



Innovation *EXPRESS*

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Canada Presents Biodiversity Expertise to the United Nations

Scientists believe that there are over 13 million species on the earth, and biodiversity – the variety of life on earth – includes even the tiniest genetic variations within these species. Researchers across the globe are working together to understand biodiversity, and the implications human activities have on its future. The delicate and irreplaceable network of plants, animals and insects that has evolved over billions of years of evolution has gained the attention of the United Nations who have declared 2010 the International Year of Biodiversity.

Agriculture and Agri-Food Canada was present during the launch of the international celebration. Dr. André Levesque, a scientist with the National Biological Collections at the Eastern Cereal and Oilseed Research Centre in Ottawa, was invited to share his expertise through a feature presentation at the International Year of Biodiversity Science Policy Conference at the United Nations Educational,

Scientific and Cultural Organization (UNESCO) Headquarters in Paris, France. The January 2010 conference gathered together 250 participants from all continents to present new scientific findings on biodiversity relating to several key themes and issues, and to assess implications for government policy-making.

Dr. Levesque's presentation at the UN conference explored how the sequencing of DNA, the blueprint of life, has created a revolution in taxonomy. Around the world many scientists, including AAFC taxonomists, are working on the DNA Barcode of Life, an international initiative that originated from the University of Guelph, to further develop the routine use of DNA sequencing for identification.

In Canada, scientists with the National Biological Collections have used DNA technology initially pioneered by the medical field to set up a DNA lab in Ottawa. The lab has become critical for rapid, routine and accurate identification of fungal organisms and supports research by other AAFC scientists. This cutting-edge technology is also allowing major advances in a number of agricultural areas such as plant pathology.

For example, take the oomycete family of algae. While this distinct group of fungus-like microorganisms contains some benign or even beneficial species, it also includes some notorious pathogens responsible for devastating diseases such as late blight of potato (the cause of the 1840s potato famine in Ireland and Europe) and sudden oak death. Some of the diseases caused by these pathogens can unleash huge economic damage to important crop species such as potato, tomato and soybean.

By creating a database of the oomycete family, this not only contributes to the Barcode of Life, it also supports pathology research by offering a quick and easy way for scientists to determine whether oomycetes in field samples are a potential threat, benefit, or even a whole new species. ●

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Canada 

Science Helps Safeguard Canada's Agricultural Biodiversity

In keeping with both the United Nation's Convention on Biodiversity and Canada's Biodiversity Strategy, Agriculture and Agri-Food Canada (AAFC) has included sustainable use of biological resources and conservation of biodiversity as key components of its agricultural policies and has included biodiversity as one of the seven priorities in the Science and Innovation Strategy.

AAFC researchers and scientists have contributed significantly to biodiversity through research in plant and animal genetics and the relationship between agriculture and biodiversity. AAFC's National Collections and Plant Gene Resources of Canada help safeguard and promote understanding of the biodiversity of Canadian ecosystems and crops by protecting and preserving Canadian agricultural genetic resources and providing genetic material to Canadian and international scientists.

AAFC has always maintained a solid core of researchers involved in taxonomy, the science of classification of species and is the most important institution in Canada for taxonomy. AAFC scientists can make authoritative identifications of plants, insects, mites, nematodes, fungi, bacteria and viruses and help industry develop technologies to identify pests.

As technology advances, international research efforts into biodiversity and taxonomy will continue to help in early detection of invasive species. With growing world trade, invasive species continue to enter Canada by accident where they compete with local species for resources, prey on local species, alter natural habitat and harm local species that have no foreign disease resistance. Taxonomy research at AAFC continues to support accurate diagnostics of invasive and native pests and pathogens and provides important information to authorities responsible for the security of international trade and commerce.

Agricultural science and innovation, whether at AAFC or with our research partners, has a strong role to play in helping the agricultural sector achieve greater competitiveness, improve environmental performance, increase the security of the agricultural sector and contribute to the health and well-being of Canadians. ●

Marc Fortin, Assistant Deputy Minister, Research Branch, Agriculture and Agri-Food Canada

The focus of work at AAFC: Seven science priorities

AAFC's Science and Innovation Strategy identifies seven strategic science and innovation goals that are aimed at sharpening the sector's competitive edge. The AAFC Science and Innovation Strategic Action Plan delivers on key outcomes associated with each priority, both through *Growing Forward* programming and other science and innovation activities.

The priorities are:

1. Enhancing human health and wellness through food, nutrition and innovative products.
2. Enhancing the quality of food and safety of the food supply.
3. Enhancing the security and protection of the food supply.
4. Enhancing economic benefits for all stakeholders.
5. Enhancing environmental performance of the Canadian agricultural system.
6. Enhancing the understanding of Canadian bioresources and protecting and conserving their genetic diversity.
7. Developing new opportunities for agriculture from bioresources.



Genetic Discovery a Step Toward Fighting Poultry Disease

A major breakthrough by scientists at Agriculture and Agri-Food Canada's (AAFC) Food Research Centre in Guelph, Ontario, the University of Guelph and the University of Arizona has identified the gene clusters likely responsible for necrotic enteritis, a deadly poultry disease, and is bringing the research one step closer to developing effective controls.

Necrotic enteritis (NE) is the most common disease encountered by poultry farmers today and is estimated to cost the international poultry industry US\$2 billion each year. The disease is currently controlled by the prophylactic use of antibiotics, a practice that has now been banned in Europe, which quickly caused a surge in NE cases there. Concerns by the poultry industry that a similar regulation will be implemented in North America have spawned intensified research into this disease, with the ultimate goal of developing alternative control strategies.

NE is caused by *Clostridium perfringens*, a species of bacteria that typically exists as a harmless inhabitant of the gastrointestinal tract. Until recently, it was believed that NE resulted from the production of alpha-toxin (the same toxin responsible for gas gangrene in humans), one of many toxins produced by this bacterium. However, this has been called into question recently and another toxin, NetB, has been implicated.

Further to the discovery of NetB, the scientists from AAFC, the University of Guelph and the University of Arizona had identified a set

of approximately 30 genes in NE-causing isolates of *C. perfringens* through a comparative genomic approach. These genes are divided into three major clusters, the largest of which also includes the NetB toxin.

Surprisingly, two of these clusters are located on plasmids, small segments of DNA that can be easily transferred from one bacterium to another. These findings suggest that NE is caused by a number of genes that work together to generate the disease, as opposed to just one toxin, and that these genes may be passed on from one *C. perfringens* isolate to another.

This is breaking news in the field and establishes a milestone in NE research. The new discovery will have a significant impact on the direction of future research by influencing the view and thinking of researchers towards the disease and its control. Further identification of the function of these genes and their role in the disease process may lead to novel innovations for controlling NE disease.

The results of the new discovery have been published in a prestigious biological journal, PLoS ONE (2010, Vol 5(5), e10795). The research is funded by Agriculture and Agri-Food Canada, the Ontario Ministry of Food and Rural Affairs, the Poultry Industry Council, the United States Department of Agriculture and Pfizer Animal Health. ●



“Catalogue of Life” to be Master List of all Known Species

There are a lot of species in the world – perhaps as many as 13 million. Classifying them all is quite complex and only a fraction of these have been properly recognized, described and named. So far there is no complete list of all of the named species, making classification even more difficult – but this issue is finally being addressed. Agriculture and Agri-Food Canada (AAFC) is part of an international partnership called the Integrated Taxonomic Information System (ITIS) which aspires to do just that – help catalogue every known living organism in the world.

ITIS is a North American initiative that is working with the global indexing project called Species 2000. Together scientists are building a ‘Catalogue of Life’ that’s aiming to index every identified living species in the entire world – from tiny microbes to giant whales.

The ITIS catalogue will contain scientific names, synonyms, common names and hierarchical classification for land, water, and airborne organisms mainly found in North America from all biological kingdoms – animals, plants, fungi, and microbes.

ITIS is like a dictionary of names and will become an indispensable underlying infrastructure for other value-added

projects that offer the more attractive information such as pictures, identification aids, or references for a species.

ITIS presently has about 600,000 names in its database and by April 2010 the collaboration with Species 2000 will have over 1.2 million species recorded from around the world, and we believe this number will be about 1.8 million when the list is complete.

AAFC is primarily responsible for providing multilingual interfaces for all of the information being put together. Through this, AAFC is facilitating the sharing of biological information among researchers and cooperating agencies globally.

This project- by giving a baseline for species at this point in time – represents a significant contribution to the world’s ability to describe, conserve, and manage biodiversity.

With 250 years of work by taxonomists, there is still no complete list of what is known to exist on our planet. We need to start adequately managing our resources, and to do that, we need to really know what’s out there right now. ●

The National Biological Collections comprise:

- The Canadian National Collection of Insects, Arachnids and Nematodes (CNC), containing over 15 million specimens and one of the five largest collections of its kind in the world;
- The Glomeromycota *in vitro* Collection (GINCO) holding 94 mycorrhiza isolates on plant hosts;
- National Mycological Herbarium (DAOM – Department of Agriculture, Ottawa, Mycology) containing 350 thousand specimens as well as the Canadian Collection of Fungal Cultures (CCFC) – a living fungal collection with over 16 thousand cultures; and the
- AAFC National Vascular Plant Herbarium (DAO – Department of Agriculture, Ottawa) with 1.5 million specimens.
- Scientists are in constant interaction with major collections around the world and collaborate with international scientific organizations which allow reciprocal borrowing of materials between collections.



Taxonomy Triggers Discovery of New Invasive Species

AAFC botanists have a very special tool for discovering plants in disguise - a collection of over 1.5 million plant specimens collected throughout Canada over the last two centuries. The collection has come in handy for detecting many of Canada's invasive plants, notably the highly invasive plant species known as European common reed. The collection is preserved in the National Vascular Plant Herbarium at the Eastern Cereal and Oilseeds Research Centre in Ottawa and is used by scientists in Canada and around the world.

The plant was originally found in Canada in 1910 but was confused with a similar native plant until 2001 when it entered a phase of rapid expansion. The rapidly increasing populations led researchers to discover that the plant was in fact an invasive alien from Europe, mistaken as a native species.

To find out if the plant that was recently spreading along the road was different, it was only necessary to go to the collection and carefully compare the spreading roadside plants with plants collected earlier in remote wetlands.

AAFC botanists analyzed traits with respect to time and habitat and discovered that the plants lacking red colour, having small flowers, and occupying nutrient-rich habitats were invaders. Without the collection of priceless specimens including a time sequence, this discovery would not have been possible.



Take a peek inside Agriculture and Agri-Food Canada's national vascular plant herbarium as part of the science videos on www.agr.gc.ca/scienceandinnovation. The videos are also accessible from the science publication page where you will also find profiles of AAFC research scientists and abstracts of scientific publications.

Following the discovery, AAFC scientists not only studied the introduced species and plotted its movement, but furthered their research to predict future spread of the invader. They estimated that it would enter the Prairie provinces and it was found there within a week! They also warned of impacts on ducks in prairie potholes and interference with water flow in western irrigation districts. These impacts could cost many millions of dollars. Being alerted to the risks now provides a little time to be prepared.

European common reed has become one of the top invasive alien plant species in Canada. Tall, thick reeds reaching to 10 feet, leaves with razor sharp edges, and deeply embedded rhizomes allow this large perennial grass to easily crowd out native plants and take over the natural environment.

It is an aggressive plant that can thoroughly dominate places where it grows, replacing native flora and changing its ability to support traditional fauna. In some regions it has become a serious competitor

of cereal crops. Detecting it early is important for more effective control to prevent extensive damage.

A correct prediction does not, however, denote the end of scientific involvement with this issue. AAFC scientists across Canada are currently working to support the development of monitoring and management strategies. ●



Strategic Approach Keeps Invaders at Bay

Over the years, Agriculture and Agri-Food Canada (AAFC) has developed significant expertise across Canada in finding and developing biological control agents and has helped introduce many natural pest control systems to protect Canadian crops or natural agricultural systems such as rangelands.

First time shipments of biological control organisms such as insects not native to Canada are routed, under permit from the Canadian Food Inspection Agency (CFIA), through the national containment facility at the Eastern Cereal and Oilseeds Research Centre in Ottawa. Here taxonomic experts at the Canadian National Collections (CNC) verify that the correct species is being imported. These scientists may also help the biological control team sort shipped colonies, destroy diseased or parasitized individuals, and select specimens to include in the CNC. The biological control organisms then find their way into research programs across Canada. Those which have not been approved for release are studied under strict quarantine, especially at the facilities at the CNC, and the Research Centre in Lethbridge, Alberta.

At the CNC lab and at research centres across Canada, AAFC scientists are conducting research on candidate biological control agents and finding new ways to naturally control invasive pests.

For example, the cabbage seed pod weevil, an invasive species of European origin, has become a major insect pest of the 5.9 million hectares of canola in Canada, reducing yields by up to 35 per cent. AAFC scientists in London, Ontario; Ottawa, Ontario; St. Jean-sur-Richelieu, Quebec; Lethbridge, Alberta and Agassiz, British Columbia are working together on different aspects of the pest and possible control options

and looking to Europe where natural enemies provide reasonable control of this pest. The Canadian scientists are collaborating with colleagues at CABI (Centre for Agricultural Bioscience International) Europe in Switzerland to study natural enemies that can be introduced to Canada to reduce yield losses in canola and decrease the use of pesticides.

Some invasive weeds, such as Dalmatian toadflax, houndstongue, leafy spurge, and knapweed which occur on rangelands in western Canada are also being controlled with foreign insects, with there being significant successes documented in recent years. Scientists at the Lethbridge Research Centre collaborate with researchers at CABI and Canadian and US universities to study and screen candidate biocontrol insects from Europe prior to petitioning CFIA for their release in Canada.

Determining the host specificity of these insects is critical to the regulatory petitioning process in North America, and the required data are collected both in the insects' places of origin overseas and within the

Lethbridge Research Centre's Insect Microbial Containment Facility. Officially opened in 2006, this internationally lauded, 883 square metre facility includes specialized insect rearing and experimentation areas. It currently houses 10 new insect species being considered as agents against five weeds of primary concern in North America.

Invasive weeds also threaten biodiversity, because they displace native vegetation, the local critters that feed on those plants, and their native pollinators. AAFC scientists are making significant progress towards minimizing the ecological disruption caused by invasive species. ●



Invasive Species Web Portal

In May 2009 the Government of Canada launched an Invasive Species Web Portal as a partnership between various federal departments (see www.invasivespecies.gc.ca). This portal serves as a gateway to information on Canada's efforts to reduce the risks invasive species pose for the environment, economy and society. It provides links to other credible sources on invasive species.



Conservation Meets Innovation in Fields of Flax

With blue, purple, white or pink flowers, brown, yellow, olive or speckled seeds, and plants as short as 17 cm or as tall as 130 cm - the genetic diversity of flax is striking! As the largest producer and exporter of oilseed flax in the world, this genetic diversity is crucial to improving Canadian flax and enhancing future market opportunities. The nutritional qualities of the crop, which is rich in omega-3 fatty acids, dietary fibre, lignans and other antioxidants, have also sparked a renewed interest in using flax to enhance foods and in developing new varieties for specific end-uses.

For the three independent flax breeding programs in Western Canada which develop varieties for different end uses such as fibre, seed or industrial oil, having access to a diverse gene pool is key. Agriculture and Agri-Food Canada's Plant Gene Resources of Canada (PGRC) offers just that - allowing for the development of new lines of flax to meet the needs of the latest farm practices, tap new markets or that are adapted to climate change and disease outbreak.

The PGRC fulfills an international mandate to protect and preserve genetic resources for food and agriculture. On a global scale, the United Nations Food and Agriculture Organization has recognized the importance of protecting and preserving genetic resources for food and agriculture. They work in concert with the Consultative Group on International Agricultural Research (CGIAR), a worldwide network of plant genetic resources centres and the Global Crop Diversity Trust based in Rome, Italy.

In Canada the PGRC preserves over 113,000 seeds samples representing over 1,000 species of plant in a seed genebank at the Saskatoon Research Centre in Saskatchewan, maintains over 3,500 tree-fruit and small-fruit crops at the Greenhouse and Processing Crops Research Centre in Harrow, Ontario, and stores over 130 heirloom and modern Canadian bred potato varieties at the Potato Research Centre in Fredericton, New Brunswick.

The flax collection housed in Saskatoon has been assembled over the last 40 years and hosts Canada's national collection of

plant germplasm for food and agriculture. Through exchange with genebanks and flax breeders in the United States, Russia, Germany, the Czech Republic, Poland, Turkey, Chile, and many other countries, this irreplaceable resource of more than 3,500 samples of flax lines from 76 countries has been made possible. The germplasm represents an extremely diverse array of flax types selected for over the course of 10,000 years –an incredible resource!

Historic cultivars and lines developed by AAFC, Canadian universities and private breeders are all a part of this collection. Seeds from the PGRC flax collection are also available to breeders and researchers nationally and internationally. The PGRC Web site (see www.agr.gc.ca/pgrc-rpc) provides access to information about the germplasm and can be used for ordering seed samples.



Besides having the resources to create new flax lines with specific attributes for different application, and to keep them secure in the future, the collection also offers the opportunity for detailed flax characterization and evaluation. In 1998, PGRC pursued this opportunity by beginning a number of projects with financial support from the Saskatchewan Flax Development Commission. These research projects led to many publications assessing the diversity of characteristics such as molecular structure, drought tolerance, seed yield, plant height, disease resistance as well as the quality of seed oil, and fibre content.

Since the base collection of flax is so large and some samples are genetically very similar, PGRC researchers decided to select 380 accessions that represent the diversity found in the entire collection. This concentration became the first core collection for flax to be created worldwide and is now being studied in a cooperative project between Canadian flax breeders at AAFC's Morden Research Station in Manitoba and the University of Saskatchewan in Saskatoon.

Ongoing collaboration with Flax Canada 2015 and Genome Prairie will enable further research into the core collection and help ensure the sustainability of the Canadian flax industry and maintain Canada's continued role as a world leader in flax production and exportation! ●



Deep Freeze Preserves Animal Genetic Resources in Canada

Relying on a few high-producing animals in breeding programs has caused a reduction of genetic diversity in livestock breeds around the world. Now scientists worldwide are joining forces to protect valuable genetic resources and support the long-term resilience of livestock production systems, bolstering food security.

The response in Canada has been the creation of the Canadian Animal Genetic Resources Program (CAGRP), a joint initiative from Agriculture and Agri-Food Canada (AAFC) with the University of Saskatchewan located at AAFC's Saskatoon Research Centre.

This issue is not foreign to Canada. For example, in Holstein cattle, the inbreeding coefficient, a mathematical indicator of the decrease in genetic variation, has increased five times over the last 15 years due to extensive use of a few elite sires and their sons. According to Rare Breeds of Canada, 13 cattle, 6 goat, 23 sheep, 18 horse, 5 pig and 37 poultry breeds are at risk of extinction in Canada through lack of use or interest.

The mission of the newly-formed Canadian Animal Genetic Resources Program (CAGRP) is to ensure the long-term conservation of genetic diversity of Canadian animal and poultry breeds by cryopreserving the germplasm to support environmentally friendly livestock production, and maintaining food security.

The Canadian Animal Genetic Resources Program, created in 2005 is a joint initiative of AAFC and the University of Saskatchewan and welcomes donations of semen, embryos, oocytes and DNA of different livestock and poultry breeds from individual producers, breeding centres, associations and veterinarians.

Donations received to June 2010 are:

Species	Breeds	Sires	# Units (semen/embryo)
Cattle	16	2963	249,044
Horse	1	2	200
Goat	4	19	247
Sheep	2	8	110
Chicken	2	26	1395
Turkey	1	34	318
Swine	3	15	38
Bison		7	600
Elk		75	10,125
Deer		75	1,244

The collection is maintained by AAFC staff in Saskatoon.

With current environmental challenges and the emergence of new and exotic animal diseases, this program will be a valuable tool for global efforts to maintain and preserve our genetic resources.

The Canadian Animal Genetic Resources is currently in liaison with national and international stakeholders and advisory committees, the United Nations Food and Agriculture Organization (FAO) and the United States Department of Agriculture to maintain and integrate the Canadian program.

The CAGRP is developing a database with colleagues in the US and Brazil which will contain pedigree, genetic and physical evaluations of each donation. The CAGR database will be linked to the FAO's International Genetic Resources database, and with breed associations and registries, industry, producers, organizations and cooperatives.

In 2010 AAFC will launch its new website for animal genetic resources – making the holdings of the genetic collection available on-line. This important tool has already attracted interest from other countries in Central and South America.

In addition to ensuring the genetic diversity of Canadian livestock breeds through acquiring, characterizing and conserving Canadian animal genetic resources, the CAGRP has several other objectives.

The program also supports research in the areas of genetic diversity, gamete and embryology physiology, and cryobiology, which will ultimately lead to the development of new techniques to better conserve Canadian livestock.

Current research continues to explore genetic diversity through assessment of temporal changes in genetic variability and inbreeding within animal breeds. Improvement in reproductive technologies to produce healthy embryos and their efficient transfer is performed through gamete and embryo biology, while cryopreservation of semen, oocytes and embryos as well as vitrification or freezing of bovine oocytes are evaluated and used to meet Canadian animal genetic resources' goals and objectives.

The ultimate goal is to support environmentally friendly livestock and poultry production and help Canada respond to biosecurity issues, environmental changes and food risks. This will not only benefit the Canadian industry but will help maintain the diversity and security of animal genetic resources for people around the world. ●



Science Sweetens Outlook for Honey Bees, Biodiversity

Pollinators - such as bees, butterflies and bats - are responsible for the continued existence of more than seventy percent of the world's flowering plant population. By carrying pollen from the male to female parts of flowers, pollinators assist in plant reproduction and thus biodiversity.

The pollination efforts of honey bees are estimated to contribute in excess of \$2.2 billion to Canada's agricultural economy, each year. From the production of hybrid canola seed in Southern Alberta to the pollination of blueberries in the Maritimes and British Columbia, honey bees are the primary managed pollinator for Canada's agricultural food production.

Unfortunately habitat destruction and alteration, pesticide use, and pathogen spill-over is contributing to a decrease in the abundance and diversity of wild and managed pollinators, such as honey bees. In 2009, the Canadian Association of Professional Apiculturists reported three consecutive years of wintering losses hovering at thirty per cent, twice the normal rate.

To address emerging bee health issues and help honey producers cope with these challenges, Agriculture and Agri-Food Canada (AAFC) researchers are working closely with the Canadian Honey Council, the Canadian Association of Professional Apiculturists and their international counterparts.

AAFC's national apiculture research scientist in Beaverlodge, Alberta specializes in the management and detection of honey bee diseases and the prevention of chemical residues

in honey. One research project is examining and developing treatment strategies for *Nosema ceranae*, a newly-introduced parasite implicated in the recent losses of colonies world-wide. Here researchers are developing safe and easy methods for beekeepers to disinfect their equipment of the disease, determining how to best target the application of treatments and establishing how the disease impacts colonies under Canadian conditions.

Research in Beaverlodge has also led to innovative solutions to enhance bee health. One project is examining a marker-assisted selection technique for improved breeding of bees resistant to American foulbrood disease and parasitic *Varroa* mites. With collaborators from the University of British Columbia, high-throughput proteomic techniques are being used to identify putative markers for improving the specificity and speed by which resistance breeding can take place.

Native bees nest in a wide variety of habitats including soil, wood and cavities and, depending on the species, can pollinate a wide variety of flowers or, in some cases, form an intricate relationship with a single plant species. Unlike honey bees, whose hives can be moved closer to food supplies, native bees must make a living on the resources offered by their local environment. If the land is altered, and their food supply and home are disturbed, they'll either leave or cease to exist.

Scientific input from AAFC scientists in Beaverlodge and other partners also recently helped the Canadian Honey Council produce a handbook for beekeepers, outlining the most up-to-date techniques for monitoring and treating colonies for known diseases and pests during critical spring and fall management periods.

Though the honey bee, *Apis mellifera*, is vital to modern agricultural production, we should not overlook that over 700 native species of bees also exist in Canada. These species have a unique role in the maintenance of the country's biodiversity. They are essential to the reproductive cycles of most flowering plants and thus to the ecosystem

itself, by supporting plant populations that other animals and birds rely on for food and shelter. If the proper environments don't exist for these bees, they cannot survive to continue pollinating the plants they are uniquely responsible for.

In one sense, bees are very much the same as us; their "neighbourhood" must include a suitable place to live from which they can access food and other requirements over the course of their life span.

The loss of this "real estate" and the loss of local biodiversity via mass growing of a single crop limit areas where diverse bee communities can survive. The loss or reduction of bees and their pollination services sends ripples throughout the entire ecosystem that impact the very sustainability and resilience of the landscape.

Thankfully, researchers in Kentville, Nova Scotia are looking at the impact of changing landscape patterns on native bee communities. The goal is to develop conservation and restoration guidelines for the landscape to nurture the preservation of native bee populations in Canada. They are formulating realistic management programs for the landscapes that bees and other pollinators live in.

For example, one project is investigating the relationship between the amount and distribution of feeding and nesting habitats and the



abundance and diversity of native bees available for pollination in lowbush blueberry agro-ecosystems. In other words; *"How much habitat is required to maintain healthy native bee populations?"*

Working closely with members of the blueberry industry, these findings are being used to inform land development decisions so that critical native bee habitat, and by extension pollination service, is maintained as part of the agricultural landscape.

This research concept can also be applied in many other settings to maintain pollinator and plant biodiversity. For example, city planners can integrate green spaces into their layouts, and farmers can enhance or maintain "bee friendly" habitat on their land to promote diverse native bee communities. Incorporating native flowers and plants into a family garden not only looks nice, but can offer nesting opportunities and a source of nectar and pollen for these insects. ●

AAFC Mycologist Receives Order of Canada



MCpl Dany Veillette, Rideau Hall
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Dr. Stanley Hughes, Honorary Research Associate at the Eastern Cereal and Oilseed Research Centre (ECORC), Ottawa, has been appointed Member to the Order of Canada. According to the June 30, 2010, news release from the Governor General's office, Dr. Hughes was accorded the honour "for his lifetime contribution to the field of mycology, particularly for his seminal work on the classification of various fungi and moulds, and for his mentoring of young scientists."

The Order of Canada is the centrepiece of Canada's honours system. Established in 1967, it serves to recognize a lifetime of outstanding achievement, dedication to community and service to the nation. The order recognizes people in all sectors of Canadian society. Its motto is *Desiderantes meliorem patriam* - "They desire a better country."

Dr. Hughes joined AAFC in 1952 and almost immediately initiated a new era in the classification of conidial fungi, proposing innovative concepts that turned an art into a science. This important group of fungi reproduces asexually by producing masses of spores called "conidia" and affects most everything humans do or use.

His 1953 paper in the Canadian Journal of Botany, *"Conidiophores, conidia, and classification"*, offered a novel and exciting approach modifying classification of conidial fungi, enabling precise identification of plant pathogens, spoilage moulds, and antibiotic producers such as the original penicillin antibiotic decades before the DNA revolution.

This contribution is singled out in scientific literature as the most significant paper on the systematics of conidial fungi of the past century and the most profound contribution to mycological taxonomic literature. With the publication of this one paper, an entire field was transformed as scientists around the world quickly adapted the new methods and tools to segregate and classify moulds.

Five years later, a follow-up scientific paper containing an extensive list of more than 1000 accepted genera, species and synonymies was proof that hyphomycetology, the classification of fungi, was now a science and provided a new starting point for the worldwide effort to collect and classify moulds.

Dr. Hughes has been a role model for scientific and personal integrity for many of the taxonomists who had the honour of working with him at ECORC, and who consider him "one of our mycological heroes" who has named hundreds of species and continues to publish in the world's mycology press. Since his retirement, Dr. Hughes has focused on untangling the complex world of sooty moulds, a dark fungus that grows on honeydew excreted by sucking insects or on exudates, the fluid that escapes from lesions on the leaves or stems of certain plants. This fungal group can cover plant leaves, stems and twigs in a black sticky substance and has confused mycologists throughout the history of the science.

Dr. Hughes has received several professional honours including the Jakob Eriksson Gold Medal of the Swedish Academy of Science (1969) and the George Lawson Medal of the Canadian Botanical Association (1981). In 1975 he was president of the Mycological Society of America, and from 1971 to 1983 vice-president of the International Mycological Association. In 1986 he was elected a foreign member of the Linnean Society of London. ●

The following scientists from Agriculture and Agri-Food Canada have received the Order of Canada:

Dr. Stanley Hughes, Ottawa, ON – 2010 (Member)

Dr. Thomas Lawrence, Saskatoon, SK – 1991 (Member)

Dr. Donald Young, Fredericton, NB – 2009 (Member)

Dr. Kenneth J.W. Jenkins, Ottawa, ON - 1988 (Member)

Dr. Ron DePauw, Swift Current, SK – 2003 (Member)

Dr. Thorvador Johnson, Winnipeg, MN – 1972 (Officer)

Dr. Vernon Douglas Burrows, Ottawa, ON – 2001 (Member)

Dr. Keith Downey, Saskatoon, SK – 1976 (Officer)

Dr. Peter Harris, Lethbridge, AB – 1997 (Member)

Dr. John Craigie, Ottawa, ON – 1967 (Officer)



Nutrients Key to Understanding and Managing Crops Say Scientists

Nutrients, essential to the growth and survival of plants, are a key element in the productivity and profitability of the agriculture industry. While nutrients are present naturally in the environment, they are also added by human activity, including agricultural practices such as fertilizer application. Biologically reactive forms of nutrients, particularly nitrogen and phosphorous, when present in amounts that exceed requirements of plants and other organisms, may cause adverse effects on the environment and human health.

The presence and use of these nutrients in the Canadian environment has been the subject of targeted scientific study, monitoring and reporting, and policy and management response, in both the public and private sectors, for several decades, with interest and initiatives accelerating significantly in the past ten years. AAFC's Research Branch and the Canadian Fertilizer Institute co-hosted a workshop in Ottawa in May 2010, on the critical role of crop nutrients used for agricultural production and the complex interrelationship between those nutrients and the environment.

The workshop offered an important and unique opportunity for experts from the private and public sectors to meet with a focus on the science and management of crop nutrients (i.e., fertilizers) in agriculture. The workshop included participants from Environment Canada, the Canadian Food Inspection Agency, the Ontario Ministry of Agriculture, Food and Rural Affairs, Canadian fertilizer companies, such as Agrium

and Potash Corporation, non-government organizations, such as the International Plant Nutrient Institute, Climate Check, and the Canadian Federation of Agriculture, and the University of Manitoba.

Participants focused on the five themes of the workshop. The first three explored the key agri-environmental issues associated with crop nutrients, air quality, soil and water resources, and climate change, while the final two themes considered the potential solutions to these issues.

The workshop provided an opportunity to share and discuss information about on-going research, research results and their application in policy and programming, identify on-going and emerging research issues, needs and priorities and agree on opportunities for collaboration and partnerships in terms of future research.

To obtain a copy of the full report of the workshop, contact: tim.marta@agr.gc.ca ●

Collaborative Research Proposals to Benefit from New Review Steps

Agriculture and Agri-Food Canada is introducing a new evaluation procedure for collaborative research project proposals that will make the process more consistent and predictable. The new review methodology covers all collaborative projects outside of targeted programs and initiatives such as *Growing Forward*.

Under the new system, collaborative projects will be assessed against a standard list of criteria to ensure the work is aligned with the department's mandate and scientific priorities, creates synergies, has a high probability for positive impact and is an appropriate role for the Government of Canada.

Long-term collaborative projects (five years or more) will require a more comprehensive evaluation that includes submission of a business plan. And although the project evaluations will typically take place locally, larger projects with more intensive resource requirements will undergo a review at the national level. But no matter where the reviews take place, every effort will be made to complete them in a timely manner.

For more information, please contact your local AAFC research centre. ●



Tell Us What You Think

Innovation Express is the Research Branch of Agriculture and Agri-Food Canada's quarterly newsletter to promote research partnerships and technology transfer to organizations interested in agri-food research and development.

We welcome your comments and suggestions.

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