of the CRSAD, the Quebec Queen breeders and the Québec Apiculturists.

**Funding Sources:** Conseil pour le développement de l'agriculture du Québec et Centre de recherche en sciences animales de Deschambault

### 3. Project Project Title : Optimisation de la sélection et de la production des faux-bourçons Optimizing drone selection and production (2012-2014)

**Researchers:** Pierre Giovenazzo (Centre de recherche en sciences animales de Deschambault) (PI), Andrée Rousseau

**Objectives:** 1) To measure the impact of various environmental factors on drone fertility.

**Funding Sources:** Programme canadien d'adaptation agricole and Centre de recherche en sciences animales de Deschambault

**4. Project Title: Saskatchewan Honey Bee Queen Quality: A Survey of Mating Success and Vitality (2012-2014)**

**Researchers:** Graham Parsons, (SK)

**Objectives:** 1) Assess the mating success and viability of the mating of queens by surveying Saskatchewan and imported queens, 2) Test the collected queens with their attendant workers for tracheal mites (*Acarapis woodii*) and *Nosema* spp. (*N. apis* and *N. ceranae*), known parasites of honey bees, and 3) Provide information on the colonies where the queens are collected, as well as information on queens as a source of disease transmission.

**Funding Sources:** Canadian Agriculture Adaptation Program (CAAP), Saskatchewan Beekeepers Association and Saskatchewan Beekeepers Development Commission

## **D. Bees and the Environment including Neonicotinoids**

**1. Project Title: The effects of sub lethal neonicotinoid exposure on brain state and behaviour of honey bee workers (2014-2016)**

**Researchers:** Amro Zayed, PhD (York University), Nadia Tsvetkov (York University), Valerie Fournier, PhD (University of Laval), Olivier Samson-Robert (Laval)

**Objectives:** 1) study how neonicotinoids alter the brain state of worker bees, 2) Study how neonicotinoids affect social immunity in honey bees, 3) study how neonicotinoids affect spatial memory of honey bee workers, and 4) quantify levels of neonicotinoids in bee colonies near and far away from corn fields overtime during the season.

**Funding Sources:** Ontario Ministry of Agriculture, New Directions Research Program

**2. ProjectTitle: Monitoring of honey bee and bumble bee colonies during corn planting in Quebec (2012-2014)**

**Researchers:** Valerie Fournier (Université Laval) (PI), Olivier Samson-Robert (grad student); Geneviève Labrie (CÉROM), Dr. Madeleine Chagnon (UQAM)

**Objectives:** 1) Study surface water as a potential source of neonicotinoid exposure for honeybees, and wild bees, 2) Determine concentrations of clothianidin and/or thiamethoxam found in all samples collected from exposed sites, and 3) Analyze with Real Time qPCR to determine the expression level of a biological marker (AChE).

**Funding Sources:** Stratégie Phytosanitaire du Québec (MAPAQ)

**3. Project Title: Effects of miticides and agricultural pesticides on the mite *Varroa destructor*, and on the health and behaviour of honey bees (2013-2014).**

**Researchers:** Ernesto Guzman (PI), Hanan Gashout, Hassan Tarek, Paul G. Kelly (All from University of Guelph)

**Objectives:** 1) Study the effects of synthetic and natural miticides used by beekeepers to control varroa mites as well as agricultural pesticides, particularly neonicotinoids, on honey bees including toxicity, longevity, immune responses and behaviours, and 2) Test the hypothesis that these compounds are harmful to the bees and affect their health and behaviour, contributing to the depopulation of colonies.

**Funding Sources:** Private

**4. Project Title: Environmental Contamination of Honey Bee Colonies and Residues in Hive Products (2013-2016)**

**Researchers:** Pernal S (AAFC) (PI), Thompson T, van den Heever J, and Best N (Alberta Agriculture and Rural Development), Greg Appleyard (CFIA)

**Objectives:** 1) Develop and validate LC-MS/MS techniques for quantifying fumagillin residues in honey, 2) Employ LC-MS/MS techniques for determining incurred residues of fumagillin and degradation products in honey, 3) Determine how environmental storage conditions affect the viability and infectivity of *N. ceranae* spores, 4) Evaluate environmental contamination of hive products with pesticides.

**Funding Sources:** AAFC Project Proposal Grant

**5. Project Title: Interaction of clothianidin with *Varroa destructor* and deformed wing virus and their effect on the health of brood and adult honey bees**

**Researchers:** E Guzman, Paul H. Goodwin, Mollah Hamiduzzaman, Nuria Morfin, David Mackay (All at University of Guelph)

**Objective:** 1) To analyze the interaction and effects of sublethal doses of clothianidin, *V. destructor* and deformed wing virus on honey bee development, health and behaviour

**Funding Sources:** Ontario Ministry of Agriculture and, Food and Rural Affairs (OMAFRA)

**6. Project Title: Sub-lethal effects of neonicotinoids on queen fertility and drone sperm viability.**

**Researchers:** Les Eccles (PI), Ontario Bee Tech Transfer Program

**Objectives:** 1) Determine sublethal doses of clothianidin and thiamothexam effects on virgin queens after which sperm counts are analyzed and sperm viability tested post mating, 2) Study sublethal doses of clothianidin and thiamothexam impacts on developing immature drones during the first two weeks of life, after which sperm counts and viability are tested once the drones are mature.

**Funding Sources:** Ontario Ministry of Agriculture and, Food and Rural Affairs (OMAFRA)

**7. Project Title: Detection of Chemical Residues in Hive Products (2011-2013) ended**

**Researchers:** Stephen Pernal (AAFC) (PI), Tom Thompson, Johan van den Heever, and Norine Best (Alberta Agriculture and Rural Development), Greg Appleyard (CFIA Calgary)

**Objectives:** 1) Develop analytical methods (LC-MS/MS) for the determination of multiple antibiotics and pesticides in pollen, honey and wax with particular attention to new generation agricultural pesticides and apicultural products, 2) Generate residue information related to environmental contamination of hive products, and 3) Analyze whether beekeepers are using antibiotics and acaricides in a manner that reduces the risk of violative residues entering the food chain.

**Funding Sources:** AAFC Project Proposal Grant

## **E. Tech Transfer and Extension:**

- 1. Project Title: Saskatchewan beekeepers adapting technology to meet their needs: hive health, colony mortality and productivity (2009-2014)**

**Researchers:** Graham Parsons, (PI) (SK Tech Adaptation Team)

**Objectives:** 1) Testing treatment products for Varroa and tracheal mites, as well as nosema sp., 2) Evaluation and adapting of existing treatments and their timing and configuration of application, and 3) Conducting an extension program of the research findings and best management practices for pest control and improved overwintering technique.

**Funding Sources:** Canadian Agriculture Adaptation Program (CAAP), Saskatchewan Beekeepers Association, Saskatchewan Beekeepers Development Commission

- 2. Project Title: Implementation of bee best management practices: Business development extension program (2013-2016)**

**Researchers:** Medhat Nasr (PI),

**Objectives:** 1) Training industry on new management and business practices to improve bee health for crop pollination and production of honey that meets market demand, 2) Developing extension and educational resources including up to date fact sheets addressing production and managements practices, and 3) Utilizing efficiently the expertise of apiculture program staff to improve skills and aid in decision making processes

**Funding Sources:** Alberta Agriculture and Rural Development –GF2

- 3. Project Title: Implementation of honey bee best management and On Farm Food Safety (OFFS) extension and tech-transfer Program (2013- 2016)**

**Researchers:** Medhat Nasr (PI), Pramod Kumar (PI) (Alberta Agriculture and Rural Development)

**Objectives:** 1) Deliver extension program and services on Farm Food Safety program based on science and innovative business tools to encourage industry adoption of technology and best practices, and 2) Develop extension and outreach materials for beekeeping training.

**Funding Sources:** Alberta Agriculture and Rural Development –GF2