2009

2009 Vol 22 Supplement

Hive Irghts

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Reports from 68th Canadian Honey Council Meeting in Niagara Falls

Canadian Honey Council Activities

Canadian Bee Research Reports

Industry Statistics

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AGM Photos.....Garry McCue

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Canadian Beekeepers Association 1940-1972

President

Year	Name	Town	Prov
1940-41	William R. Agar*	Brooklyn	ON
1942	Sam M. Deschenes*	Montreal	QC
1943	J. W. Braithwaite*	Brandon	MB
1944	P.C. Colquhoun*	Maple Creek	SK
1945	Allan T. Brown	Peterborough	ON
1946	W.E. Phillips*	Dauphin	MB
1947-49	Frank Garland*	Winnipeg	MB
1949-51	J.N. Dyment	Smithville	ON
1952	Peter Kowalski*	Edmonton	AB
1953-54	W.H. Turnbull*	Vernon	BC
1955-56	H.C. Allen*	Toronto	ON
1957-58	Sid J. Lye	Oakville	ON
1959-65	Victor Mesley	Kemptille	ON
1966-67	Earl J. Burnett	Roland	MB
1968-69	Robert Asher	Brooks	AB
1969-71	Lou Truscott	Creston	BC

Secretary

Year	Name	Town	Prov
1940	W.T. Patterson	Winnipeg	MB
1941-48	Roy M. Pugh	Tisdale	SK
1949	W.G. LeMaistre*	Edmonton	AB
1950-59	Roy M Pugh*	Tisdale	SK
1960-62	R.M. McKay	Ottawa	ON
1962-69	John E. King*	Ottawa	ON
1969-72	Hank R. Taylor	Ottawa	ON

Canadian Honey Council 1972-2009

1971-72	Don F. Peer	Nipawin	SK
1972-74	Robert Bird	New West-minster	BC
1974-76	Jack M Smith*	Beaverlodge	AB
1976-78	Gerry Paradis*	Falher	AB
1978-80	Tom Taylor	Nipawin	SK
1980-82	Howard Bryans	Alvinston	ON
1982-84	Merv Abrahamson	Pelley	SK
1984-86	Jerry Awram	Hines Creek	AB
1986-88	Dale Hansen	Farmington	BC
1988-93	Roger Congdon	Cottam	ON
1993-95	Barrie Termeer	Rollyview	AB
1995-99	Wink Howland	Yorkton	SK
1999-01	Merv Malyon	Brandon	MB
2001-02	Dave MacMillan	Thornloe	ON
2002-04	Wink Howland	Yorkton	SK
2005-06	Alain Moyen	Mirabel	QC

Chair of Board

2007-2008	Ed Nowek	Vernon	BC
2009	Corey Bacon	Kinistino	SK

1972-75	Frank R. Garland*	Winnipeg	MB
1975-82	Fred Rathje*	Bassano	AB
1982-85	Bob Douglas	MacGregor	MB
1985-98	Linda Gane	Nipawin	SK

National Coordinator

1998- 2008	Heather Clay	Calgary	AB

Chief Executive Officer

2008-	Heather Clay	Calgary	AB

*Deceased

SECTION 1:

Canadian Honey Council
Motions and Reports from the
Annual General Meeting

Niagara Falls, December 9 - 10, 2008

Board Members: Ed Nowek Retiring Chair(BC), Corey Bacon (SK), Vice-Chair /Treasurer; Tom Trueman (MR), Secretary; Ted Hancock (newly appointed for BC); Luc Desaulniers (AB); Jerry Poelman (newly appointed for AB); Lorne Peters (Beemaid); Bruce Podolsky (MB); Dan Walker (ON); Jean François Doyon (QC); Heather Clay, CEO (ex officio)

Welcome

The retiring chair, Ed Nowek, welcomed all Directors and thanked them for their contribution of time to the CHC and the honey bee industry. Ed expressed his confidence that the "new" CHC is now poised to deal with the issues and challenges facing the industry. He added that there was a lot of good work done in the past, but there was a need for more strength in the organization to face the future and this goal has been achieved through the Forging a New Direction Project.

1. Minutes of Calgary AGM

Motion:

That the minutes of the 67th AGM be approved. Dan/Luc – **Carried**

Motion:

That the minutes of the meeting of October 8th Board of Directors meeting be approved. Dan/Luc – **Carried**

2. Business Arising from Minutes and Action Summary

There was no business arising.

3. CEO's Report

It has been a good year of progress. The Ottawa trip was successfully completed, addressing some issues and raising others. It is generally agreed by the directors that the Agri-Stability program is not the problem; rather, it is its inadequate administration. Officials from AAFC have said they can come to meetings to explain the program, but it is up to individual beekeepers to find out about it if they want to use it. The concern is that Agri-recovery will not be offered as long as the provinces are not on-side. Also, Agri-recovery is a "one-time deal" whereas Agri-stability is an ongoing program.

The Canadian Bee Industry Safety Quality Traceability Program continues to be developed. There will be a January 12 to 16 meeting in Banff with CFIA for technical review of the CBISQT Good Practices Manual which is now nearing completion.

The FAND (Forging A New Direction) project another current major CHC project, has been actively underway for 2 full years and finishes March 31st. The funding program that supported FAND is now over. This project has been beneficial and assisted a great deal in the restructure of the organization.

The Hive Health initiative was recently approved on November 6 and the contribution agreement is currently being refined. Rhéal will assist with this project. A stakeholder meeting is planned for January 19-20 in Winnipeg.

The CHC ad hoc Drum Standards Committee produced a report that has been accepted by the CFIA. Used drums are not acceptable. For those with old stock they may use liners.

The new websites honeycouncil.ca, hivelights.ca, canadianhoney.ca and cbisqt.ca are up and running. There is tremendous interest in the new websites and the sign-up for the monthly e-newsletter off the Hivelights site is surprisingly high, including government and out-of-country requests. The newsletter, previously for Board members, may become more frequent as it is so popular. These newsletters will be archived on the website.

The North American Pollinator Protection Campaign (NAPPC) meeting was held in Washington, DC in October. This group is very focused on demonstrating the importance of pollinators including honey bees. They use a public/private partnership approach to focusing the attention of powerful political leaders on the importance of pollination. It was instructive in terms of revealing what Canadian students are doing in the USA on bee research projects (funding support not being available in Canada).

4. Executive Committee Report-CBRF

Ed summarized the results of the Executive Committee and provided background on the CBRF Committee for the Board. The CHC members of the CBRF Committee (Chair and Treasurer) will encourage a return to the original terms of reference as well as making proposals to address:

- Compensation for CHC administration (CHC's major role in this is not reimbursed at present)
- Confirmation of the Committee's terms of reference and membership
- The need to ensure that funds invested are not at risk

RFID – Hand Held Device for Hive Management

RFID software was created for a system developed in Beaverlodge, AB, using federal funding. When development ended, the CHC was given "ownership" of the software by the Department of Agriculture and Agri-Food Canada.
One of the original developers of the software is interested in "partnering" with CHC to make the system available to beekeepers and others at a cost

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Motion:

That Executive Committee continues to investigate, with minimal investment of time, a possible agreement between the CHC and the promoter of the RFID software that would be beneficial to CHC and Canadian beekepers. Luc/Bruce – **Carried**

New Member Application

The meeting in Banff confirmed that there is a place for a pollinator organization on the CHC Board. The Board would like such a group to be broader than representing one geographic location - preferably national - and its name should refer to pollination or "canola pollination" and not be for just "beekeepers. This policy will be conveyed to interested organizations.

Election Process

Ed explained that a ballot would be used to elect the Executive and he briefly explained the important roles of these positions. The election occurred after the end of day one and Ed announced the new executive as follows:

Chair	Corey Bacon
Vice-Chair	Tom Trueman
Treasurer	Jerry Poelman
Secretary	Ted Hancock

The standing committees and membership proposed are:
Finance (Jerry - Chair, Corey, Tom, Lorne - alternate)
Membership and Events (Ted - Chair, Bruce, Dan, Jean François - alternate)

The ad hoc Committees and membership proposed are:
Foreign Workers (Corey, Bruce, Luc)

There was discussion about an Issues Committee and it was agreed that this would be appointed as an ad hoc committee under the chairmanship of the Vice-Chair (Tom) for a year. Membership could vary depending upon the issues arising.
Issues Committee (Tom - Chair, Lorne, Bruce, Luc - alternate)

Other Committees:
The Chair and Treasurer (Corey and Jerry) sit on the CBRF Committee on behalf of CHC.

An Advisory Committee for Hive Health is to be appointed as part of the Hive Health Initiative project and members of the CHC Board on that Committee have yet to be determined.

It was generally agreed that the preferred committee structure is to have just a few committees that are effective in their work.

5. Finance Committee Report

The auditor's report was reviewed (see Section 3).

Motion:

That the report from the auditor be accepted as received. Jerry/Corey - **Carried**

Motion:

That the current auditors, Parker Quine LLP of Yorkton SK, be retained for 2008-09. Corey/Bruce – **Carried**

6. Ad Hoc Committee Report Foreign Worker Committee

Rhéal made a brief report, referring to the proposal developed and forwarded to federal government officials. After the Ottawa meeting the HRSDC suggested that CHC should submit recommendations for changes wanted for the Foreign Worker Program. Corey talked with western provincial associations and he and Rhéal worked on these issues, especially the code. Another issue is that honey producers are not consulted when wages are set and this needs to be addressed. Regional adminis-

tration is another issue; i.e., the regions do not talk to one another. Still another area that stuck out is regarding the Labour Market Opinion (LMOs); i.e., agriculture is not included in the expedited group. There are strong arguments to be made that it should be and worries about LMOs could then be alleviated. CHC should be able to convince the HRSDC that it should continue to be consulted on behalf of the beekeepers regarding LMOs and other foreign worker program issues.

Drum Standards Committee

Jerry reported briefly on behalf of the committee. The ad hoc committee involving CHC and CFIA officials established standards for a transition to better levels of food safety. Liners, sealed, are acceptable. Packers are to deal with any outstanding issues they may have. Jerry emphasized that the producer's responsibility is what is inside the barrel and the new standards indicate the producers are doing their due diligence, including using liners that are accompanied by letters of compliance ensuring they are acceptable and meet the established standards (e.g. for heat resistance). It was generally agreed that there should be compliance from producers of honey coming into the country as well. Jerry noted that if an operation is CFIA inspected, they will likely be examining the plant for compliance though the drum standards are still voluntary. In conclusion, he noted that totes are becoming more popular.

Motion:

That the CHC approves the new drum standards as developed by the ad hoc Drum Standards Committee.
Jerry/Bruce – **Carried**

7. Resolutions from Member Organization AGMs

Resolution 1:

WHEREAS CFIA has refused the CHC definition without providing any explanation,

THEREFORE BE IT RESOLVED:

That CHC revisits the Battery Box (i.e. Queen Shipping Cage) definition issue with CFIA to determine what needs to occur to obtain approval.

Moved/Seconded: Bruce P/Luc D
CARRIED (1 ABSTENTION)

Resolution 2:

WHEREAS Manitoba producers have expressed appreciation for the emergency use registration of a hive health product (Apivar®) in late 2008,

THEREFORE BE IT RESOLVED:

That CHC works with CAPA to evaluate the availability of, and possible registration of, additional resources to support Honey Bee health.

Moved: Bruce P/Jerry P
CARRIED

Resolution 3:

WHEREAS the manufacturer of Apivar® is required to perform data requirements for re-registration of Apivar® (Amitraz),

AND

WHEREAS this will cost the company an estimated $100,000 to do this work required to keep the registration current,

THEREFORE BE IT RESOLVED:

That CHC enters discussions with distributors and others to raise funds (to be held in a CHC account) for new miticide research (starting in 2009).

Moved: Bruce P/Luc D
CARRIED AS AMENDED (2 ABSTENTIONS)

Resolution 4:

WHEREAS the registration for Apivar® expires 27 April 2009,

AND

WHEREAS it is too short a window for a full spring treatment as per the original label,

THEREFORE BE IT RESOLVED:

That the CHC petitions PMRA and the federal ministers of agriculture and health to grant a reasonable extension of 30 days to the 27 April 2009 expiration, to accommodate possible late arrival of spring, where strips cannot be installed in a timely manner, thus preventing waste in cost and unused treatment.

Moved: Bruce P/Luc D
CARRIED AS AMENDED

Resolution 5:

WHEREAS it appears the December 2008 CHC AGM is only open to directors,

THEREFORE BE IT RESOLVED:

That CHC's Membership and Events Committee plans an open question and answer session with the Board at the next AGM; that the Action Summary of CHC Board meeting minutes be made available on the CHC website; and that the Resolutions Report from this year's AGM be made available on the CHC website as soon as possible.

Moved: Bruce P/Ted H
CARRIED AS AMENDED

Resolution 6:

WHEREAS the Canadian Honey Council is currently lobbying the Federal Government for funds to assist the bee industry due to high winter losses country wide in 2007 and 2008

And

WHEREAS suggested allocations of these funds include a component to support research programs

And

WHEREAS there remains a shortage of replacement bulk bees for extraordinary winter losses that are more common due to Varroa mite infestations, Nosema infestations, and viruses affecting the hives;

BE IT RESOLVED

That if Canadian Honey Council is successful in lobbying the federal government for funds, including support for research programs, CHC includes in its programs a proposal to allocate an effective portion of

research dollars to projects that will help identify sources of healthy bees and develop, in a timely fashion, the means and methods to secure healthy bees from the continental U.S.A. and other sources as an additional tool to help ensure industry sustainability in Canada.

Moved: Jerry P/Luc D

CARRIED AS AMENDED
(2 ABSTENTIONS)

Resolution 7:

WHEREAS the registration for CheckMite + ™ expires this year (2008) and since CheckMite + ™ is still a useful mite control agent in various parts of the country

And

WHEREAS CheckMite + ™ is the only registered product for diagnosis and control of Small Hive Beetle.

BE IT RESOLVED

That Canadian Honey Council lobbies Bayer Animal Health to continue renewal of registration for CheckMite + ™ and lobby PMRA for an extension of its registration.

Moved: Jerry P/Luc D

CARRIED AS AMENDED

Resolution 8:

WHEREAS Formic Acid is a useful and effective Varroa and Tracheal Mite Control, but very susceptible to fluctuation in behavior under various atmosphere conditions

And

WHEREAS Formic Acid application can be modified to make various regional climatic conditions to improve efficacy.

BE IT RESOLVED

That the Canadian Honey Council lobbies Pest Management Regulatory Agency to continue CAPCO 94-05 directive to make Formic Acid available to the industry for mite control programs.

Moved: Jerry P/Corey B

CARRIED AS AMENDED

Resolution 9:

WHEREAS Apivar® has proven to be a useful tool in the face of failure by other various mite control products

And

WHEREAS beekeepers don't have a product with efficacy independent from climate conditions that can protect bees from mite kill

And

WHEREAS Apivar can fit in a management program for resistance and be integrated with alternative chemical control;

BE IT RESOLVED

That the Canadian Honey Council petitions PMRA and Arystra Life Science to continue the registration of Apivar® and further, that PMRA include Varroa Mites in their screening tests for new pesticides, and that the CHC acknowledges the extraordinary effort that the PMRA expended in getting the EUR for Apivar.

Moved: Jerry P/Bruce P

CARRIED AS AMENDED

8. Strategic Priorities for 2009

Ed referred the Board to the Strategic Priorities identified as the priorities to be addressed - all of which contribute to the profitability and sustainability of the Canadian honey bee industry:

• Hive Health – thriving, productive livestock (Hive Health project is underway, oxalic acid registration in progress, Apivar® Emergency Use received to April 09)
• Market Access/Share – increased demand that creates better prices (Pierre the Bear in ON and SK, school kits project completed for grades 1-3, proposal for trade show in Florida 2010.)
• Food Safety – top quality products that instill consumer confidence (C-BISQT technical review in January 09)
• Labour and Succession – people to work in the industry now and in future (Foreign workers proposal submitted, stock import under consideration)

9. Board Calendar 2009

Heather reviewed the calendar and noted the addition of AHPA meetings in Fresno January 6 & 7 as well as the stakeholder meeting in Winnipeg (invitees only – January 19 and 20 with Board meeting to follow on 21). The meeting with the Minister will be deferred to February. Heather reminded Directors that the next AGM is at the 2010 major meeting in American is in Orlando, FL. At this time, the meeting includes the American Beekeeping Federation, AIA, AAPA, CHC, and CAPA, with an invitation to honey producers, as well.

10. Other Business

CFA (Guest Ron Bonnett at 9:30-10:30 on December 10)
Ron introduced himself as beef cow-calf producer and VP of CFA. He added that Kevin Nixon (AB) had recently made a presentation to CFA regarding the issues facing honey producers. He went on to give an overview of CFA:

• General farm organizations from each province, and commodity groups, are members.
• Initiatives come from gov't policies that need a reaction, member issues, and the committee structure that deals with Safety Net, Strategic Development, and Environment.
• There is also a best management advisory board.
• A seat at the table gives members a voice in CFA's policy development/watchdog role. CFA's lobby role works effectively as CFA can rally a large lobby.
• CFA's strength is in its multi-type, multi-region membership.
• Connectedness amongst members is recognized. The horticultural sector had problems with PMRA that have been resolved – similar problems exist here at CHC.
• For results, "You can't have different sectors putting forward different positions". The aim of CFA is to achieve a consensus and pursue an issue collectively, not to advance just one cause.

Rathje Award

The Board considered the submitted names for the Rathje Award and acknowledged that Roger Congdon achieved some very important things in his long association with the industry. It was generally agreed that it was the right time and place to acknowledge this.

Motion:

That the 2008 Rathje Award be presented to Roger Congdon. Jerry/Ted – **Carried**

The Chair thanked the Directors. He again extended a sincere welcome to Jean François Doyon and acknowledged Quebec's stated intent to participate fully in the new CHC. He expressed his appreciation to the Directors with whom he had worked on the "New Direction".

On behalf of the Board, Jerry thanked Ed for his hard work and expressed, in turn, his appreciation for the Chair's efforts and guidance. Heather and Corey added their thanks; she, for Ed's support in her new CEO position and he, for Ed's leadership through the transition to the new Canadian Honey Council.

Motion:

That the meeting be adjourned. Luc/Jerry – **Carried**

Fred Rathje Award Winners

2008	Roger Congdon (ON)
2007	Heather Clay (AB)
2006	Dale Hansen (BC)
2005	Domiongo d'Oliveira
2004	Wink Howland (SK)
2003	Mark Winston (BC)
2002	Doug McRory (ON)
2001	Don Nelson (AB)
2000	John Gruszka (SK)
1999	Doug McCutcheon (BC)
1998	Jean Pierre Chapleau (PQ)
1997	Merv Malyon (MB)
1996	Lorna & Jack Robinson (ON)
1995	Gordon Kern (BC)
1994	Kelly Clark (BC)
1993	Linda Gane (SK)
1992	Babe & Charlie Warren (BC)
1991	Gerry Paradis (AB)
1990	Cam Jay (MB)
1988	Don Dixon (MB)
1987	John Corner (BC)
1986	Gerry Smeltzer (NS)
1985	Paul Pawlowski (AB)
	First year of award

Honourary Members

1950	Hon J. G. Gardiner (ON)
1950	Tom Shield (ON)
1950	Harry Jones (PQ)
1950	G.H. Pearcey (BC)
1951	P.C. Colquhoun (SK)
1951	C.G. Bishop (PQ)
1955	J.N. Dyment (ON)
1956	F.R. Armstrong (ON)
1963	C.F. Pearcey (BC)
1964	Percy Hodgson
2002	Kenn Tuckey (AB)

This year the award was presented to Roger Congdon by Ed Nowek (holding award)

2009 CANADIAN HONEY COUNCIL BOARD OF DIRECTORS

SPONSORSHIP OPPORTUNITY

Platinum ($20,000.00) Gold ($15,000.00)

Silver ($10,000.00) Bronze ($5,000.00)

The Canadian Honey Council, as the national voice of the Canadian honey bee industry, has served the industry for more than 50 years. During this long history the Council has been supported by generous donations from many individuals and organizations. To strengthen its relationship with current sponsors and encourage new sponsors, the Canadian Honey Council has created a Sponsorship Program to offer individuals and organizations opportunities to support the national organization and receive specified benefits and recognition in return. The purpose of the Program is to expand participation to those who wish to demonstrate their support for the day-to-day work of the Canadian Honey Council.
There are several types of sponsorship and the benefits vary with each.
We need your support. If you would like to be a sponsor of the Canadian Honey Council please contact our office or call 403-208-7141.

Elise Gagnon - ODEM International Inc. receiving her plaque from Ed Nowek Chair of Board and Heather Clay CEO Canadian Honey Council

CAPA President's Report to CHC

Stephen F. Pernal, Ph.D.
President, CAPA

It is a pleasure to see you all in Niagara Falls and I thank you all allowing me a few moments to relate some of the issues and activities CAPA has been involved with over the last year.

Of concern to all, honey bee losses were extremely high again in 2008. In Canada, CAPA members documented overwintering losses to be 35.0%, an increase of 6% over 2007. In the U.S. numbers were very similar, with colony losses at 35.8%, an increase of 11.4%. In Canada, two of the most tangible factors associated with operations in which losses were high have been the presence of high levels of varroa mites, typically with multiple acaricide resistance, and the presence of high nosema levels, often Nosema ceranae. The sustained losses in 2008 led to a national evaluation of disaster assistance for beekeepers by AAFC, the results of which are presently being discussed with the provinces.

Concern over the loss of pollinators has resulted in some opportunities for funding being available. In the U.S., a $4.1 M Managed Pollinator, Coordinated Agricultural Project was recently announced. This is a national research and extension initiative intended to reverse pollinator decline in the U.S., which will be carried out by a team of 19 researchers and extension specialists in 17 states. In Canada, CAPA member Peter Kevan was successful, as Principal Investigator, in being awarded a $5 M NSERC Strategic Network Grant known as the Canadian Pollination Initiative (CANPOLIN). This five-year project, encompassing work on many types of pollination systems, will be carried out by a team of 48 collaborators with a total budget of $5 M. Within this large project, the managed pollinators sub-section will examine aspects of Apis mellifera health. It is hope that this initiative, and those of other CAPA researchers, may provide solutions for beekeepers.

In the last year, the CAPA Chemicals Committee dealt with a number of concerns. Based on a need for additional options to control mites resistant to registered products, and strong support from the beekeeping industry, CAPA members were involved with PMRA's emergency use registration of Apivar®, a strip formulation of amitraz used for varroa control. It is hoped that improved mite control during the fall of 2008 will result in lower levels of wintering losses. Chemicals committee was also requested re-examine formic acid uses outlined in Note to CAPCO 94-05. It is anticipated that PMRA will seek input from stakeholders regarding this issue over the next several months.

CAPA's import committee was also kept busy, providing consultation at the request of the CFIA on multiple issues. One example was the timely action by members of this committee to ensure a safe and uninterrupted supply of queens from the Big Island of Hawaii after the discovery of varroa mites near Hilo this summer. Among other requests, the import committee also reviewed a proposal to extend the duration of apiary health certificates for queens exported from California from 45 to 90 days, which was later granted by CFIA.

This year saw the third introduction of small hive beetle (SHB) into Canada, discovered on September 19, in the south-western Quebec. Previous introductions were discovered in Alberta and Manitoba in 2006, as a consequence of infested Australian package bees, while the original introduction, also in Manitoba, resulted from the importation of unprocessed wax from Texas in 2002. Genetic testing of beetles from Quebec has confirmed that they have originated from populations in the U.S. and not Australia. CAPA members with the Department of Agriculture, Fisheries and Food of Quebec (MAPAQ) have been overseeing surveillance and control programs in the area of introduction.

This year saw substantial changes to the CAPA website, www.capabees.ca, which has undergone redesign and rehosting. Again this year, CAPABEES proved to be particularly valuable instrument to post CAPA's position on overwintering losses. I encourage you to visit the web site for newly-posted content, which we intend to increase over time.

The Canadian Honey Council (CHC) continued its redevelopment efforts over the last year, and as part of this CAPA is defining its relationship with the new organization and participating in new projects with it. Assisting CHC in its newly-evolving role during 2008 and 2009 is CAPA member Rhéal Lafrenière, who is serving as acting project coordinator. CAPA will be represented at CHC's stakeholder meeting in January 2009 to assist with the Hive Health Initiative Project, recently funded by ACAAF.

This meeting is the last at which long-standing member, John Gruszka, will be in attendance before his upcoming retirement from his position as Provincial Apiculturist for the Province of Saskatchewan. I encourage you all to thank John for his many years of dedicated service to the Canadian Beekeeping Industry and to welcome his successor, Geoff Wilson.

On April 25, 2008, CAPA lost one of its long-standing and most highly-regarded members when Dr. S. Cameron Jay, Emeritus Professor at the University of Manitoba, died at the age of 79 years in Winnipeg. Cam joined the Department of Entomology at the University of Manitoba in 1961 serving as a professor until his retirement in 1991. Cam was noted as an award-winning teacher and trained 24 graduate students during his time at the university. Many of these students have gone on to research, regulatory and extension positions in Canada and other parts of the world. Cam was also a dedicated researcher and his impact on Canadian beekeeping was truly enormous over the years. Though Cam's achievements were many, he will be best remembered for his irrepressible optimism, his down to earth manner and concern for all. Rest in peace, our teacher, mentor and good friend.

In closing, I wish to emphasize that CAPA values its relationship with the beekeeping industry in Canada and wishes beekeepers success during these difficult years. CAPA also encourages the Canadian Honey Council to continue with its restructuring efforts to produce a vibrant, capable and sustainable organization that will meet the needs the beekeepers for many years to come.

I sincerely hope your time in Niagara Falls is enjoyable and productive. Thank you.

SECTION 2:

Canadian Bee Research Fund Reports

Apis mellifera Proteomics of Innate reSistance (APIS)

Leonard Foster, Marta Guarna, PhD and Robert Parker, PhD, University British Columbia, #301-2185 East Mall, Vancouver, BC V6T 1Z4

The APIS project focuses on two diseases affecting honey bees in North America, American foulbrood (AFB) and varroasis. Although treatments for these diseases are available, increased resistance to current treatments as well as the concern of chemical residues makes selective breeding of resistant bee stock the most desirable solution. The APIS project aims to build on previous selective breeding efforts to develop molecular tools for accelerating and strengthening the selection process. We are now completing the first year of this three-year project. We have received funds from CBRF to assist in the fist year of this research program.

We have been working in close collaboration with Liz Huxter of BC Bee Breeders Association (BCBBA) at Grand Forks, BC for the Varroa project and with Steve Pernal and Andony Melathopoulos of the Agriculture & Agri-Food Canada (AAFC) Research Station in Beaverlodge, AB for the AFB project. We collected samples from bee populations with different levels of resistance to disease. Organs sampled included adult midguts and antennae from 64 colonies belonging to 8 distinct populations at Beaverlodge, and larval hemolymph and adult antennae from 55 colonies at Grand Fork. We are currently performing a proteomics analysis of these samples to obtain a quantitative readout of protein expression. To complement this analysis, Steve Pernal and Liz Huxter's teams performed tests to evaluate disease resistance including test of hygienic behaviour, in situ disease development, and in vitro larval survival to infection. The analysis of these data is near completion. As these and the proteomics data become available, we will correlate molecular patterns with resistance to disease. This information will be used to develop tools to distinguishing resistant stocks from susceptible ones and facilitate selective breeding programs.

University of Manitoba CBRF Research Report

R.W. Currie, S. Desai, R. Bahreini and Young Je Eu
Dept. of Entomology, Faculty of Agricultural and Food Sciences, University of Manitoba, Winnipeg, MB

The Canadian Bee Research Fund has contributed seed funding to a multifaceted study that has a number of objectives. Below we summarize the work that we have carried out in the past year with respect to the effects of viruses on honey bees (1) and how to control them (2), the effects of breeding for resistance to mites on fall survival of colonies under indoor and outdoor winter management in colonies treated with oxalic acid (3), the effects of honey bee nutrition on grooming success against varroa in laboratory studies (4) Assessing differences in the hive environment of stock selected for resistance to varroa and in unselected stock (5) and the effects of three formic acid treatment methods on treatment efficacy and impact on colonies (6).

1. Suresh Desai and Rob Currie: Preliminary investigation on honey bee viruses in Manitoba

Honey bees are currently under threat because they are attacked by various pathogens including viruses, bacteria, microsporidia and mites causing serious problems in beekeeping industry. Viruses are the least understood of these pathogens as information is lacking about the dynamics of underlying disease outbreaks. New strains of pathogens and unknown effects of how viruses interact with other parasites and stressors has resulted in the need for more sophisticated methods of identifying these pests than have been used in bee diagnostics in the past. The University of Manitoba has developed methodology to detect and quantify both strains of Nosema disease (*Nosema apis* and *Nosema ceranae*) as well as seven of the most important viruses affecting bees. The methods use the reverse transcriptase polymerase chain reaction (PCR) to identify the pathogens and real time PCR to quantify their relative abundance.

A preliminary study of seven bee viruses in Manitoba was undertaken by using bee colonies by employing reverse transcription-PCR technique. Samples of adult bees were collected from the University of Manitoba apiary. The most prevalent virus was Black Queen Cell Virus (BQCV) present in 81% of samples, followed by Deformed Wing Virus (DWV) 77% and Israeli Acute Paralysis Virus (IAPV) 54% of the samples. Chronic Bee Paralysis Virus (CBPV) was present in 40% of the samples, Sac Brood Virus (SBV), Acute Bee Paralysis Virus (ABPV) and Kashmir Bee Virus (KBV) detected in 9% of colonies. Colonies and even single bees frequently had more than one pathogen and up to four different viruses in a single host were found. In some studies Israeli Acute Paralysis Virus has been associated with CCD like symptoms in the U. S. Despite the fact that a high proportion of colonies in our study were infected with this virus they did survive the winter and did not exhibit signs associated with colony collapse disorder in the following season.

Further research into the relative importance of these pathogens and their interactions with mites and other stressors are continuing so we can better predict how to manage colonies of bees to prevent colony loss.

2. Suresh Desai, Young Je Eu and Rob Currie: Inhibition of deformed wing virus (DWV) gene expression and replication in honey bees by RNA interferance

The ability to control viruses directly could be of considerable benefit as it could allow beekeepers to tolerate higher mite levels without experiencing economic loss. The objective of this segment of our research is inhibition of deformed wing virus gene expression and replication in honeybees by RNA interference.

RNA Interference (RNAi) is a simple, rapid and specified method for silencing gene function – in essence it is a targeted "drug" that destroys the virus within cells. RNAi reduces gene expression by causing degradation of the target mRNA or viral RNA. RNA interference has recently been utilized in a number of species including human beings, plants, animals and insects (Drosophila) to suppress viruses. In this study, we have cloned the 700bp region of RNA dependent RNA polymerase (RdRp) gene into a plasmid with T7 promoter in inverse and forward directions (see figure). Later we cloned inverted repeat of the above 700bp region into a plasmid with T7 promoter. The dsRNA targeting to RdRp mRNA was made using in vitro transcription with T7 RNA polymerase.

Feeding dsRNA to honeybees (or topical applications) should result in a reduction in DWV titer. This in turn should lengthen life span of bees with DWV infection relative to infected untreated bees.

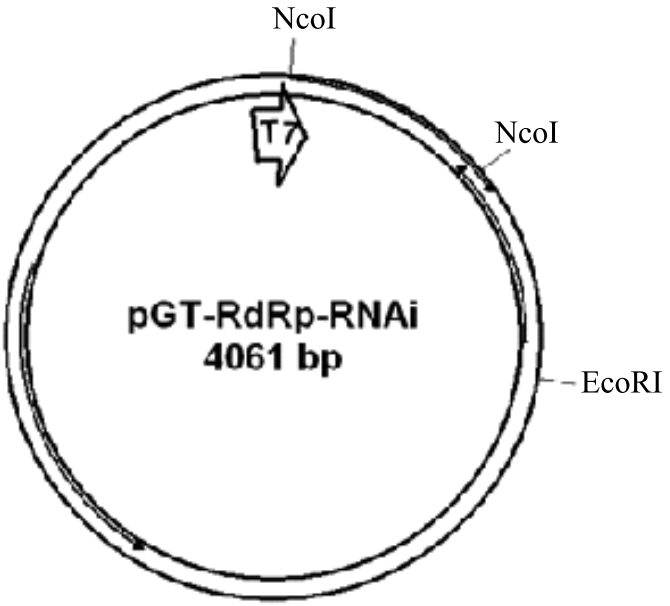

Figure 1. DNA construct for RNAi. Two copies of the 700 bp of RdRp of DWV are inserted into the restriction enzyme sites of NcoI and EcoRI in inverse direction. Double stranded RNA is made using T7 RNA polymerase in vitro.

The experiment outlined above will increase our understanding of how viruses affect life span of honey bees and will use recent advances in molecular biology to develop methods to control honey bee viruses. If successful, the results will help beekeepers to manage honey bees with higher thresholds for varroa mites while reducing the probability of colony loss. In instances where mites cannot be adequately controlled, their impact on bees could be reduced by eliminating the viruses that the mites inject into the bees. This could allow bees to tolerate higher mite loads without experiencing as severe an economic impact.

3. Rassoul Bahreini and R.W. Currie Increasing the economic threshold for fall treatment of varroa mite (*Varroa destructor* A.&T.) in honey bees (*Apis mellifera* L.) by using mite-resistant stocks in the prairie region of Canada.

The goal of an economic threshold is to predict when treatments should be applied to keep the pest population below a level that causes economic damage to its host. Economic damage occurs when the value of the damage is greater than the cost of the control method (Osteen, 1993). Beekeepers can use the economic threshold to reduce miticide applications, increase honey production and prevent colony loss. Fall thresholds for the prairie region of Canada, suggest producers should treat mite-susceptible (S) honey bee stock when the mite level is greater than 4 mites per 100 bees in late August to early September to prevent fall or winter colony loss (Currie and Gatien, 2006). Significant winter colony loss occurs in susceptible stock, when mite infestations reach levels greater than 10 mites per bee in late fall if only varroa are present and at much lower values in the presence of tracheal mites and other stresses. The objective of this study was to manipulate varroa mite levels in late fall through the application of an oxalic acid fumigation treatment in November and estimate the impact of different varroa mite levels on mite mortality, colony populations and colony survival in "mite-susceptible" (S) and "mite-resistant" (R) honey bee colonies.

Materials and Methods

The experiment was carried out at University of Manitoba, Winnipeg (49° 54' N, 97° 14' W). Thirty nine colonies from mite-susceptible (S) (n=23) and mite-resistant (R) stocks (n=17) were chosen and each randomly assigned into two groups that would either receive a late fall treatment with oxalic acid or be left untreated. Acaricide-treated colonies (n=8 and n=12 for resistant and susceptible stock respectively) were fumigated with 1 g of oxalic acid crystals on 13 November 2007. All colonies were weighed and randomly arranged in two small rooms in over wintering building maintained at 5°C. Colony worker population and mean abundance of varroa mites was assessed in each colony prior to treatment in fall 2007 and after removal from winter storage in spring of 2008. Numbers of mites and bees falling onto bottom board samples of hives were assessed at 15 day intervals (five periods) from 18 January to 25 March during the winter of 2007-2008. Mean abundance, mite drop and colony population score were assessed on all surviving colonies and bee population loss was assessed before and after winter in all colonies in the experiment.

When fall varroa mite levels were above the normal treatment threshold average winter loss across all treatments was significantly lower when colonies were wintered Indoors (44% loss) than when wintered outdoors (95% loss). The results showed that colony survival in mite resistant stock (75% survival) was significantly greater than in mite susceptible stock (43% survival) and "resistant"

colonies that survived could tolerate higher average mite levels (16-17%) than non-resistant colonies (8-9%). Before winter, colonies were established with mite levels that were above the economic threshold. Oxalic acid treatments reduced mite levels to 3 to 5 mites per bee 100 bees where as the mean abundance of mite levels in untreated colonies averaged from 12 to 14 mites per 100 bees. Under these conditions populations of surviving colonies of mite-resistant and mite-susceptible stock were similar but bee populations in resistant stock tended to be higher than in susceptible stock whether colonies were treated with acaricide or not. Resistant stock appeared to have a slight reduction in mean abundance of mites over winter and slightly higher mite mortality than in susceptible stock in untreated groups of colonies. The results showed that when late fall mite levels were above the fall economic threshold, resistant stock could be used by producers to help minimize colony loss.

4. Rassoul Bahreini and R.W. Currie. The influence of honey bee nutrition on the effectiveness of grooming behaviour against varroa mites.

Nutritional stress has been cited as a potential factor that may interact with other stressors to contribute to increased colony loss. Pollen is the only source of protein in diet of honey bees. Pollen affects physiology of bees, population growth, brood rearing, queen ovaries, health, behavior etc. and thus is likely important to the colonies ability to resist diseases and pests. Pollen feeding also might enhance grooming behavior in honey bees because of healthier bees would be more capable of defending against pests.

The objectives of this experiment were to assess the effect of pollen feeding on daily mite and bee mortality in selected and unselected stock, and to assess the effect of pollen feed on newly emerged and mixed age populations of bees.

Approximately 200 bees were collected from colonies with stock selected for resistance to varroa and form unselected colonies. Bees were introduced into bioassay cages (n=24) with the following treatment combinations: (1) selected vs. unselected bees each of which were either fed pollen or not fed pollen (four treatment combinations). Cages of bees containing different stocks were fed pollen for 3 days (or left unfed as controls) then infected with varroa mites. Daily mite and bee mortality were then assessed for a period of five days. The entire experiment was repeated on three different groups of either newly emerged or mixed-age bees and conducted between Aug 8- Sep 29, 2008.

The results showed that feeding pollen increased daily mite mortality rate in newly emerged and mixed-age bees but only in the cages containing stock selected for resistance to varroa. In cages of bees that were not fed pollen, bee mortality of selected stock was slightly greater than in unselected stock. However, daily bee mortality rates were similar in unselected and selected stock of bees when pollen was fed. This indicates that providing good nutrition may be particularly important in allowing resistant stocks to defend against varroa. Future research will also need to focus on understanding how methods of feeding, time of year and age structure of bee population affect mite tolerance and extending these experiments to full size colonies.

5. Rassoul Bahreini and R.W. Currie. Assessing differences in the hive environment of stock selected for resistance to varroa and in unselected stock.

Previous research has shown that some colonies are capable reducing their mite loads by up to 60 percent during winter under some environmental conditions within winter buildings (Underwood and Currie 2007). Manipulation of ventilation can increase ambient CO_2 level and increase mite mortality in cage studies (Kozak and Currie submitted for publication) but the effectiveness of this manipulation on different strains of bees in full size colonies has not been examined. Research on the effects of environmental factors on parasite mite's mortality and their interaction with cluster dynamic in different strains of bees on mite mortality is required to allow development of control measures that utilize manipulation of building ventilation.

The objectives of the current study were to monitor CO_2 concentration in selected and Unselected bees in a simulated winter condition, to determine CO_2 concentration effects on grooming behavior and mite load reduction in selected and unselected bees and to estimate the relationship between CO_2 concentration and mite and bee mortality in selected and unselected stock.

The experiment was carried out on colonies of 1,500 bees per colony mixed age worker bees that were collected in summer 2008 from selected and unselected hives and then established nucleus size colonies (n=24). Nucleus colonies were queenless but a Bee Boost Lure was inserted in each hive. Each colony was infested with 75 varroa mites and then maintained at 10 °C for 7 days. Dead mites and bees were removed from bottom boards of colonies on a daily basis. CO_2 and O_2 concentration were measured in room space and inside the cluster of bees by Gas Analyzer 2-3 times per day.

The results showed that mite load reduction was higher in selected than unselected honey bee colonies when they were kept at 10 °C. Daily bee mortality rate was lower in selected stock relative to that found in unselected stock in a simulated winter condition. Carbon dioxide (CO_2) concentration was slightly higher in selected bees than unselected bees, but the difference in this level was not significant and did not appear to be correlated with mite mortality when cluster CO_2 concentration was low (less than 1.6%). Manipulating ventilation might be used in combination with the use of resistant stock to increase these CO_2 levels to the level that causes increased mite mortality in our cage studies. This is currently being examined in studies in the winter of 2009.

6. R.W. Currie. The effects of different formic acid application methods on treatment efficacy and impact on colonies.

Single applications of formic acid using the "Amrine method" in combination with honey bee healthy are reported to provide effective control of mites because they kill a very high proportion of mites in the brood (90-95%) (Amrine et al 2006). The objectives of this study were to compare the relative efficacy of three different application methods for formic acid in killing mites in brood cells, and to examine the effects of each treatment on queen loss. In the summer of 2008 colonies infested with varroa mites were exposed to the

following three formic acid application treatments (and an untreated control): 1. Amrine pads in combination with Honey Bee Healthy; 2. a pour-on application of formic acid that consisted of 5 applications of 40 ml of formic acid; and 3. a Miteaway II® pad. Formic acid concentration in hive air was monitored, frames of brood were removed from each colony following treatment (a full single Amrine treatment 1 application of pour on and only partial exposure to the Miteaway II®), the proportion of mites killed and remaining on emerging bees after treatments were monitored and queen supersedure rates throughout the season were assessed.

Formic acid levels in hive air were highly variable but reached the highest levels (max 525 ppm) in the Amrine treatments compared to a Miteaway II® pad (330ppm) or the formic acid pour-on (max 150 ppm) . The results showed that mite mortality rates were 7+3, 4+3, and 3+3 percent in the "recommended" single application Amrine treatment, and partial (1 application) of Formic acid and Miteaway II pad treatments respectively. The proportion of mites left on emerging bees were 9+5, 17+4 and 6+4 percent in the single application Amrine treatment, and partial Formic acid and Miteaway II pad treatments respectively indicating that a single application of the Armine treatment would not provide effective of varroa under conditions found on the Canadian prairies. At 14 days after treatment began (only after 2 pour-on treatments and a partial Miteaway II pad treatment) the infestation level on adult bees was lowest in the Mite Away II pad treatments, followed by the pour-on and Amrine treatments. A second Amrine application was applied and mite levels were monitored throughout the summer. Mite levels remained lowest in the Mite Away II pad treatments throughout the summer although differences in mite infestation did not differ between treatments. Queen supersedure rates were higher in Amrine (two applications) treatment 20% than in the pour-on formic acid 10%, MiteAway II, 12% or control 10% treatments. Beekeepers using the Amrine pad would have to be prepared to replace more queens than in the other treatments. Honey bee healthy used in combination with the Amrine pad is reported to reduce the rate of queen loss but we did not compare Amrine pads with and without Honey Bee Healthy so we cannot comment on whether this was effective or not.

References:

Osteen, C. 1993. Pesticide use trends and issues in the United States. In Pimentel, D. And H. Lehman (eds.), The Pesticide Question: Environment, Economics and Ethics. Chapman and Hall, Inc., New York, New York, USA Pp. 307-336.

Currie, R.W., and P. Gatien. 2006. Timing acaricide treatments to prevent Varroa destructor (Acari: Varroidae) from causing economic damage to honey bee colonies. Canadian Entomologist 138:238-252.

Underwood, Robyn M., and Robert W. Currie. 2007. Effects of release pattern and room ventilation on survival of varroa mites and queens during indoor winter fumigation of honey bee colonies with formic acid. Canadian Entomologist 139:1-13.

Kozak, Paul R., and Robert W. Currie. 2009. The impact of modified atmospheres on infestations of Varroa destructor in clusters of honey bees (Hymenoptera: Apidae). Journal of Economic Entomology. Submitted Aug 28, 2008

Amrine, J.W. and B. Noel. 2006. Formic acid fumigator for controlling varroa mites in honey bee hives. International Journal of Acarology. 32(2):115-124.

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The Saskatraz Project: Selection of productive honey bee genotypes with tolerance to varroa and tracheal mites and development of molecular markers.

Albert Robertson, Saskatchewan Beekeepers Association, Saskatoon, SK.

The on going objective of this project is to breed gentle, productive honey bee colonies, with tolerance to mites and brood diseases. Attempts are also being made to correlate tolerant phenotypes with microsatellite, single nucleotide pair polymorphisms (SNPs) and protein markers. Honey bee genotypes showing potential mite tolerance and beneficial economic traits have been and continue to be accessed through out the world, as well as from Canadian populations and established at an isolated yard site designated "Saskatraz". Colonies were initially established in June 2004 at the Saskatraz site, after infection with tracheal and varroa mites, and natural selection is being allowed to identify tolerant phenotypes.

In the spring of 2008 both indoor (300) and outdoor (1200) wintered colonies were phenotypically evaluated for wintering ability, varroa and tracheal mite infestations as well as other important economic traits (brood pattern, chalk brood, queen characters, pollen storage, temperament, longevity, etc.). Evaluations began in early May, involving 50 apiaries at Meadow Ridge Enterprises as well as Saskatraz. Six Saskatraz selections (SAT 14, 17, 23, 28, 30, 34) were out crossed by approximately 25 different Saskatchewan beekeepers between 2005 and 2007. About 3500 queen cells and 40 breeder queens from 14 different breeding lines were distributed. In 2008 reselection of 5 lines were returned to the program by 3 different breeders, and approximately 1200 queen cells and twenty breeder queens of 8 new breeding lines (SAT-63, 65, 84, 87, 88, 94, 96 and 98) selected between 2007 and 2008 were released to queen breeders in Saskatchewan, Alberta and Manitoba in 2008.

A thorough evaluation of varroa and tracheal mite population growth was continued in the spring, summer and fall of 2008 at

the Saskatraz Apiary. Twenty-eight colonies were put in to winter in the fall of 2007. Twenty-three colonies survived into the honey flow with no chemical miticide treatments. Colonies were sampled monthly for tracheal mite population growth (Provincial Apiculture Lab, Prince Albert. Sk.) in adult bee populations by collecting 100 to 200 bees per colony. Adult bee populations were also evaluated for varroa population growth analyzing alcohol washes. Varroa population growth in all surviving colonies was also evaluated by natural drop on a weekly basis at Saskatraz by counting sticky boards. In the last 4 summers we only looked occasionally at varroa reproduction in sealed colony brood; however, we have found this is the most important assay. The varroa mite reproduces in the bee worker and drone brood. Some colonies were found to suppress varroa reproduction in the brood in general and others were found to reduce the number of reproductive varroa per cell. These selection parameters were added in 2008 for new selections. Honey production was measured between July and September and selections were made on the basis of honey production and varroa population growth (adults and brood). The following selections were made in 2008 (SAT 63, 65, 84, 86, 87, 88, 96, 98). SAT 65 and 84 showed excellent suppression of varroa population growth and all colonies except SAT 84 showed above yard average honey production (332 lbs/hive). Selected colonies showed the following honey production for 2008: SAT 63= 483 lbs; SAT 65= 415 lbs; SAT 84= 273 lbs; SAT 86= 379 lbs; SAT 87= 359 lbs; SAT 88= 340 lbs; SAT 96= 486 lbs.

Analyses of varroa population growth by natural drop indicated that SAT 65, 76, 78, 84, and 93 showed the lowest varroa population from May to September 30, 2008. This data agreed with the alcohol wash data collected by sampling adult bee populations. SAT 76, 78, and 93 were removed from the selections because of poor honey production. Natural drop analyses showed SAT 90 and 91 had the highest varroa population growth, SAT 90 dying in early September. Further selections were made by extensive analyses of worker brood (100 cells/time period) for selected colonies between July and Sept 2008, and for all colonies on September 16, 2008. Per cent cell infestation was 16 per cent for SAT 84, and SAT 65, where as some sensitive colonies had up to 92% of their brood cells infested (SAT 94). Analyses of the total number of varroa per brood cell indicated SAT 84 was the lowest at 2.1 varroa per cell and the greatest infestation was in SAT 94 at 8.5 varroa per cell. A detailed investigation on the health of the pre-emergent pupae in cells infested with varroa has been initiated. We have found pupae heavily infected with varroa are showing morphological anomalies including shorter abdomen, deformed wings and many appear to die quickly on emergence or prior to emergence. Hundreds of samples have been preserved for morphological analyses by light microscopy. In addition 200 samples have been collected and stored in liquid nitrogen for molecular analyses (PCR, RT-PCR, proteomics) by GenServe Laboratories, SRC.

In the spring of 2008 an intensive effort was launched to select outcrosses of previous Saskatraz breeding lines and to establish these colonies at an isolated yard site for closed population mating with new Saskatraz selections. The purpose of this project was to preserve the genetics selected since 1992 at Meadow Ridge and by the Saskatraz Project since 2004. Honeybee semen and embryos cannot be successfully cryopreserved for any substantial period of time; therefore, queen lines must be maintained and reselections (recurrent selection) must be continually maintained. We now have 48 colonies reselected in 2008 at a new Saskatraz yard designated Saskatraz ECP. This yard will be maintained under standard commercial honey production procedures and will not only serve for progeny analyses on the heritability of honey production and varroa and tracheal mite suppression, but as a source of elite drones for crossing with new Saskatraz selections obtained by natural selections at Saskatraz. The queens mated at Saskatraz ECP will serve as breeder queens for commercial queen breeders and for further research.
In the spring of 2007 we discovered colonies showing characteristics of Colony Collapse Disorder (CCD) at Saskatraz. CCD is a serious worldwide threat to the survival of domestic honey bees, considered to be responsible for one third of the world's food supply because of pollination. Saskatraz is unique in that it was established with a diverse genetic base, all colonies were infected with both varroa and tracheal mites, the bees are not moved, no chemicals were used and all colonies were subjected to detailed analyses over a four year period. We continue to perform post-mortem analyzes on dead bees and pupae from these colonies. We are currently evaluating these bees for the presence of viral and trypanosome like parasites, using information published in Science Express (Cox-Foster et al. 2007 A Metagenomic Survey of Microbes in Honey Bee Colony Collapse Disorder. Science Express 00I: 10. 1126 Science 1146498).

The evidence collected at Saskatraz over the past five years suggests that the stress imposed by varroa and/or tracheal mites may cause CCD. The honeybee and varroa mite samples collected over the past five years at Saskatraz should shed light on this phenomenon. This work is being done in collaboration with GenServe Labs at the Saskatchewan Research Council in Saskatoon who have the equipment and technical expertise to perform these assays. Saskatraz honey bee and varroa samples collected from both selected breeders and control colonies evaluated between 2004 and 2008 are being extracted and subjected to Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR) and PCR reactions to assay the presence of honey bee pathogens and will focus on the pathogen history of Saskatraz colonies dying with CCD symptoms in 2007 and 2008. Procedures are following those published in (Cox-Foster, et al. 2007; Ibid) and will use the DNA primer sequences published to assay for Nosema spp and the honey bee viruses, Israeli Acute Paralysis Virus (IAPV), Chronic Bee Paralyses Virus (CBPV), SacBrood Virus (SBV), Deformed Wing Virus (DWV), Black Queen Cell Virus (BQCV) and Kashmur Bee Virus (KBV). All of these primers have been synthesized and used to screen DNA from the following samples: SAT-04, SAT-34, Ger-25, Russ-1, CDN 2, and varroa. SAT-04 was a non-selected colony sensitive to varroa, SAT-34 showed varroa tolerance, Ger-25 was DNA from drone semen from a German selection for varroa tolerance imported in 2005, Russ-1 was a blue 40 Russian line imported as embryos from USDA, Baton Rouge, La.; CDN 2 was a Canadian selection from Meadow Ridge Enterprises Ltd, sampled in 2003 and varroa DNA was obtained from varroa collected at Saskatraz in 2006. *A. Mellifera* actin (bee muscle) was used as a control. Positive signals were obtained for BQCV in SAT-04, 34, and Russ-1; for CBPV in all samples but Russ-1 and varroa; for DWV in all but SAT-04 and varroa; for Entomophthorales (fungus) in all samples except varroa DNA; for IAPV-1 in all samples but varroa; for KBV-1 in all DNA samples

but varroa, for Trypanosomatidae in all samples but varroa; for *Nosema Apis* and *Ceranae*, in all samples but varroa DNA; for SBV in all DNA samples but varroa, and for IAPV in all DNA samples but varroa. No clear signals were obtained for IAPV-2; KBV-2; or ABPV. A positive signal was detected for a varroa marker in SAT-04 DNA, but results in the other samples were not clear. These observations suggest that viral DNA sequences exist for IAPV-1 in genomic DNA from all honey bee lines tested since 2002. We set out to test the hypothesis that some pathogenic honey bee viruses (i.e. IAPV-1) exist in the honey bee genome and stress (such as varroa infestation) may induce the expression of the RNA form, which is the pathogenic entity. Therefore, these viruses may be retroviruses and exist in latent forms in the honeybee genome.

This spring and summer RNA isolation and RT-PCR procedures were performed at GenServe Labs, SRC on the same samples listed above as well as samples of pupae collected at Saskatraz in the spring of 2007. Adult bees and pupae from dead Saskatraz colonies were sampled, RNA extracted and RT-PCR procedures performed for IAPV with a 586 base primer received from Dr. Judy Chen, USA. A positive signal was obtained in a 17 day old pupae with severe varroa infection. We have now collected a new set of pupae in 2008 showing symptoms of DWV, supporting our hypothesis. These samples will be analysed in 2008-2009.

After five years of selections for honey production and varroa tolerance we have identified 14 lines with good honey production and varroa tolerance (SAT-34, 65 and 84). We have also identified at least 6 lines (SAT 04, 06, 24, 90, 91, 94), which show extreme sensitivity to varroa population growth. We expect to obtain definitive molecular markers (microsatellites, SNPs and proteins) for varroa tolerance from these lines in the next year.

Integrated Management of Nosema & Detection of Antibiotic Residues CBRF Progress Report 2008

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During 2008, we commenced the first year of our nosema project, making significant progress towards our objectives. First, a large spring field study was conducted which examined alternative formulations and dosaging of fumagillin, coupled with analyses for fumagillin residues in honey. A second field study was also started which assessed the efficacy of fumagillin treatments for wintering colonies. We also attempted to determine the seasonal abundance of *N. ceranae* in Canada by analyzing samples from cooperating producers, collected throughout the field season. Finally, we screened a wide range of alternative compounds for the control of *nosema* using incubator cage trials.

A. Developing Optimal Application Methods for Fumagillin

Spring 2008 Nosema Efficacy and Residue Study

Objective:
To evaluate optimal dosing and formulation combinations for applying fumagillin to package bee colonies in the spring, and to examine residual effects of fumagillin deposition into honey. This information will be vital for devising a strategy to control *N. ceranae* in the spring and avoid contaminating honey.

Methods:
Nosema Treatment Efficacy
An apiary site was established at the Mountain Trail facility of Agriculture and Agri-Food Canada Research Farm in Beaverlodge, AB. Colonies used in the experiment were established from 1 kg package bees imported from New Zealand, being hived on 26 April 2008. Eighty-eight packages were housed in full-depth Langstroth hive bodies and were maintained as single brood chamber colonies for the duration of the experiment. Frames in the centre of brood nests used to hive packages were previously irradiated, with peripheral frames obtained from disease-free honey supers. At the time of hiving, 30 adult bees were sampled from each package for the detection of inherent *Nosema* spore densities, using standard light microscopic techniques.

Nine days after establishment, colonies were inspected to ensure queens were laying and to ensure that colonies were of even strength. Colonies retained their New Zealand queens as provided in packages and were replaced with unselected stock in the event of mortality.

Eighteen days after establishment, all colonies to be treated were inoculated by drenching with 200 mL of 1:1 (v:v) sucrose solution in which 1 × 108 viable *N. ceranae* spores were suspended. These spores were derived from freshly killed and macerated live bees which had previously been determined to be infected with high levels of *N. ceranae*, confirmed by PCR techniques by our collaborators at USDA Beltsville.

Eleven treatments were used in the experiment, each with 8 replicate colonies. One treatment, established to be free of nosema, served as an uninoculated, untreated control while a second control treatment was inoculated with *N. ceranae* but was not treated. The remaining nine inoculated treatments were treated with Fumagilin-B (Medivet Pharmaceuticals, High River, AB) (DIN 02231180) formulated in syrup, sugar dustings and pollen patties. The total amount of active ingredient (a.i.) applied over two successive, weekly applications corresponded to 0.5, 1 and 2x label dose rates (95 mg) for package colonies. Syrup treatments were applied in each of two - 2 L 1:1 (v:v) sucrose solutions, while dusting treatments were applied in two applications of 20 g of icing sugar. Pollen patties (100 g) were composed of a base (by weight) of 40% pollen, 20% soy flour and 40% sucrose syrup 1:1 (v:v). Each patty contained half of the total treatment dose.

Treatments were applied 27 days after establishment with the second (final) application of treatments occurring six days later. The amount of treatment materials remaining in colonies was visually estimated (sugar dustings) or weighed (pollen patties) each week, until fully consumed.

All bee colonies were sampled for adult bees for the determination of nosema spore levels at weekly intervals (6 weeks), then bi-weekly until 22 Aug 08. Thirty foragers were collected from the hive entrance or, if the weather was inclement, from the inner cover. Collections took place during early afternoon periods, and bees were placed in 50 mL centrifuge vials containing 70% ethanol.

Colony strength was evaluated by estimating the area of adult bees, as well as sealed and unsealed brood, using a plexiglass grid with 2.5 x 2.5 cm divisions. Colony assessments were made the day prior to the second treatment application, at the end of June and at the end of August.

Two control colonies were maintained on a scale and weight loss or gain was recorded twice a week throughout the experiment. Supers were weighed and net honey production recorded for each colony at the time of extraction.

Antibiotic Residues

Five replicate colonies were sampled per treatment for residues. For residue determination, 15g of newly-deposited honey was collected using a sterile wooden splint. Honey was representatively sampled across several frames in the brood nest of each colony and placed in opaque plastic containers with lids. Samples were drawn starting 7 days after the last treatment application, and continued weekly for four weeks. Thereafter, sampling continued biweekly until the end of July. When honey supers were placed on colonies, two samples were collected, one from the brood nest and one from the honey supers. Immediately after being drawn, samples were temporarily stored in an enclosed cooler with dry ice. When returned to the lab, samples were held at -20° C, or colder, until analyzed. Shipping of samples to our collaborators at the AAFRD Agri-Food Laboratories Branch was also done on dry ice.

Representative samples of bulk treatment batches on each of the two treatment dates were also retained to verify initial concentrations of fumagillin in syrup.

For analysis, fumagillin residues were concentrated and purified by solid phase extraction of diluted honey samples and then analyzed by reversed-phase HPLC with electrospray ionization tandem mass spectrometry.

Results and Discussion:

Nosema Treatment Efficacy

Preliminary conclusions can be made regarding nosema inoculations of colonies from this experiment, and the effectiveness of fumagillin treatments. First, initial samples of spore levels from the New Zealand package bees were exceedingly low, with almost no detectable spores found in any sample. After applying our nosema spore suspensions on 14 May 08, infections rapidly established by 20 May in all treatments (Fig.1). It is of interest to learn that even though three previous PCR analyses of spores used to infect experimental colonies were positive for the presence of *N. ceranae* only, samples from the experimentally infected colonies on 20 May proved to contain both *N. ceranae* and *N. apis*.

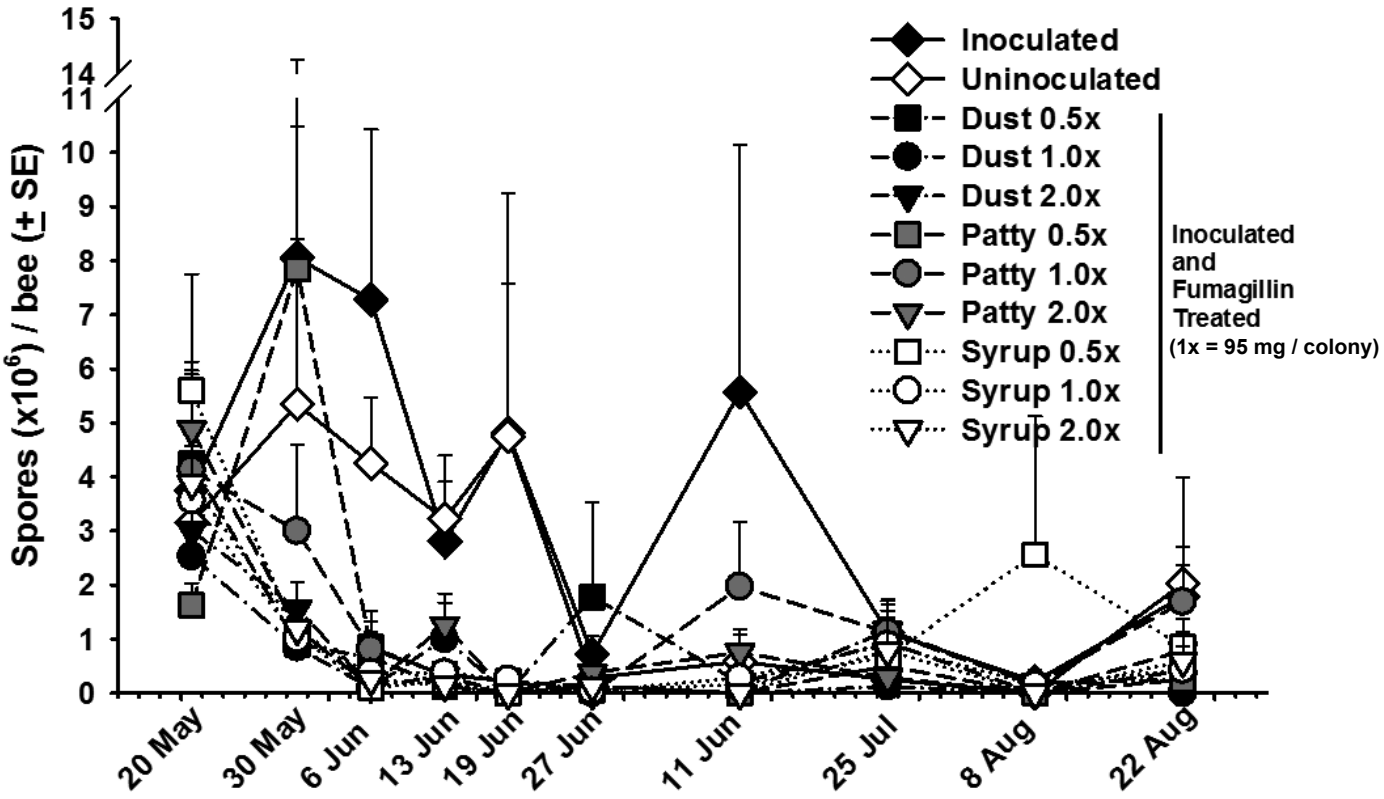

Figure 1. Mean number of nosema spores per bee from spring applied treatments for package bees, established 26 April 2008 (n = 8 colonies / treatment). Multiples of label dose rate of fumagillin (0.5, 1.0, 2.0x) refer to cumulative dose applied over two successive dates (23, 29 May). (Dust = Icing sugar dustings; Patty = pollen patties; Syrup = Sucrose syrup).

After application of treatments on the 30 May, spore levels were observed to rapidly decrease with the exception of the unmedicated treatments and the lowest dosages of the patty treatments. The latter may suggest that higher dosages of fumagillin are needed for early season disease suppression when administered in patties, or that suppression using patties is slower to occur than with other methods. Also of interest was the fact that the uninoculated control treatments appear to have moderate spore levels on the same date, despite having non-detectable spore levels at the beginning of the experiment. Though unexpected, this could suggest transfer of the disease by drifting foragers, the unexpected contamination of spores from comb used to stock this treatment or insensitivity of our sampling technique in determining pre-inoculation nosema levels. Nevertheless, this result does not preclude our ability to assess the efficacy of fumagillin treatments.

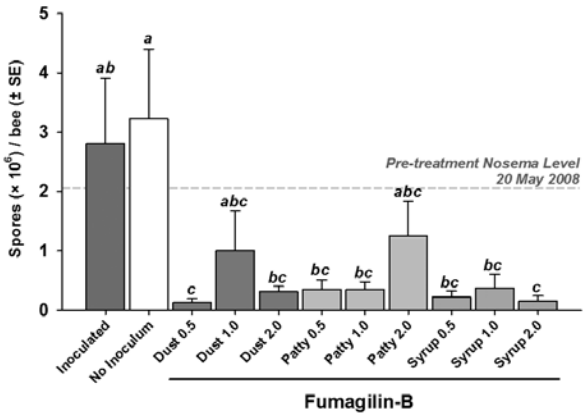

Figure 2. Mean number of nosema spores per bee from spring applied treatments for package bees, on 13 June 2008 (n = 8 colonies / treatment). For treatment descriptions, refer to Fig. 1. (Tukey-Kramer HSD comparisons for square root transformed data, raw data plotted; $\alpha = 0.05$).

In Figure 2, we see a detailed profile of specific treatments on 13 June. On this date, spore levels in all treatments were reduced compared with that of the controls and with pre-treatment levels on 20 May. Statistical separation of the 1.0x Dusting and 2.0x Patty treatments from the control treatments was not possible on this date, because of high within-treatment variance. Nevertheless, early indications would suggest that even half-label doses of fumagillin have the potential to suppress nosema spp. mixtures in the spring, irrespective of the delivery vehicle.

The general trend in spore reduction across fumagillin treatments continued for the remainder of the experimental period (Fig. 1), and appears to have protected colonies from excessive nosema build-up or spikes in population. Some individual treatments, on specific dates, were observed to have elevated spore counts, however these were transitory, and typically related to an elevated count within a single colony in the treatment. Mean nosema spore densities in treated colonies were lower than for the untreated colonies on the last sampling date, 22 August, for all but the 1x patty treatment.

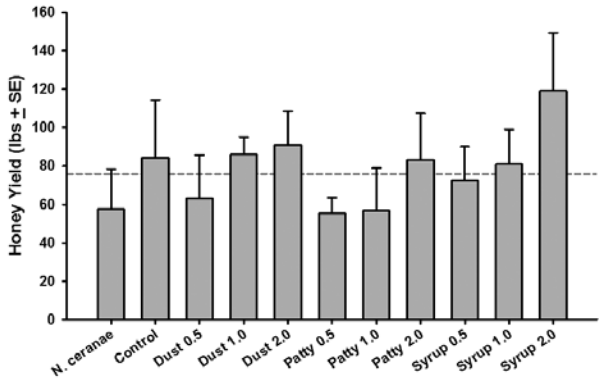

Figure 3. Mean honey production per colony for treatments in spring nosema package efficacy experiment 2008 (n = 8 colonies / treatment). Dashed line represents overall mean. For treatment descriptions, refer to Fig. 1.

In Figure 3, honey production from treatments in the spring fumgillin efficacy experiment is presented. In gross terms, higher levels of honey production are seen in treatments with higher doses of fumagillin, however no statistical separation can be made. Because honey production is a colony-level factor influenced by many variables, this separation might only be seen if the level of replication in the experiment was significantly increased. Honey production is known to be influenced by inherent infection levels for *N. apis*. As such, correlations between honey production and spore levels at different times in the season will be further examined, now that data from all sampling dates is available.

During 2008, two studies were been published supporting the efficacy of fumagillin in syrup applications. The first by Higes et al. (2008) shows that a total of 120 mg. a.i., applied as four successive applications in 250 mL of sucrose syrup, is effective at suppressing *N. ceranae* infections in Spain for a period of six months, after which time reinfection occurs. The other, a study of Nova Scotia commercial beekeepers by Williams et al. (2008), shows general suppression of N. ceranae spore levels among apiaries in the spring, compared with untreated apiaries, subsequent to label dose treatments of fumagillin the previous fall. Though spring-time reductions in infection levels were seen, these results also showed high variability among apiaries and loss of suppressive effects by summer. Collectively, the data from these studies and our work are supportive of the control of *N. ceranae* with fumagillin. It is anticipated that our project, when complete, will provide comprehensive information on the management of nosema with fumagillin and other chemotherapies.

Antibiotic Residues

At this point in time, fumagillin residue LC-MS/MS methodologies are being developed by our collaborators at the Alberta Provincial Agri-Food Laboratories Branch in Edmonton. After this development is complete, residues of fumagillin and its degradation products in honey can be determined. We anticipate these data will not be available until the spring or summer of 2009.

Fall 2008 Nosema Efficacy Study

Objective:
To evaluate optimal dosing and formulation combinations for applying fumagillin to full-size colonies in the fall, prepared for outdoor wintering.

Methods:
This experiment was conducted using full-sized colonies occupying two brood chambers. Methods employed were similar to those in the spring efficacy experiment. As such, only a brief description of methods will be provided.

Colonies available for the study were screened for nosema infections during the first week of September 2008. All colonies used in the experiment were initially determined to be free of any infection. Colonies were infected from 1 - 3 October by applying 87 million spores per colony in 250 mL of 2 M sucrose syrup, dribbled onto the brood nest frames.

A total of 48 colonies were selected for the experiment which had 4 treatments, each with 12 replicate colonies. One treatment served as an inoculated, untreated control, while the remaining three treatments were treated with fumgillin at normal label rate doses for fall (190 mg a.i. per colony), either in bulk syrup, icing sugar dustings or as a limited volume syrup drench. Bulk syrup treatments were applied in 8 L of syrup, as per normal fall feeding. Icing sugar dustings were administered using one application of 20 g of icing sugar while syrup drenches used a single application of 250 mL of syrup poured over the brood nest. All syrups consisted of 2 M sucrose solution. Treatments were applied one day after colony inoculation.

Colonies were sampled for older bees from the periphery of the brood nest, immediately before treatment application, and at two and four week intervals thereafter. Colonies will be sampled biweekly after being unwrapped from wintering, until late August 2009.

Results:
At the present time, samples from this experiment are being processed and spring sampling has not yet occurred. We anticipate presenting these data at Beekeeping Industry Meetings in2009.

B. Screening Alternative Therapies for The Control Of *Nosema* spp.

Objective:
To broadly screen alternative chemotherapies for control of *N. apis* and *N. ceranae* using incubator-based cage trials.

Methods:
An incubator-based bioassay was developed to screen multiple compounds over a wide dose range to against both *N. apis* and *N. ceranae*. To accomplish this, one-hole queen cages (C.F. Koehnen & Sons, Glenn, CA) were loaded with 10 newly-emerged worker bees, derived from healthy colonies. Cages were inoculated with spore suspensions of either species of *nosema* and were provided with treatments formulated in candy, ad libitum. Candy was placed in plastic queen cell cups fit into the upper hole of the cages. The candy base was mixed in bulk, composed of 30 g of nulomoline mixed with 100 g of drivert sugar. In turn, the candy was formulated with compounds or commercialized products to be evaluated at precise doses. Bees were incubated in a humidity-controlled incubator set to hold 34±1° C and 70% RH. Two cage screening experiments were conducted during 2008.

Cage Experiment 1:
Newly-emerged bees, collected from four separate colonies, were loaded 10 per cage and inoculated with 100 µL of 1:1 (v:v) sucrose syrup containing 3 million spores per mL of either *N. apis* or *N. ceranae* spores (day 0). Similar inoculations were made over the next two successive days.

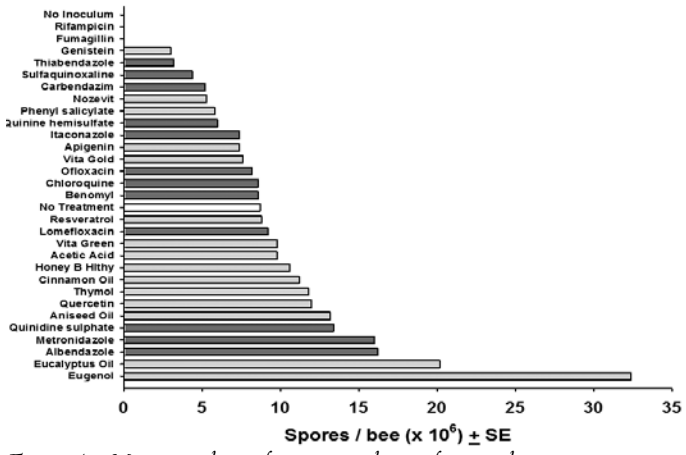

Figure 4. Mean numbers of spores per bee in first antibiotic cage screening trial (n = 4 cages/ dose/ treatment). Dose presented is for the highest dose tested (1 mg/kg for powdered solids and 10 mg/kg for liquid products). Spore counts for surviving bees at day 12 after exposure to N. apis.

Cages containing each species of nosema were provided on day 0 with treated candy-based formulations of 29 compounds or formulated products, listed in Figure 4, or were given unmedicated candy. For compounds that were powdered solids, dosages used were 0.01, 0.1, and 1 mg/kg. In order to achieve an acceptable candy consistency, formulations for liquids (Nozevit, Vita Green, Vita Gold, Acetic Acid, Honey Bee Healthy, Cinnamon Oil, Aniseed Oil, Eucalyptus Oil, Eugenol) were required to be in a higher dose range: 0.1, 1 and 10 mg/kg. Four replicate cages per dose per treatment were used.

The number of dead bees was visually inspected on days 4, 7 and 12. Three live bees were removed from the cages on day 12 and their ventriculi added to 300 ul of water. The ventriculi were macerated and spore levels counted microscopically.

Cage Experiment 2:
Newly-emerged bees were collected from five different colonies and loaded into cages and inoculated as per Cage Experiment #1.

Cages containing each species of nosema were provided on day 0 with treated candy-based formulations of 12 compounds or formulated products, listed in Figure 5, or were given unmedicated candy. These compounds proved to be the best at suppressing nosema infections in Cage Experiment #1, without causing excessive mortality. For compounds that were powdered solids, dosages used were 0.01,

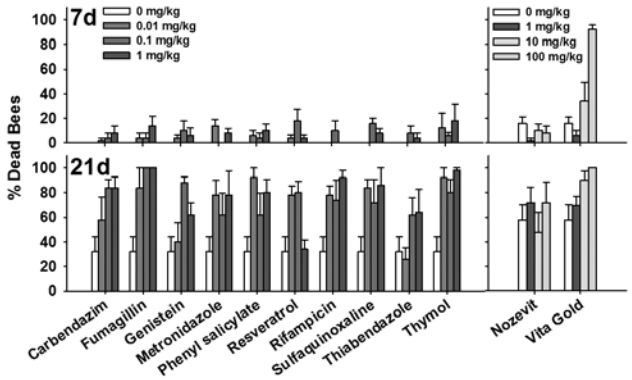

Figure 5. Proportion of dead bees per cage across treatments in second antibiotic cage screening trial on days 7 and 21 after exposure to N. apis (n = 5 cages / dose/ treatment.)

0.1, and 1 mg/kg. In order to achieve an acceptable candy consistency, formulations for liquids (Nozevit, Vita Gold) were required to be in a higher dose range: 1, 10 and 100 mg/kg). Five replicate cages per dose per treatment were used.

The number of dead bees was inspected on day 4, 7, 14 and 21. Three live bees were removed from the cages on day 21 and their ventriculi added to 300 ul of water. Ventriculi were macerated and spore levels counted microscopically.

Results:
Not all samples from this experiment have been fully processed and analyzed. A complete data set for pertaining to *N. apis* is available and is discussed herein.

Representative results for Cage Experiment #1 can be seen in Figure 4, which shows reductions in spore numbers for 29 individual compounds or formulated commercial products tested at the highest dose used in this experiment (1 mg/kg for powders and 10 mg/kg for liquids). These bioassays are useful in broadly screening compounds into three categories: 1. those that suppress spore development; 2. those that do not suppress spore development; and 3. those that very readily kill bees. Of interest are such commercial formulations as Honey Bee Healthy and Vita Green which showed no effective spore reduction, whatsoever. Thymol also proved not to reduce spore levels significantly in this experiment, though other studies have shown some anti-nosema effects. Nevertheless, fumagillin proved to completely suppress spore development at every dose tested. Also highly effective was rifampicin, which is also known to be very effective at suppressing the growth of *Paenibacillus larvae*.

Based on results of this preliminary screen over all doses tested and taking into account all mortality data and other hazardous characteristics of the materials evaluated, 12 of the more promising candidates were run in a second screening. In this experiment bees were sampled for spore reduction after a much longer interval of exposure to nosema and medications.

Figure 5 lists the ten powdered treatments and two liquid commercial products evaluated in the second cage screening experiment.

This figure summarizes mortality at two intervals, day 7 and day 21, the latter being the end point of the experiment. By day 21, most treatments, irrespective of dose had high levels of bee mortality with the exception of thiabendazole, the 0.01 and 1 mg/kg dose of genistein and the 1 mg/kg dose of resveratrol. This period of evaluation may be too long for comparative purposes; in future assays we may wish to terminate the experiment earlier.

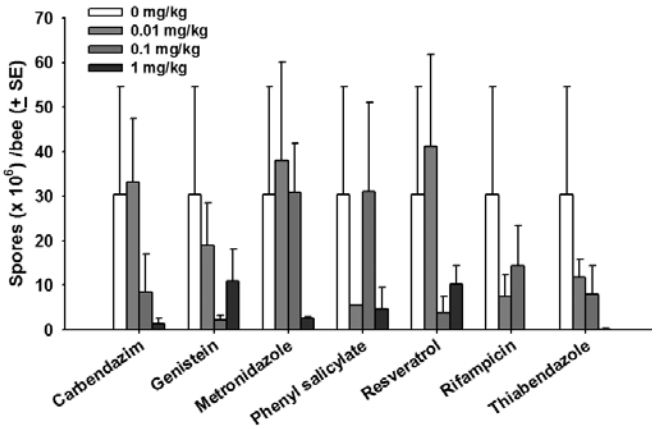

Figure 6. Mean numbers of spores per bee in antibiotic cage screening trials (n = 5 cages / dose/ treatment). Spore counts for surviving bees at day 21 after exposure to N. apis.

Figure 6 lists the most promising candidates based on all screening, taking into account overall mortality and spore reductions at day 21. These compounds are all interesting and most have several other uses. Thiabendazole and carbendazim are fungicides which have long been off patent, and are now carried in the marketplace by generic manufacturers. Both have uses as prophylactic treatments for the control of Dutch Elm Disease. Thiabendazole is also registered for use in Canada as part of an ingredient in a veterinary topical dermatologic solution, and is used in other parts of the world to control mould and blight on fruit. Genistein is an isolflavone found in a number of plants and is primarily isolated from soy. It has demonstrated activity against human microsporidia. Resveratrol is also a plant derivative, a phytoalexin, found in the skin of red grapes. It extends the lifespan of short-lived species of animals and is produced by several plants under attack by bacteria of fungi. It has been shown to have promise against honey bee *N. ceranae* in a recent study (Maistrello et al. 2008). Metronidazole is registered for several human uses in Canada. It is used mainly in the treatment of infections caused by anaerobic bacteria and protozoa. Phenyl salicylate is an intestinal antiseptic, formerly used in sunscreens. It has a registered human use in Canada as part of an oral medication and was shown by White in 1919 be effective against *N. apis*. Rifampicin appears to have no registered uses in Canada but has been used as part of a cocktail drug treatment against tuberculosis.

We will continue to evaluate these and other compounds. Those that show promise will also be examined for their potential for registration in Canada.

C. Nosema Phenology

Objective:
This project will survey the seasonal occurrence of *N. ceranae* and *N. apis* across different regions in Canada. A more complete understanding of the seasonal occurrence of these two species will help in formulating a more effective strategy for managing both nosema species.

Methods:
With the assistance of provincial extension personnel, we identified cooperating producers (1 BC, 4 AB, 1 SK, 3 MB, 3 ON) with *N. ceranae* in their operations. These beekeepers agreed to sample apiaries on a biweekly basis from April until October in 2008. For beekeepers sampling a small number of colonies, 50 foragers were sampled per colony. In situations were larger apiaries are sampled, a minimum of 10 foragers per colony were sampled. Samples were placed in isopropyl alcohol for preservation.

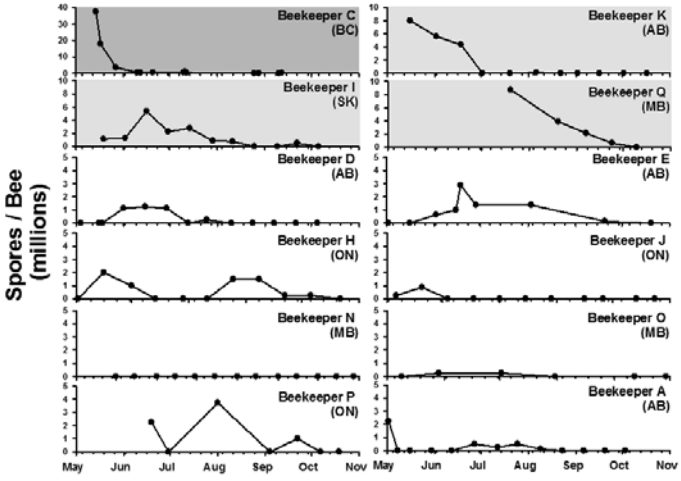

Figure 7. Temporal patterns of N. ceranae infections sampled from commercial apiaries in five Canadian provinces. Graphs with different coloured backgrounds are plotted against different Y-axis scales.

Results:
Groups of 2008 samples were received by our laboratory and spore counts per bee were determined via microscopic methods for each sampling date. Figure 7 illustrates the results of these counts. Though no one, distinct, pattern is observed from these samples, these preliminary data indicate that *N. ceranae* can be detected in mid-summer months, in some cases at high levels. High mid-summer spore counts are not typical with *N. apis*. As such, if build-up and honey production in colonies appears to be suspect, sampling for *N. ceranae* in mid-summer may be advised. The possibility of high *N. ceranae* infections during mid-summer also emphasizes the need for active management of this disease during the spring.

Further phenological sampling will occur in 2009. In addition, more detailed examination of the nosema species compositions of samples will take place.

D. Project Personnel:

In addition to the PI and project collaborators, two summer students were hired to assist with this project and maintain honey bee colonies. These were Julian Camsell, a recent high school graduate with aspirations in the field of biology, and Kelly Camsell, a postsecondary student having completed first year biology at Grande Prairie Regional College.

The PI will also co-supervise a new Ph.D. student, Mr. Johan van den Heever, who will commence his graduate tenure in January of 2009. Mr. van den Heever will be responsible for much of the technique development for LC-MS/MS residue detection of fumagillin and its degradation products in honey, as well as residue determination for experimental samples.

The hiring of a postdoctoral fellow was delayed because of restrictions in the use of AAFC MII matching funding, only made known to the PI in late spring of 2008. Because there was little time to restructure budgets or attract alternate personnel (such as a Ph.D. student) the PI deferred the matching finding for one year, to start in April of 2009. This will not reduce the matching funding available for 3 continuous years, unless industry funds fall below committed levels established in 2008.

References Cited:

Higes, M., Martín-Hernández, R., Botías, C., Garrido-Bailón, E., González-Porto, A.V., Barrios, L., del Nozal, M.J., Bernal, J.L., Jiménez, J.J., Palencia, P.G. and Meana, A. 2008. How natural infection by *Nosema ceranae* causes honyebee colony collapse. Environ. Microbiol. 10: 2659-2669.

Maistrello, L., Lodesani, M., Costa, C., Leonardo, F., Marani, G., Caldon, M., Mutinelli, F. and Granato, A. 2008. Screening of natural compounds for the control of nosema disease in honey bees. Apidologie 39: 436-445.

Williams, G.R., Sampson, M.A., Shutler, D. and Rogers, R.E.L. 2008. Does fumagillin control the recently dectected invasive parasite *Nosema ceranae* in western honey bees (*Apis mellifera*)? J. Invertebr. Pathol. 99:342-344.

Canadian Therapeutic Honey: Capturing Market Opportunity by Advancing Research Results

Katrina Brudzynski, Brock University, St. Catharines, Ontario, Canada

Canadian honey producers are confronted with several challenges as a result of global competition for honey market share. This competitive environment allows only for modest profit margins to beekeepers due to a pressure to produce large volumes of high quality honeys at low wholesale prices. To increase the industry profitability new approaches are needed such as diversification of the products and generating new markets.

A new market opportunity emerged recently with a re-discovery of honey health-promoting qualities. Research results conducted mostly on New Zealand Manuka honeys, derived from *Leptospermum spp.*, demonstrated its broad antibacterial activity and led to a development of Manuka honey as a therapeutic agent. The medical use of Manuka honey allowed it to enter a very profitable $4.2 billion wound-healing market.

Question arose whether Canadian honey could follow similar path to active Manuka honey and become an antibacterial agent. Research conducted on over 100 samples of Canadian honeys demonstrated that they possessed antibacterial activity and therefore can be developed into a therapeutic product. However, further advancements of these research results were needed to justify development of Canadian honey for wound-care market, mainly: (a) to identify honey type as the best candidate for Canadian Therapeutic Honey, (b) to demonstrate the antibacterial activity of Canadian honeys against bacteria commonly colonizing wounds and (c) to formulate best practices guidelines for beekeepers interested in the production of Canadian Therapeutic Honeys. This research project was possible thanks to funds received from the Agricultural Adaptation Council, Canadian Bee Research Funds, Bee Maid Honey and Canadian Medicinal Honey Co. Ltd.

The outcomes of this project indicate that Canada produces abundance of honey types with a very good antibacterial activity (MIC 90 ranging from 25% to 6.25% v/v). This fact alone creates a potential for marketing some types of Canadian honeys, such as buckwheat, blueberry and sweet clover varieties, for health-food market and for clinical use.

Importantly however, these well-identified active honeys showed in our project ability to inhibit growth of antibiotic-resistant bacteria isolated from non-healing wounds such as Methicillin-resistant *Staphylococcus aureus* (MRSA) and Vancomycin-resistant *Enterococcus* spp.(VRE) generating the prospect for their future medical uses.

The project showed a need for establishing best practice guidelines for those interested in the production of therapeutic honeys to assure its efficacy, purity and stability/ shelf-life. The results of the project demonstrated that the current practices of honey extraction and processing in temperatures up to 42°C would have some impact on

Le miel thérapeutique canadien: Résultats d'une recherche avancée visant les opportunités du marché

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Les producteurs de miel canadien sont confrontés à plusieurs défis en raison de la concurrence globale sur les parts de marché du miel. Cette compétitivité n'offre qu'une modeste marge de profit aux apiculteurs, et ce, en raison de la pression pour produire de grande quantité de miel de qualité à prix très abordable. De nouvelles approches axées sur la diversification des produits et la création de nouveaux marchés sont nécessaires pour augmenter les marges de profit de l'industrie.

Une nouvelle opportunité a récemment émergé sur le marché grâce à la re-découverte d'un miel aux attributs pro-santé. Les résultats de la recherche effectuée en grande partie sur les Nouveaux miels de la Nouvelle Zélande Manuka, qui dérivent du *Leptospermum*, ont révélé l'étendue de ses propriétés antibactériennes et ont conduit au développement du miel de Manuka employé comme agent thérapeutique. L'utilisation de ce miel a permis de cibler un marché très abordable à des fins médicales, celui de la guérison des blessures, évalué à 4,2 milliards de dollars.

Une question capitale intervient afin de déterminer si le miel canadien peut suivre le même chemin que le miel d'Active Manuka et, ainsi devenir un agent antibactérien. Une recherche effectuée sur une centaine d'échantillons de miels canadiens a démontré que ceux-ci possèdent également des propriétés antibactériennes et peuvent donc devenir des produits thérapeutiques. Cependant, une analyse plus poussée des résultats a été nécessaire pour expliquer le développement du miel canadien sur le marché des soins aux blessés et ce pour : a) identifier les meilleurs candidats du miel thérapeutique canadien, b) démontrer les propriétés antibactériennes des miels canadiens contre la formation des bactéries au niveau des blessures et, c) pour établir de meilleures directives pour les apiculteurs intéressés à la production du miel thérapeutique canadien. Ce projet de recherche a été possible grâce aux fonds reçus du Conseil de l'adaptation Agricole, au Fonds canadien de recherche apicole, au Bee Maid Honey et à la Companie Canadian Medicinal Honey Ltd.

Les résultats de ce projet démontrent que le Canada produit une grande quantité de miel ayant de très bonnes propriétés antibactériennes (un MIC 90 allant de 25% à 6,25% v/v). Ce facteur crée à lui seul une opportunité de mise en marché pour certains types de miel canadien, tel que les variétés de sarrasins, de bleuets et de trèfles des champs, pour le marché sur la nutrition biologique et pour l'emploi médical.

Qui plus est, ces miels ont le potentiel de pouvoir retarder la croissance des bactéries luttant contre les antibiotiques qui sont isolés de tout soin curatif, comme le *Staphylococcus aureus* résistant à la méthicilline (SARM) et l'*entérocoque* résistant à la vancomycine (ERV), et anticipent beaucoup d'espoir pour la médecine de demain.

Ce projet révèle le besoin d'élaborer de meilleurs stratagèmes en faveur d'un public intéressé à la production des miels thérapeutiques afin d'en assurer son efficacité, sa pureté et sa stabilité (c-à-d sa durée

the final antibacterial activity reducing the activity of very active to honeys with the average antibacterial activity.

The eradication of yeast is usually done by heating of honey at 62°C for 15 min. Yeast are completely destroyed at this temperature. Results from our laboratory indicated that this relatively short heating time (15 min) at 62°C (when the internal temperature of honey reached 62°C as indicated by the temperature probe inserted into honey) has been found acceptable since it had a little impact on the antibacterial activity.

Extracted honeys kept in conditions of high humidity absorb water from the environment, increasing their moisture and water activity levels. Water activity is generally defined as free water available for microorganisms to be used for their growth and multiplications. High water activity therefore is responsible for honey fermentation and spoilage.

We have shown in this project that keeping the moisture content of extracted honeys between 0.52 to 0.69 water activity (which translates to 14 – 21% moisture content) was critical for maintaining the high antibacterial activity of honeys. Honeys characterized by low water activity had high antibacterial activities.

Medical-grade honeys for clinical application require purity from microbial contaminations. Two ways of eradication of contaminating microbes were tested in this project: flash heating (72°C for 3 min) and sterilization of honey by UV light. The results showed that honey sterilization by flash-heating was detrimental to the antibacterial activity. The high temperature of flash heating (72°C) completely destroyed the antibacterial activity of honeys. In contrast, sterilization by UV-irradiation did not affected the antibacterial activity at all and prolong shelf-life of active honeys from one day to over 100 days.

In conclusion, the project outcomes present clearly a feasibility of developing Canadian honey, such as buckwheat honey, clover and fresh blueberry honey, into a therapeutic agent. The next important step in this process will be acquiring the regulatory approval for therapeutic honeys from Health Canada.

The novel application of honey as a therapeutic agent opens new markets for this honey: health- food and wound-care market. Market research showed that both markets are growing in a fast pace, with wound-care market projected to reach $5.6 billion by 2009. Entering these markets with Canadian Active Honeys will present an immense benefit to beekeepers at the national level: It presents an opportunity for honey producers to receiving premium prices for this value-added product. It would also provide health-care with a novel antibacterial agent of broad spectrum of action including antibiotic-resistant bacteria.

de conservation). Les résultats du projet révèlent que l'établissement usuel d'extraction et de traitement de miel, à température maximale de 42 °C, a un impact sur l'activité antibactérienne résultante et permet de passer d'une activité antibactérienne très grande à une production de miel modérément active.

L'extirpation de la levure est normalement obtenue en chauffant le miel à 62 °C pendant quinze minutes car c'est à cette température, que les levures sont réduites à néant. Les résultats de notre laboratoire indiquent que ce temps de chauffage de 15 min, qui est relativement court, est acceptable puisqu'une fois que la température interne du miel, indiquée par le thermostat, a atteint 62 °C il n'y a quasiment pas d'impact sur les propriétés antibactériennes.

Les extraits de miel maintenus à l'état de givrage absorbent l'eau environnante, augmentant ainsi le taux d'humidité et d'activité de l'eau. L'activité de l'eau est un terme normalisé employé pour décrire la disponibilité de l'eau dans la croissance et la multiplication des micro-organismes. Ainsi, une augmentation des propriétés de l'eau serait responsable d'une fermentation et de la détérioration du miel.

Grâce au progrès technique établi dans ce projet, on réalise qu'il est indispensable de garder le taux d'humidité des extraits de miel à une activité de l'eau de 0,52 à 0,69 (ou à une teneur d'humidité de 14 – 21 %) afin de maintenir les propriétés antibactériennes à un niveau très élevé. Tout miel à faible teneur d'eau se retrouvera donc avec une activité antibactérienne élevée.

Les catégories du miel médical à usage clinique exigent un assainissement de toute contamination microbienne. Deux façons d'extirper les germes sont examinées dans cette étude : les températures du chauffage Flash (élevées à 72 °C, pendant 3 minutes) et la stérilisation du miel par les rayons UV. Les résultats confirment que la stérilisation du miel par chauffage instantané est nuisible aux propriétés antibactériennes. La température du chauffage Flash (de 72 °C) détruit toute activité antibactérienne dans les miels. En revanche, la stérilisation faite par l'irradiation des UV n'affecte nullement les propriétés antibactériennes et prolonge même la durée de conservation de ces miels d'une journée à plus de 100 jours.

En conclusion, les résultats de l'étude présentent clairement un côté pratique pour le développement du miel canadien comme le miel aux sarrasins, le miel de trèfles et de bleuets frais, en leur permettant d'agir comme des agents thérapeutiques. La prochaine étape qui est cruciale dans ce processus s'obtiendra avec l'approbation de Santé Canada sur la normalisation des miels thérapeutiques.

La nouvelle utilisation du miel comme agent thérapeutique ouvre les portes du marché des produits de santé naturels et des soins de plaies. L'étude effectuée sur ces deux marchés présente des opportunités sans cesse grandissantes dans le domaine des soins-curatifs et devrait atteindre 5,6 milliards de dollars en 2009. Grâce aux propriétés des miels canadiens, les apiculteurs auront un énorme avantage au niveau national en accédant à ces marchés. C'est une occasion en or pour les producteurs de miel qui recevront de fortes sommes pour leur produit. Cela permettra également au domaine de la santé d'avoir un nouvel agent antibactérien possédant un grand éventail d'antibiotiques qui peuvent résister aux bactéries.

Canadian Honey Council - General Fund

Calgary, Alberta
Statement of Financial Position as at October 31, 2008
(Unaudited)

	2008	2007
Assets		
Current Assets		
Cash and cash equivalents	5,527	(23,974)
Short-term investments	51,091	9,753
Accounts receivable	18,731	
Receivable from project fund	41,000	
Prepaid expenses	431	1,431
	$ 116,780	$(12,790)
Liabilities and Net Assets		
Current Liabilities		
Accounts payable and accrued liabilities - note 5	20,268	3,984
Deferred revenue - note 6	16,122	6,906
	36,390	10,890
Net Assets		
Unappropriated	80,390	(23,680)
	$ 116,780	$(12,790)

Approved on behalf of the board:

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The notes to financial statements are an integral part of these financial statements.

Canadian Honey Council - General Fund

Statement of Changes in Net Assets
For the year ended October 31, 2008
(Unaudited)

	2008	2007
Balance (deficit), beginning of year	(23,680)	19,699
Excess (deficiency) of revenue over expenses for the year	(36,032)	(60,165)
Interfund transfer	103,003	16,786
Transfer to/from reserves	37,099	
Balance (deficit), end of year	$ 80,390	$(23,680)

The notes to financial statements are an integral part of these financial statements.

Canadian Honey Council - General Fund

Statement of Operations
For the year ended October 31, 2008
(Unaudited)

	2008	2007
Revenue		
Memberships	70,107	45,551
Director fees	68,250	32,000
Project administration fee	15,000	22,824
Hivelights	21,914	21,973
Annual general meeting	23,464	6,274
Investment income - note 2(b)	(7,947)	2,572
Promotion materials	8,950	30,813
Sponsorships and donations	6,001	
Website hosting	750	1,760
Other	2,542	3,660
	209,031	167,427
Expenses		
Apimondia committee	1,241	1,773
Awards and donations	175	350
Canadian on Farm Food Safety Program - CBISQT		5,000
Consulting fees	60,927	29,821
Credit card charges	774	638
Delegates	10,044	6,694
Hivelights	31,335	25,948
Honorariums	2,000	2,000
Insurance	1,620	
Interest and bank charges	123	154
Meetings	27,812	147
Office	10,407	6,031
Oxalic acid registration	1,958	
Professional fees	2,825	4,063
Promotion expenses - general	8,349	
Project to Promote Consumption of Canadian Honey		61,253
Rent - office	6,596	5,908
Telephone	4,055	2,384
Travel - employees	10,281	8,391
Wages and benefits	64,541	67,037
	245,063	227,592
Excess (Deficiency) of Revenue Over Expenses for the Year	$(36,032)	$(60,165)

The notes to financial statements are an integral part of these financial statements.

Canadian Honey Council - General Fund

Statement of Cash Flows
For the year ended October 31, 2008
(Unaudited)

	2008	2007
Cash Provided By (Used In):		
Operations		
Excess (deficiency) of revenue over expenses for the year	(36,032)	(60,165)
Add items not requiring cash resources		
Market value adjustments on held-for-trading investments	13,343	
Net change in working capital	(33,230)	6,362
	(55,919)	(53,803)
Investing activities		
Additions to short-term investments	(65,396)	(2,572)
Proceeds on disposal of short-term investments	80,500	30,000
	15,104	27,428
Interfund transfers	70,316	16,786
Net Cash Increase (Decrease) for the Year	29,501	(9,589)
Cash position, beginning of year	(23,974)	(14,385)
Cash Position, End of Year	$ 5,527	$(23,974)
Represented By:		
Cash and cash equivalents	$ 5,527	$(23,974)
Net change in working capital consists of:		
Decrease (increase) - accounts receivable	(18,731)	
- prepaid expenses	1,000	5,762
- other current assets	(41,000)	
Increase (decrease) - accounts payable and accrued liabilities	16,285	847
- other current liabilities	9,216	(247)
	$(33,230)	$ 6,362

The notes to financial statements are an integral part of these financial statements.

4. **Capital Disclosure**

The organization manages its General Fund capital with the goals of maintaining a responsible financial position allowing it to meet its goals and obligations. Capital consists of cash, short-term investments and net assets.

	2008	2007
5. **Accounts Payable and Accrued Liabilities**		
Accounts payable and accrued liabilities are comprised of the following items:		
Accounts payable	15,125	2,898
Payroll deductions payable	5,143	1,086
	$ 20,268	$ 3,984
6. **Deferred Revenue**		
Prepaid Hivelights advertising	8,622	6,906
Prepaid memberships and director fees	7,500	
	$ 16,122	$ 6,906

Production and Value of Honey

Statistics Canada

	Beekeepers[1]	Colonies[1]	Honey		
			Production[2] of honey, total	Production[2] of honey, total	Value[4] of honey, total
	number		thousands of pounds	metric tonnes	thousands of dollars
Canada[3]					
Average 2003 to 2007	7,843	598,883	81,477	36,968	107,284
2007	7,313 r	589,254 r	69,402 r	31,489 r	84,916
2008 p	7,059	585,441	61,958	28,112	..
Prince Edward Island					
Average 2003 to 2007	25	2,090	110	50	227
2007	13	3,641 r	236 r	107 r	519
2008 p	15	4,267	277	126	..
Nova Scotia					
Average 2003 to 2007	333	18,856	715	325	1,301
2007	215 r	18,500 r	600 r	272 r	900
2008 p	225	19,000	600	272	..
New Brunswick					
Average 2003 to 2007	226	5,520	221	100	325
2007	223	3,440 r	123 r	56 r	124
2008 p	225	1,800	107	49	..
Quebec					
Average 2003 to 2007	235	30,181	2,606	1,182	5,534
2007	248 r	31,824 r	2,260 r	1,025 r	6,133
2008 p	250	33,800	2,603	1,181	..
Ontario					
Average 2003 to 2007	2,520	74,480	7,884	3,577	13,409
2007	2,300	76,700	5,968 r	2,708 r	9,354
2008 p	2,200	80,000	5,353	2,429	..
Manitoba					
Average 2003 to 2007	599	81,600	14,016	6,359	17,013
2007	632	77,500	12,400	5,626	12,100
2008 p	533	75,000	12,000	5,445	..
Saskatchewan					
Average 2003 to 2007	1,104	99,000	18,825	8,541	24,054
2007	1,049 r	95,000	16,625	7,543	19,950
2008 p	1,045	95,000	17,480	7,931	..
Alberta					
Average 2003 to 2007	727	242,200	33,770	15,322	42,946
2007	726 r	237,000 r	28,914 r	13,119 r	29,627
2008 p	700	240,000	21,600	9,800	..
British Columbia					
Average 2003 to 2007	2,073	44,956	3,330	1,511	8,439
2007	1,907 r	45,649 r	2,276 r	1,033 r	6,209
2008 p	1,866	36,574	1,938	879	..

1. Beekeeper and colony numbers include pollinators that may not extract honey.
2. Production excludes inventory.
3. Does not include Newfoundland and Labrador.
4. Value excludes inventory sales except for in Québec.

Note(s): Figures are compiled by Statistics Canada from provincial data, except for New Brunswick and Prince Edward Island where data are collected through a Statistics Canada mail survey.

Next Canadian Honey Council Annual Meeting
will be the North American Beekeeping Conference
held jointly with
the Canadian Association of Professional Apiculturists
and the
American Beekeeping Federation

January 12th to 16th 2010

Location is the Wyhdham Orlando Resort, in the heart of Orlando's Tourist Attractions.

More information at www.honeycouncil.ca