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The Canadian Botanical Association Bulletin

Bulletin de l'Association Botanique du Canada

September/Septembre 2014. Volume 47 Nº2

Dear CBA members,



John Markham

Compared to members of other disciplines, scientists don't tend to dwell very much on their history. We're so busy trying to move forward that we have little time for a long glance backward. However, 2014 has been a special year for the CBA. Not only does it mark the 50th anniversary of the CBA but draws to a close the process of continuance under the federal government Corporate Act. Both have given us a chance to see where we have come from and where we may be going.

Annual CBA meetings are always a great opportunity to reflect on what we do, as well as learn about developments across a range of botanical topics, show off our work, meet old friends, connect with new colleagues, and be impressed yet again at the quality of student's work. Our meeting this summer at the Montreal Botanical Gardens gave us a special opportunity for an overview of Botany in Canada. The opening symposium reflected on where we have come from as an organization and the truly world class contributions Canadian botanists have made to their fields. We learned that the CBA is not as large as it once was, possibly due to the emergence of other scientific societies in Canada. Ian Taylor reminded us that one of the original mandates of the CBA was to include amateur botanists. Given that in recent years we have become more focused on public outreach, it is perhaps time to consider how we encourage amateur botany in Canada. For me, having the meeting in the Montreal Botanical gardens, made this point particularly poignant. Celine Arsenault's talk on the history of the garden showed how the work of Brother Marie-Victorin lead to the development of not only of one of the worlds foremost botanical gardens, but also helped to foster both professional and amateur interest in botany in Quebec and beyond.

Our AGM at this year's annual meeting brought to a close the final step in the CBA's continuance process as a non-profit organization. This was the culmination of a number of years of work. While the this process was initially only a bureaucracitic exercise, the need for by-laws in line with the new federal regulations means that we have had to modify the operations of the CBA. We unanimously agreed to adopt the new by-laws required for re-incorporation. The

The Canadian Botanical Association Bulletin

The CBA Bulletin is issued three times a year (March, September and December) and is freely availble on the CBA website. Hardcopy subscriptions are available for a fee.

Information for submitting texts

All members are welcome to submit texts in the form of papers, reviews, comments, essays, requests, or anything related to botany or botanists. For detailed directives on text submission please contact the Editor (see below). For general information about the CBA, go to the web site: http://www.cba-abc.ca

Bulletin de l'Association Botanique du Canada

Le Bulletin de l'ABC paraît trois fois par année, normalement en mars, septembre et décembre. Il est envoyé à tous les membres de l'ABC.

Soumission de textes

Tous les membres de l'Association sont invités à envoyer des textes de toute natureconcernant la botanique et les botanistes (articles, revues de publication, commentaires,requêtes, essais, etc.). Tous les supports de texte sont acceptés. Pour des renseignements détaillés sur la soumission de textes, veuillez consulter le rédacteur (voir ci-dessous). Infos générales sur l'ABCà l'url suivant: http://www.cba-abc.ca

Editor / Rédacteur:

Dr. Tyler Smith
K.W. Neatby Building Rm. 4017C
960 Carling Avenue, Ottawa
K1A 0C6
Tel: (613)694-2446
cba.abc.bulletin@gmail.com

Next issue / Prochain numéro

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efficient adoption of such a major change to the CBA was no doubt due to Frederique Guinel's hard work and efficiency in communicating the changes to all of us. Moving forward we will be updating our policy manual to reflect these changes.

US President Harry Truman once said that a president's job is to flatter, kiss and kick people. Given the dedication of the CBA membership to making the association work, I think this President's job is to give a heartfelt thanks to everyone involved in keeping the CBA going. First, thanks to all the organizers of the Montreal meeting, especially Anne Bruneau and Denis Barabé. Your attention to detail and hospitality made for a truly memorable meeting. Thanks to all of the members of the board of directors and section chairs. To those stepping down as directors (Bruce Ford, Melanie Jones and Marian Munro) and Jane Young, who spent years as treasurer, thank you for your service. Thanks to Hughes Massicotte for his service as Past President. A very special thanks to Frederique Guinel for her work as President and all the guidance she has provided to me. To the new board members (Michele Piercey-Normore, Art Davis, Geraldine Allen, Deb Metsger, Erica Wheeler) new section chairs (Andre Arsenault, Simon Chuong), thanks for stepping forward. Finally to returning board members and section chairs, thank you for your continued dedication.



Past President Frédérique Guinel passes the presidential seal to President-Elect John Markham at the 2014 CBA Congress

Announcements

Botanical Nomenclature Training Course

The Royal Botanic Gardens, Kew is organizing a one week Botanical Nomenclature course from 26–30 January 2015. The course is part of the DEST Modern Taxonomy Programme and is aimed at postgraduate students and early-career researchers in taxonomy.

Programme

Taught by Kew specialists with extensive practical experience, the course looks in detail at the essential principles of plant nomenclature according the the Code of Nomenclature for algae, fungi and plants (ICN). By the end of the week, participants will be able to apply good nomenclatural practice when undertaking taxonomic revisions, compiling checklists etc. This will be achieved by lectures illustrated with examples from the ICN, workshop sessions applying what has been learned to "real life" cases, and by encouraging participants to discuss nomenclatural problems they have encountered.

Duration and Location

The course runs from Monday–Friday for one week: classes are taught in Kew's Herbarium, Library, Art & Archives (situated next to the Main Gate to the Gardens); about 15 minutes' walk from Kew Gardens Underground station (District Line/London Overground) and 10 minutes' walk from Kew Bridge station (South West Trains).

Course costs

The course fee for non-Kew staff is 600 euros: this covers teaching costs and course materials; funds for travel to Kew and subsistence must be sought elsewhere.

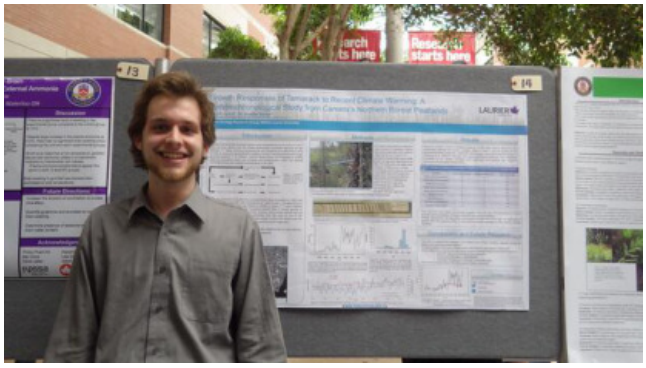
Applications should be made using the registration form on the DEST website www.taxonomytraining.eu/content/botanical-nomenclature-3 BY 10 OCTOBER 2014. Further information and copies of this poster can be obtained from the course coordinator: Katherine Challis (k.challis@kew.org)

The 27th Ontario Biology Day (OBD) Conference Plant Biology Awards

The 2014 OBD was held at the University of Toronto Mississauga Campus, March 22-23. The following awards were presented for botanical projects:

The Best Plant Biology Poster Award

Greg Lynch from Wilfrid Laurier University, "Growth Responses of Tamarack to Recent Climate Warming: A Dendrochronological Study from Canada's Northern Boreal Peatlands" co-authored with Dr. Jennifer Baltzer.



The Best Plant Biology Oral Presentation Award

Margaret Sawatzky, University of Western Ontario, "Effects of temperature and atmospheric carbon dioxide on microbe-mediated nitrogen and carbon dynamics of the boreal bryosphere" co-authored by Dr. Zoe Lindo.



Announcements

2014 UBC Botany Graduate Students' Association Symposium



Sean Graham, giving the Plenary Talk and wearing his jacket from Grad-School, it still fits!

This year, the Canadian Botanical Association kindly supported the UBC Botany Graduate Students' Association Symposium on April 11th. The UBC Department of Botany has research programs across three buildings and a wide range of study subjects. The annual symposium is a crucial opportunity for graduate students to share their research, build cohesion and establish links across the department.

This flagship event is very exciting in bringing together researchers from diverse disciplines including biochemistry, cellular biology, ecology, evolution, genetics and microbiology. Diverse study organisms also feature including plants from algae to trees but also fungi and various microorganisms. There were 24 excellent graduate student presentations, showcasing this variety of research.

Professor Sean Graham provided the keynote address on the evolutionary relationships between land-plants, which he has had a prominent role in discerning using molecular tools. For example, he touched upon his work on monocot phylogeny (using DNA sequences), parasitic plant evolution and the surprising placement of the aquatic Hydatellaceae among the earliest diverging flowering plant lineages. The symposium also gives an opportunity for professors to share their life-history and how they came to be where they are now. An overall story of life and research Sean called "Botanical Adventures in Time and Space".

Overall, the event was a great success. Thanks to the generous support of the CBA-ABC we were able to supply coffee and snacks, over which many remarked how important this event is for graduate students, and how much fun it is to hear about all the great research performed at UBC Botany.

Michael Scott

2014 BC Interior 9th Annual Undergraduate Research and Innovation Conference

Thompson Rivers University, Kamloops

The CBA sponsors the Best Undergraduate Botany Poster Award. This year there was a tie, with the awarded shared between Katelyn Strangway, Thompson Rivers University, and Jennifer Rumley, Trinity Western University. Congratulations to both!



Katelyn Strangway and Christine Peterson



Jennifer Rumley and Lyn Baldwin

Announcements

Iain and Sylvia Taylor Poster Award 2014

The CBA/ABC gives an award for the best student poster presented at the Annual Meeting. The award is in honor of Iain and Sylvia Taylor, members who, for many years, have actively contributed to the development of the CBA, and continue to be involved to this day. Thank you to the judges this year: Irene McKechnie, Kevin Stevens, Martin Dubé Christine Peterson and Sylvie Laliberté.

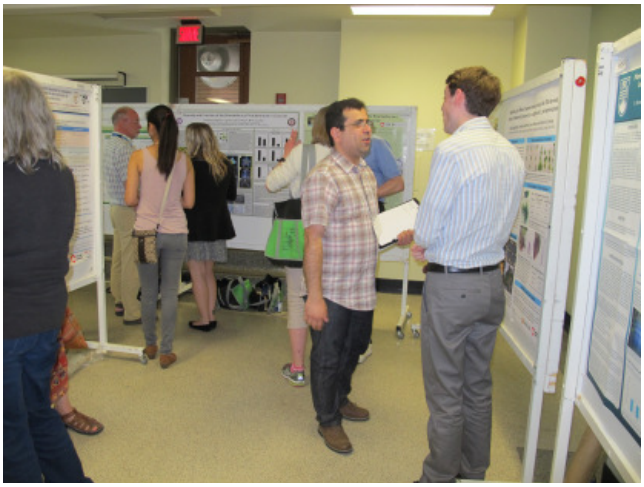
There were three honourable mentions:

Chris Deduke, Department of Biological Sciences, University of Manitoba, Winnipeg for his poster, "Substrate preference of two Shield lichens: an experimental approach" co-authored with M. Piercey-Normore.

Dustin Sigurdson, Department of Biology, University of Waterloo, for his poster "Optimizing an efficient regeneration protocol for TDZ-derived shoots of *Bienertia sinuspersici*, a single-cell C4 terrestrial plant" co-authored with J.A. Northmore, S. Schoor and S.D. X. Chuong.

Catherine Weiner, Department of Biology, Wilfrid Laurier University, Waterloo, for her poster "Cytokinin, abscisic acid, and root symbioses in the pea mutant E151" co-authored with R.J.N. Emery and F.C. Guinel.

The winner was Courtney Clayson, Department of Biology, Wilfird Laurier University for her poster "Water loss through specialized structures in Cuscuta (dodders, Convolvulaceae) drives the water uptake by the host" co-authored with I. Garcia-Ruiz and M. Costea.



Botany 2014 Poster Session

Job Posting: Academic Director

Memorial University Botanical Gardens

Located in St. John's, Newfoundland, the Memorial University of Newfoundland Botanical Garden (MUNBG) is a resource centre for basic and applied botanical research and education with a particular interest in the flora of Newfoundland and Labrador. It seeks to foster an appreciation of natural history in the development and future of the University and the Province. It is the province's premier botanical garden.

MUNGB is currently seeking its first Academic Director. Reporting to the Associate Vice President, Research (Grenfell Campus) and collaborating closely with the Director responsible for operations, public education and outreach, the Academic Director will garner and realize externally funded research programs at the Botanical Gardens and optimize their use for undergraduate and graduate research, teaching and learning programs. This opportunity is a 2-year funded pilot project.

The Academic Director will work with the significant resources of Memorial University to seek out and create a network of relevant researchers and principal investigators, encourage research programs, obtain and manage external research funds, as well as contribute to and share oversight of the Botanical Gardens applied research programs.

The Academic Director will collaborate extensively with faculty and staff across the University to promote the use of the Botanical Gardens as a research, teaching and leaning resource and will seek, foster, and develop appropriate linkages with provincial and federal agencies, industry and community partners and the College of the North Atlantic.

As a strategic leader, you are capable of managing multiple priorities with proven time and resource management skills. You have successfully managed complex organizations with various internal and external stakeholders. You are diplomatic, aware, and sensitive to the conflicting needs of others. You are skilled in conflict resolution and finding common ground on which mutually beneficial partnerships can be built.

As a research leader, you have a successful track record of building research programs through fund sourcing and the development of multidisciplinary programs. You hold a PhD in a scientific or related field and have a robust research history.

To be considered for this unique opportunity, please apply electronically at http://jobs.kbrs.ca/Careers/10508/ or contact Beverley Evans, Practice Leader or Tim Edwards, Executive Recruiter at 902-421-9849 with any questions.

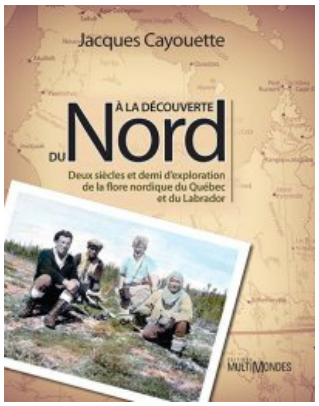
Book Release: À la découverte du Nord

Jacques Cayouette

L'histoire de l'exploration botanique de la péninsule du Québec-Labrador nordique fait partie du patrimoine canadien et il y a un besoin urgent de la faire découvrir et de la documenter. Ce territoire, délimité par la baie James, la baie d'Hudson, le détroit d'Hudson et la mer du Labrador, représente à peu près la moitié du territoire du Québec. Il s'étend sur des milliers de kilomètres carrés de terres, de mers, de lacs et de rivières. Alors que l'exploration des îles de l'Arctique canadien est assez bien connue, celle du Québec nordique et du Labrador l'est beaucoup moins. Pourtant, les ressources naturelles et la flore y sont très diversifiées. Depuis plus de deux siècles et demi, des dizaines de milliers de plantes furent récoltées sous ces latitudes boréales et arctiques. On cherchera en vain un travail bien documenté sur ces explorations botaniques courageuses.

Dans ce livre, le botaniste chercheur chevronné, Jacques Cayouette, en brosse le portrait d'ensemble d'une main de maître. Ce livre inédit aidera grandement à compléter nos connaissances sur la flore, à retracer nos richesses naturelles et à déterminer quelles régions et quels sites méritent d'être protégés. En 27 chapitres bien étoffés, l'auteur nous présente plus de 420 explorateurs ou autres, près de 400 illustrations et environ un millier de références. Le chapitre 1 fait un bref rappel de la situation de la cueillette des spécimens à la baie d'Hudson à partir du XVII^{e} siècle. C'est en 1765 que débutent les premières récoltes (chapitres 2 à 8) au Labrador. Celles au Québec nordique (chapitre 9) ne commenceront qu'un siècle plus tard, soit en 1870 environ. La suite de l'histoire se déroule de manière chronologique, en alternance entre le Labrador et le Québec nordique. Les limites du territoire traité correspondent à celles utilisées dans la *Flore nordique du Québec et du Labrador*, soit le nord du 54^{e} parallèle.

Les personnages sont regroupés par périodes, thèmes, régions géographiques ou suivant des institutions. Malgré les inévitables chevauchements, cette approche facilite l'analyse, permet de mesurer l'importance des contributions et de dégager des points communs ou de comparaison. Ce travail couvre également la période actuelle, en fait jusqu'à l'été 2013, si bien que l'histoire continue toujours de s'écrire. Pour chaque exploration et personnage impliqué, les raisons de ces voyages éloignés et les circonstances ayant mené à la cueillette de spécimens sont relatées. Suivent une brève présentation de la région explorée et des sites de récoltes, l'importance des récoltes en nombre et en découvertes, les publications qui en ont résulté, les livres, les rapports, les notes, les lots de spécimens, leurs citations, leur aboutissement et leur dispersion dans des herbiers privés ou publics. Pour la période des 18, 19 et début du 20^{e} siècle, le plus de récolteurs possibles ont été retracés.



The history of botanical exploration in the northern Quebec-Labrador Peninsula is an important part of Canada's heritage, and there is an urgent need to increase awareness of and document it. This vast northern region bordered by James Bay, Hudson Bay, Hudson Strait and the Labrador Sea consists of thousands of square kilometres of land, sea, lakes and rivers. While much is known about the expeditions to Canada's Arctic Islands, the exploration of northern Quebec and Labrador is not well documented, despite the diversity of natural resources and flora found there. There are no comprehensive accounts of the expeditions to these boreal and arctic regions.

In the book *À la découverte du Nord. Deux siècles et demi d'exploration de la flore nordique du Québec et du Labrador*, Jacques Cayouette, an experienced botanist, recounts the history of the exploration of the flora of northern Quebec and Labrador. This groundbreaking work will contribute substantially to our knowledge of the flora and other natural riches of these northern regions, providing valuable information that can be used to determine which areas merit protection. Including 400 illustrations and about a thousand references, the author introduces us to more than 420 explorers and other persons. The book begins with a brief account of expeditions to the Hudson Bay region beginning in the 17th century. It continues right up to 2013, alternating between Labrador and northern Quebec.

À la découverte du Nord. Deux siècles et demi d'exploration de la flore nordique du Québec et du Labrador covers the same territory—the area north of the 54th parallel—as the book *Flore nordique du Québec et du Labrador*. This approach makes it easy to assess the significance of the contributions made by the various explorers. For each expedition, the author describes the explorers' motivation for travelling to the distant locations concerned and the circumstances leading to the collection of plant specimens.

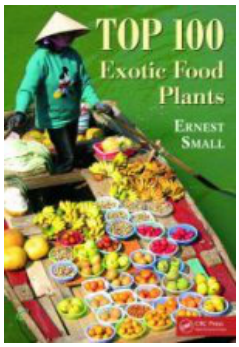
More Information

À la découverte du Nord. Deux siècles et demi d'exploration de la flore nordique du Québec et du Labrador is available in print or digital format from Éditions MultiMondes, www.multim.com.

Book Reviews

TOP 100 Exotic Food Plants

Small, E. 2012. Boca Raton (FL): CRC Press. 658pp. ISBN 978-1-4398-5686-4



Growing up on a farm, I have always been interested in plants and especially how they are used by humans. My mother liked to experiment with new plants in the garden. Each new food plant or varietal fascinated me—I loved watching it develop and the excitement of the first taste. Our modern economy with global trade and transport makes it possible and affordable for people to sample plant products from virtually anywhere on the planet. This allows residents of temperate regions like me to encounter some of the many types of plant products that have been traditionally utilized by people in the tropics. Dr. Small's book, *Top 100 Exotic Food Plants* introduces temperate residents to unfamiliar tropical plant resources and provides a broader understanding of some of the exotic plants that northerners are finding at the market or encountering on travels. I thoroughly enjoyed reading the book.

Choosing 100 top anything is likely to be a somewhat arbitrary process and the choices here are from the perspective of a resident of temperate regions. Dr. Small, follows 3 basic criteria; "(1) likelihood to be encountered as imports in the English-speaking, temperate-climate Western world, or by travelers to the remainder of the world; (2) importance, either globally or in particular regions; and (3) limitation of English language information with respect to culinary aspects."

In truth I was aware of most of the plants listed in the book although some were completely new to me. The reader will certainly be familiar with the cashew, but may not know of the accessory fruit that is savored in the regions where the tree grows. The cultural and culinary descriptions will provide the reader with a much fuller understanding of the value of the plants.

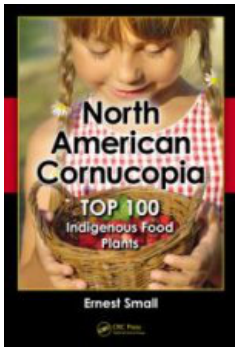
Each plant description is divided into sections. Names, Plant Portrait, Culinary Portrait and Culinary Vocabulary, Curiosities of Science and Technology, and Key Information Sources with a section listing Specialty Cookbooks. The Names section lists the variations of the vernacular and scientific names that have been given to the plant (or group of plants that make up the crop). The origin and meaning of the names is described. The Plant Portrait provides a simple botanical description, distribution and cultivation details. Harvesting, production, value and marketing of products from the plant are sometimes discussed. The Culinary Portrait describes the uses of the plant including flavor and nutrition. Regional variations are discussed. The Culinary Vocabulary defines terms associated with uses or products from the plant. Curiosities of Science and Technology offers interesting facts about the plants. These are quite varied. They can be historical, scientific, or cultural. The Key Information Sources are conveniently listed at the end of each plant chapter. The Specialty Cookbooks highlights references for preparation and consumption of the exotic plant.

The book is certainly a pleasure to read. It is filled with colorful cultural references and fascinating facts about the plants and their products. I laughed out loud when I read the descriptions of the flavor of durian, "…French custard passed through a sewer pipe." The book would be welcome on the shelf in reading rooms of botanic gardens, garden clubs and culinary groups. Plant descriptions are not comprehensive in a botanical sense, but the text would be suitable to courses in economic botany, human culture and agriculture.

Eric La Fountaine, Accessions Technician, UBC Botanical Garden

North American Cornucopia: Top 100 Indigenous Food Plants

Small, E. 2014. Boca Raton, Florida: CRC Press. 793pp w/153 illustrations. ISBN 978-1466585928



North American Cornucopia: Top 100 Indigenous Food Plants is a weighty tome that feels intimidating in one's hands. However, open up the book and enjoy; the subject matter is approachable and engaging through the apt and experienced writings of Dr. Ernest Small. The title is accurate, as Small examines one hundred indigenous food plants found in North America (north of Mexico).

The book begins with a preface by Small explaining the need for such a book; "The North American food industry now offers more than 300,000 food items…[but] less than a dozen plants…furnish the bulk of almost everything that most humans currently eat…fewer than 100 species individually generate a world annual value of at least a billion dollars…[North America] is the native home of only one of these economic superstars, the sunflower." Small then convincingly argues for a re-examination of North American indigenous food crops, many of which have been ignored or dismissed as potential food crops.

In the introduction, Small first defines what is meant by indigenous, contrasting these plants against introduced plants in North America that are often highlighted in "wild food" books. An explanation of how the 100 plants were chosen follows. Importantly, cautions about the potential dangers from consumption of indigenous food plants appear in several places, with notes on natural toxins,

allergic reactions, and other risks (including misidentification).

The next section of the introduction explores the subject of plant domestication and crops. It begins with the global history of domestication. Eventually, this gets into the specifics of North American domestication. This part addresses the topic of why meat-dependent societies emerged in North America compared to other parts of the world (the lack of an indigenous cereal crop and pulse crop combination, meaning that a complete diet required amino acids from meat). This section also discusses how the lack of an indigenous cereal-pulse combination may have led to the slowing of crop development in North America. The introduction ends with a discussion on whether "obsolete" commercial North American crops can be resurrected and whether North America's wild plants can be rapidly domesticated.

The one hundred core accounts of plants are the meat of the book. Each plant entry is divided into a number of sections. First, the names of the plant are detailed. This can take up to a page for longer sections (e.g., North American species of cherries). The origin of both the scientific and the common names are shared, with notes on alternative names and imagined origins where warranted. This is followed by a section on the geography and ecology of wild plants, which discusses the natural history of the plants in brief.

Plant portrait then starts with a brief morphological description of the plant, followed by aspects of the economic botany including indigenous peoples' use of the plant as well as notes on cultivation. This is followed by a culinary portrait, which emphasizes use as food (e.g., if it was/is consumed raw, or how it was/is prepared. This section also includes a culinary vocabulary, where notable dishes and cultural specialties are highlighted, e.g., (for epazote), "*Sopa de flor de calabaza* is a soup prepared in Central and South America from squash blossoms, flavored with epazote, onions and pepper". Do note, though, that the epazote entry is also filled with warnings about toxic properties. The culinary portrait is succeeded by a section on prospects, which explores the potential for expanded agricultural production.

"Curiosities of science and technology" is the next section; it could be labeled trivia, but is far from trivial in its span and depth. Three examples: "The city of Chicago derives its name from the Menomini Indian word shika'ko, meaning "skunk place", a reference to the odor of the wild leek that was prevalent at the location"; "Fiddlehead fern is the only native Canadian plant that has achieved commercial success as a vegetable"; and, "…it has been shown that dusky-footed woodrats…place California bay leaves on or near their sleeping nests with the result that volatile substances in the leaves repel skin parasites…"

All of these tidbits of information are backed by an exhaustive "key information sources" which range from popular works to scientific papers, and, depending on the plant, "specialty cookbooks" (and rarely, a recipe!). Accompanying the textual information is often a comprehensive set of photographs as well as range maps in North America.

A real treat is that the book is comprehensively indexed – one can find the content that one wants to get to through both scientific name guides and common name guides in the front of the book as well as indices of common, scientific (including synonyms) and culinary names in the back. This makes up for any difficulty one might have in locating the foods by browsing through the book alphabetically, as "D" contains duck potato but not dewberries (which are under Blackberries and Dewberries).

The obligatory criticisms are difficult with this work. Perhaps if one wanted to make the book heavier, larger photographs would be included, as some images lack detail at the published size. Another nit is that despite the copyright for the work being assigned to Her Majesty the Queen in Right of Canada as represented by the Minister of Agriculture and Agri-Food Canada (where Small is employed), the American spellings of "odor" and "flavor" are used.

Who is this book for? Firstly, if you are a bibliophile who enjoys rich books with well-researched information, this book is for you. Academically, Small notes early on that the work is not intended to be a textbook, but rather a complement to students taking economic botany, agriculture and resource management courses. Still, the comprehensive references are useful as a starting point for any literature review of these subjects. For those investigating or curious about developing new crops, this is a book to guide you into what has potential. Wildcrafters and their ilk will of course find utility. If you are a natural history interpreter, this book is a treasure trove of information for public engagement. And, if you are a chef, or even a menu-writer for restaurants with locally-grown foods, this should both occupy your bookshelf and be used frequently.

It ranks in my top ten of plant reference books, sitting proudly alongside Brodo et al.'s *Lichens of North America* and Gracie's *Spring Wildflowers of the Northeast*.

Daniel Mosquin, Research Manager, UBC Botanical Garden



Montreal – 2014

At this meeting - 50 years of Botany in Canada - we had the opportunity to unite many of the Past and Present Presidents of the Canadian Botanical Association. It was a cheerful moment that we want to share with you.

From left to right at the back, we can see: Joe Gerrath (2000-02) from the University of Guelph; John Markam (2014-16) from the University of Manitoba; Iain Taylor (1985-86) from the University of British-Columbia; Christian Lacroix (2006-08) from the University of Prince-Edward Island; Luc Brouillet (1986-87) from the University of Montreal; Rodger Evans (2008-10) from Acadia University; C.C. Chinnappa (1996-98) from the University of Calgary; Liette Vasseur (2002-04) from Brock University; Larry Peterson (1989-90) from the University of Guelph; Vipen Sahwney (2004-06) from the University of Saskatchewan; Denis Barabé (1998-00) from the University of Montreal; Nancy Dengler (1979-80) from the University of Toronto; and Usher Posluszny (1992-94) from the University of Guelph.

From left to right, at the front we can see Frédérique Guinel (2012-14) from Wilfrid Laurier University; Hugues Massicotte (2010-12) from the University of Northern British Columbia; and Irwin Brodo (1988-89) from the Canadian Museum of Nature.

May our Association be strong in its next 50 years with many more capable Presidents at its helm!

Thanks to Mihai Costea (Wilfrid Laurier University) for the photograph and to Iain Taylor for the dates of Presidency tenures.

Montréal - 2014

Lors de cette réunion - 50 ans de Botanique au Canada - nous avons eu l' occasion de réunir de nombreux Présidents et Présidentes, anciens et nouveau, de l'Association Botanique du Canada. Ce fut un moment de bonne humeur que nous voulons partager avec vous.

De gauche à droite à l'arrière, nous pouvons voir: Joe Gerrath (2000-02) de l'Université de Guelph; John Markam (2014-16) de l'Université du Manitoba; Iain Taylor (1985-1986) de l'Université de la Colombie-Britannique; Christian Lacroix (2006-08) de l'Université de l'Ile du Prince - Édouard; Luc Brouillet (1986-1987) de l'Université de Montréal; Rodger Evans (2008-10) de l'Université Acadia; C.C. Chinnappa (1996-1998) de l'Université de Calgary; Liette Vasseur (2002-04) de l'Université Brock; Larry Peterson (1989-1990) de l'Université de Guelph; Vipen Sahwney (2004-06) de l'Université de la Saskatchewan; Denis Barabé (1998-1900) de l'Université de Montréal; Nancy Dengler (1979-1980) de l'Université de Toronto; et Usher Posluszny (1992-1994) de l'Université de Guelph.

De gauche à droite, à l'avant, nous pouvons voir Frédérique Guinel (2012-14) de l'Université Wilfrid Laurier; Hugues Massicotte (2010-12) de l'Université du Nord de la Colombie-Britannique; et Irwin Brodo (1988-1989) du Musée Canadien de la Nature.

Que notre Association soit forte pendant les cinquante prochaines années avec de nombreux président(e)s capables à la barre!

Merci à Mihai Costea (Université Wilfrid Laurier) pour la photographie et à Iain Taylor pour les mandats des Président(e)s .

Canadian Botany Mentors: Margaret McCully

Frédérique Guinel, Professor, Wilfrid Laurier University

Last year, at the AGM held in Kamloops, we agreed to have a new Award of Distinction for the Canadian Botanical Association. This award is the Magister Award for teaching excellence in Plant Biology. That same year, the Executive Board thought that to launch this new award, it would be fitting to celebrate great Canadian Mentors in the Bulletin. I thought that as the CBA Past-President, I should be the first one to celebrate my Canadian teacher, Professor Margaret McCully, who has become over the years a true friend.

My relationship with Dr. McCully began in early 1981 when she accepted me as a foreign graduate student in her lab. She showed me a great deal of trust. One thing I will never forget was her welcomimg me to Ottawa. Margaret was waiting for me at the airport when I first arrived from France. She drove me to her lab at Carleton chatting about her research and presenting potential topics for my dissertation. She continued over dinner and an evening walk along the canal to explain what others in the field were doing. I understood none of this, as my letters to her from France had indicated far greater fluency in English than I actually possessed. Interpreting my mute nods as a sign of exhaustion rather than a lack of comprehension, she took me back to her home and offered me a bed for the night. Only in the morning did I learn that Margaret had slept on the floor since her apartment had only a single bedroom. Margaret quickly understood my communication problems and soon she suggested that I enroll in an English as a Second Language class.

I have now known Margaret for more than 30 years. I consider her a friend and if I may say so as an integral part of me. She taught me so much and continued to teach me about so many things. Of course, she gave me the basics of plant biology but she also told me to be curious about what I read. By doing this, she pushed me to ask questions and to look for the answers in the literature. This an inquisitive person on his/her toes, and gives them a never-ending line of research. She demonstrated to me and to her other students that nothing could stop them except their imagination. She gave us early on the tools we would require for widening our mind. She did not limit her lessons to science, but would talk to us about novels, plays, operas, concerts, and artists (Canadian or not). At conferences, she did introduce us to colleagues, peers, friends, but also and always to the campus' Art Gallery and Bookstore. So many times did she invite me to share good moments: at theatres (for movies and plays), concert hall, talks (one memorable one was that given by Barbara McClintock in 1983 in Ottawa after she received the Physiology and Medicine Nobel Prize; imagine me being introduced to Dr. McClintock! Guess what? We talked about maize), picnics on the edge of her favourite lake in the Gatineau Hills, and at our respective places.

Margaret is and was a generous person. She has taught many undergraduate students and graduate students. She has "knitted many stitches" between her students so that we have generally remained close to each other and we continue to care about each other. She shared with us her ethics; she taught us that there were no problems in making mistakes as long as one recognizes and fixes them. By example, she showed us to produce our best. What a difficult battle it is to produce as beautiful and artistic manuscripts as she published with her late husband Martin Canny! I chose not to even try and worked on a different system. This may be cheating but many of you will understand my position.



Photo of Margaret and Frédérique, taken by Moira Galway at the Hotel Arcade, at the occasion of the AIBS conference in Montreal in 1994.

How many times now, as a professor at a Canadian university, do I recall what she taught me? When facing a problem, I wonder how she would react. When reading certain results in an article, I can imagine her reading the same results and asking an unsettling question. She is (of course!) still my mentor, and I still look up to her. I do not think I will ever be able to give her back all what she has given to me, and this is why I am trying to give to my good students as much as I can: not only facts about Plant Biology, but much more.

Margaret has touched many lives. I know for a fact that her former students have "landed" in many fields, Plant Biology of course, but also Agriculture, Medicine, Veterinary Science, the arts and business. These former students are located across the world, Canada, Australia, the US, Europe, and China. She has been a strong driver in her field.

I invite you to be the next person to acknowledge here your mentor and share with us your memories about that person. Do not be shy. This is an excellent way to recognize scientists who have made a difference in your life and to thank them.

Studying vegetation ecology in the Arctic

Maxime Tremblay, Recipient of the Laurie Consaul Arctic Research Award

This summer I had the chance to conduct my field season for my master studies in the Arctic Canadian Archipelago, on Bylot Island. The island is part of Sirmilik National park and is recognized as a Migratory Bird Sanctuary as it supports the most diverse avian community north of 70° N in the Canadian Arctic.

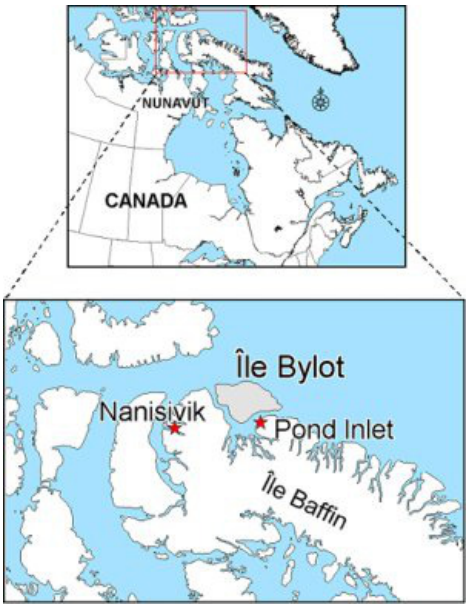


Figure 1: Bylot Island. Source: www.cen.ulaval.ca/bylot/studysite.htm [Accessed 09/24/2014]

Research on the Island started in 1988 as a collaboration between Laval University and Canadian Wildlife Service to study Greater Snow Geese breeding. Since then, the research team has grown and the studies have diversified to other birds, mammals, geomorphology and vegetation.

I arrived at the station on the 11th of June after a full day of flights through the beautiful landscapes of Nunavut, with short stops at several Inuit communities. On my arrival to the camp, as the helicopter was landing in the tundra, a little group of students and researchers was outside to welcome me to my new home for the next two months.

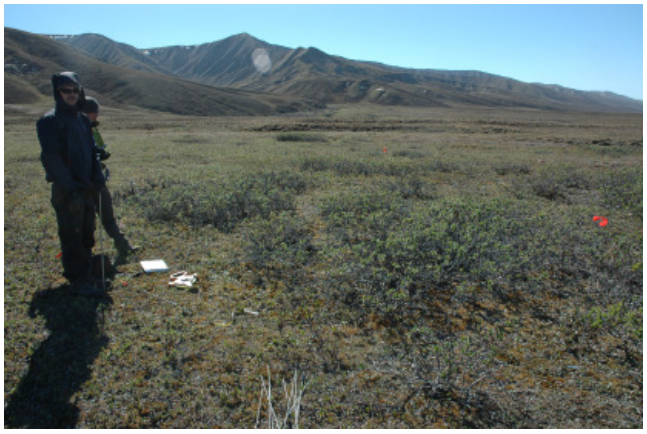


Figure 2: ©Esther Levesque, used with permission

I was there to study the distribution and the environmental factors associated to the presence of *Salix richardsonii*. Since it is the only erect shrub on the island, the species has particular importance for the local ecosystem, which is otherwise essentially composed of prostrate vegetation. As it is hypothesized that shrubs are taking advantage of the new conditions brought by climate change in the high latitudes, my aim was to evaluate the distribution of the population to get some



Figure 3: ©Laurent Gosselin, used with permission



Figure 4: ©Laurent Gosselin, used with permission

hints of its potential development and its potential impacts on the northern ecosystems.

As soon as my tent was set up and my belly was sated, I was looking forward exploring around the camp, but although the sun never set during the arctic summer, I was too exhausted from my travel to cross the electric fences and leave the camp.

I used the first days of my stay to explore my study area and to evaluate how *S. richardsonii* was roughly distributed. Essentially, my work was conducted on the south plain of a glaviofluvial valley separated by a braided river fed by two glaciers. As I walked in the valley I was able to detect some patterns in the shrub distribution. My work was then to find a way to measure these patterns. After some trial and error, and good talks with my supervisors, we finally settled on a good method to sample the populations. With that, my assistant and I began sampling all across the south plain of the valley, a task that would fill the rest of the summer.

The days we passed in the tundra went incredibly fast. Every day had its share of surprise and astonishment. As the short arctic summer passed on, we witnessed the plants and animals evolving. We saw the flowers blooming, the birds nesting and the eggs hatching, the foxes and the birds of prey hunting lemmings and smaller bird species. At the end of the summer we saw the massive arrival of Greater Snow Geese which annually come to the valley to feed with their goslings.

The atmosphere in the camp was also very effervescent. Around fifteen researchers and students were staying there for weeks or months. It was very stimulating to hear about the other projects and to open my mind to all the connections that intertwine all aspects of this simplified ecosystem. In my spare time, I even had the chance to get a bit involved in these other projects. That gave me the opportunities to see the capture of a snowy owl, to visit rough-legged hawk nests and to observe geomorphological processes linked to global warming.

August 15th was my last day on Bylot Island. My work, was done for the season and I was ready to go back home with a lot of samples and data to analyze. As the helicopter was bringing me back to Pond Inlet, the closest Inuit community, where I was going to stay for another three days working on berry experiments, I saw a polar bear mom and her cub walking slowly along the shore. And I thought to myself how special this summer had been with a bit of a growing nostalgia.



Figure 5: ©Laurent Gosselin, used with permission

Top Canadian Ornamental Plants. 7. Petunia

Ernest Small[1,2]

Although it is one of the world's most popular ornamentals, the petunia has image problems. Because it was the first to be widely planted as a bedding plant, and is one of the easiest to grow, it has become so common that many gardeners prefer less frequently encountered flowers. Indeed, seeds and planting stock are so cheap that many consider the petunia to be low-class, associated with the less affluent. Even more vulgar are several pejorative sexual meanings associated with the petunia. Finally, the petunia is height-challenged, its low, ground-hugging stature not afforded the respect acquired by taller flowering plants. Despite its universal occurrence, there are almost no societies and festivals dedicated to the petunia, while roses, peonies, lilacs and others are much more celebrated. The limited esteem in which the petunia has been held for many years is epitomized by the song Petunia in an Onion Patch, that became wildly popular in the mid-20th century.

I'm a lonely little petunia in an onion patch
and all I do is cry all day
Boo hoo, boo hoo

The air ís so strong it takes my breath away
feee—you

Who put me in this bed?
I'll bet his face is red
I call him down with every teardrop that I shed.

— From Petunia in an Onion Patch by J. Kamano, B. Faber and M. Hartmann, published in 1946



Figure 1. Petunia in an onion patch. Drawn by B. Brookes.

As described in this review, in the 21st century the petunia has risen far above its former humble reputation, with the development of an astonishing range of floral and branching forms suitable for diverse applications. Moreover, once considered delicate, breeding has turned the petunia into a rugged, low-maintenance plant that is quite resistant to biotic and climatic stresses. Perhaps more than any other ornamental, the petunia has become the premier outdoor container plant for enhancing all forms of architecture from buildings to statues.

Names

Scientific names: The genus name *Petunia* (and the corresponding vernacular name petunia) is derived from a South American word, perhaps the Paraguayan Guaraní *pety*, applied to another member of the Solanaceae family, tobacco (the Old French word *pétun* means tobacco). Indeed, the plant is known as petunia or by a very similar word in most Roman alphabet languages. Almost all cultivated petunias belong to *Petunia* ×*atkinsiana* (Sweet) D. Don ex W.H. Baxter (= *P.* ×*hybrida* hort. ex E. Vilm.).

English names: Most petunia cultivars are appropriate called "garden petunia" or simply petunia. Some plants with "petunia" in their name do not belong to the genus *Petunia* (notably "Mexican petunia," species of *Ruellia*, sometimes grown as ornamentals). *Calibrachoa* and ×*Petchoa*, discussed later, are often marketed as petunias.

French names: pétunia.

Wild *Petunia* species

The genus *Petunia* consists of 14 or 15 species of South American herbs and shrubs growing up to 1 m tall. These occur in temperate and subtropical parts of Argentina, Brazil, Bolivia, Paraguay and Uruguay, with a centre of diversity in southern Brazil. Destruction of their native grasslands is currently endangering the survival of some of the narrowly distributed endemic species.

Reports in the literature regarding whether *Petunia* species are annual or perennial can be quite misleading. It is commonly stated that they are perennial but grown as annuals. In fact, in their native situations most are naturally annual, but when protected in greenhouses many can be grown as perennials. Some species with a distribution in both areas with freezing winter temperatures and areas with milder temperatures are likely flexible, annual in the former, biennial or perennial in the latter. In the related genus *Calibrachoa*, both annual and perennial species are known.

[1]Science and Technology Branch, Agriculture and Agri-Food Canada, Saunders Bldg., Central Experimental Farm, Ottawa ON, K1A 0C6
[2]©Government of Canada. Verbatim redistribution for personal, non-commercial use is permitted.



Figure 2. The two major parental species of modern hybrid garden petunias. **Left:** *Petunia integrifolia*. Source: Curtis's Botanical Magazine (London), 1918, vol. 144 [= Series 4, vol. 14], plate 8749. **Right:** *Petunia axillaris*. ©Magnus Manske (CC BY SA 2.5).

The wild species are mostly insect-pollinated, except for *P. exserta*, a red-flowered, hummingbird-pollinated species. Not surprisingly, garden petunias are attractive to bees and butterflies. Hummingbirds will visit garden petunias (which are often on lists of recommended hummingbird flowers), but usually find limited nectar available.

The evolution of cultivated petunias

Garden petunias are of hybrid origin, the first hybrid apparently having been generated in 1834 by a British nurseryman. Various species have been suggested to have been used historically to generate modern garden petunias, especially the white-flowered, night-fragrant *P. axillaris* (pollinated nocturnally by hawkmoths) and the purple-flowered ("violet-flowered") *P. integrifolia* (*P. violacea*) (pollinated diurnally by bees). These plants were discovered in the late 1700s in South America, and soon became cultivated in Europe.

Up until 1930, most petunias cultivars were developed sexually by mass selection (using large numbers of superior plants as breeding parents) and by vegetative propagation (maintaining superior clones). Subsequently, intensive selection for desired characteristics occurred, and the marketing of F_1 hybrids became important (first generation hybrids can of course be distributed as seeds which will establish superior plants but will not breed true; or as cuttings which will remain true to type). Today, most commercially produced plants are generated by seeds, although vegetatively propagated cultivars have become quite popular.

Flowering in petunia is affected by photoperiod, but also by other factors, particularly temperature. Many of the species are "quantitative long-day plants," tending to flower with more than 13 hours of daylight. Flowering of many garden petunias has been selected to be resistant to length of daylight (i.e., although short days retard flowering, the delay has become less significant than in ancestral plants). True, day-neutral cultivars (completely unaffected by photoperiod) do not seem to be available. Because of its commercial importance, very extensive studies have been published on the genetic control of flowering.

As with numerous other ornamental plants, cultivars of petunia have been selected in which the flowers are "doubled" (i.e., extra petals have been added, usually by the conversion of stamens into petals), making the corolla more attractive. Cultivars with consistently doubled flowers first became available in the 1930s.

Variation of garden petunias

Garden petunias are tender perennials, usually grown annually, either from seed or cuttings. Their chief ornamental feature is funnel-shaped (trumpet-like) flowers, which in modern cultivars vary spectacularly in size (up to 15 cm or 6 inches in diameter) and number, whether the corolla is single or double, or ruffled or fringed. Colouration may be solid, or two-coloured ("bicolor"), and there are various variegation patterns such as spotting, speckling, longitudinal stripes, contrastingly coloured venation, and differently coloured edges (termed "picotee" and "frost") or centres ("star" patterns). Although petunias are available in virtually all colours (brown is absent, blue and black are rare), flowers that are purple (the traditional royal hue) are especially popular (indeed, "petunia" is sometimes used to designate a particular shade of purple). Many cultivars, especially with white or violet flowers, have a pleasant fragrance. The foliage is hairy and sticky.

The architectural habit of garden petunias varies considerably. Some plants produce upright or mounding shapes, others cascade attractively from hanging



Figure 3. Doubled petunia flowers. Source: Müller, I. (ed.). 1860. Illustrierte Garten-Zeitung. E. Schweizerbart, Stuttgart, Germany. Vol. 4, plate 12.

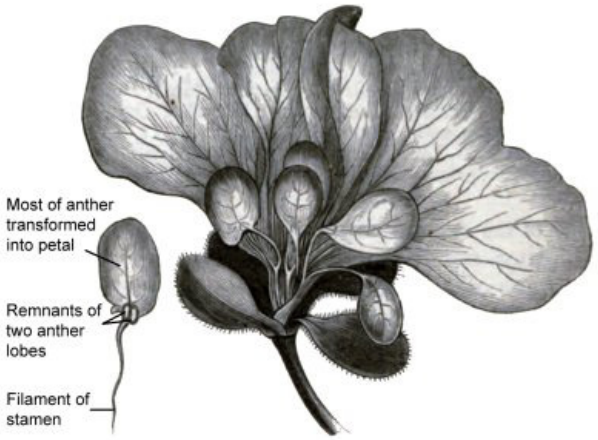


Figure 4. How doubling of petunia flower occurs by transformation of anthers into petals. Source: Masters, M.T. 1869. Vegetable teratology. Robert Hardwicke, London, U.K.

baskets, or produce spreading or trailing branches suitable as groundcover. Size or vigour also varies greatly among cultivars, ranging from short and compact ("dwarf") to tall.

Classification of garden hybrid petunias

Petunias have been assigned to several standard horticultural categories, described in the following, although hybridization has obscured the differences.

Multiflora

This is the oldest recognized class of petunias, and includes somewhat compact plants with relatively small flowers (5–7.5 cm or 2–3 inches wide) that are quite numerous. The plants are comparatively resistant to adverse weather conditions, including very hot, rainy and windy situations. Multiflora petunias are particularly suitable for massed garden bed plantings in solid or mixed colours. Some cultivars have been bred with larger flowers approaching those of the size of the next category, Grandiflora petunias, and it is has become difficult to distinguish the two classes.

Grandiflora

This category arose in the 1880s as large-flowered mutants of the Multiflora class, and has become the most popular group of petunias. Grandifloras now include plants with flowers so large (9–15 cm or 3.5–6 inches in diameter) that they are relatively susceptible to wind and rain damage, and are therefore more suitable for planters than for growth in garden beds. Most are upright, typically 30–38 cm (12–15 inches) in height, with trailing stems that tend to spread.

Floribunda

This group was produced in the 1950s by crossing Grandifloras and Multifloras, combining the larger flowers of the former and the weather resistance of the latter. Floribundas tend to be intermediate between Grandifloras and Multifloras, but there has been selection for relatively large flowers (7.5–9 cm or 3–3.5 inches).

Milliflora

These are compact, usually miniature plants, with petite blossoms (3.5–5 cm or 1.5–2 inches) that are extremely numerous. This group makes good edging and container plants, and is suitable for small gardens.

Spreading (groundcover)

These are low (10–15 cm or 4–6 inches high) but can spread up to 1.5 m (5 feet). The plants are fast-growing, low-maintenance, and noted for heat and drought tolerance. They are commonly used as ground cover, and look spectacular scrambling down sloping hillsides and over retaining walls. They also look attractive tumbling out of containers. Spreading petunias such as "The Wave," "Suertunia," "Cascadia" and "Surfinia" (these include series of cultivars) are commonly used as bedding plants, ground covers and elevated container plants from which the stems trail downward. "Hedgiflora" is a subcategory of spreading, plants which are grown close together to form a hedge 40–60 cm (15–24 inches) tall.

Petunia relatives: calibrachoa and petchoa

The genus *Calibrachoa* (commemorating 19th century Mexican botanist Antonio de la Cal y Bracho) is very closely related to the genus *Petunia*, occurs substantially in the same regions of South America, and was included in the latter in the past. However the two genera differ in chromosome number (n = 7 in *Petunia*, n = 9 or 18 in *Calibrachoa*) and in a variety of anatomical features. Calibrachoas first became popular with the public in the 1990s, and since then breeding has produced many kinds mimicking the classes of commercial petunias. The interspecies hybrid *C.* ×*hybrida* is popularly known as "Million Bells" (or as the cultivar 'Million Bells'), which is an allusion to its numerous blooms resembling miniature petunia flowers. Other names include seaside (or

seashore) petunia (a reference to presence in rocky coastal areas), and callies (a name also honouring Antonio de la Cal y Bracho).

Intergeneric hybrids between *Petunia* and *Calibrachoa* have been made, and are assigned to the genus ×*Petchoa* (a name combining elements of *Petunia* and *Calibrachoa*). The foliage of these frequently lacks the objectionable sticky foliage of petunias.

Economic Status

The petunia is one of the most popular annual bedding plants in the world. In the U.S., where it is the leading bedding plant, more than 140 million potted plants are sold annually, with a wholesale value exceeding $100 million. In Canada, the petunia is among the top ten greenhouse-grown plants, and more than 10 million potted plants are sold yearly.

Petunias are very attractive to consumers, because (1) they are usually among the cheapest annual planting stock available from nurseries; (2) they are available in a wide range of attractive growth patterns and flower characteristics, and often also are pleasantly scented; (3) they are very easy to grow; (4) they flower continuously and prolifically from spring to autumn, often until killed by a hard frost; (5) they are disease- and pest-resistant; and (6) they are extremely versatile and suitable for diverse circumstances, including large floral beds to produce masses of colour, borders for accents, and eye-catching colourful hanging baskets and window boxes.

Beginning in the latter half of the 20th century, *Petunia* has become a widely employed model system for studies of gene regulation and genome structure, particularly with respect to reproductive characteristics



Figure 5. Examples of garden petunia flowers illustrating the range of solid and mixed colours and single and doubled flowers. Sources: **A.** 'African Sunset', ©Les Serres Fortier, CC BY 2.0. **B.** 'Cascadia Indian Summer', ©Les Serres Fortier, CC BY 2.0. **C.** 'Black Velvet', ©Les Serres Fortier, CC BY 2.0. **D.** ©Serge Melki, CC BY 2.0. **E.** Rosendahl, public domain. **F.** ©Joe deSousa, CC BY 2.0. **G.** ©Aftabbanoori, CC BY 3.0. **H.** 'Cascadia Rim Magenta', ©Les Serres Fortier, CC BY 2.0. **I.** ©HitroMilanese, CC BY 3.0. **J.** ©Steve Slater, CC BY 2.0. **K.** ©The Greenery Nursery, CC BY 2.0. **L.** ©Mark Baylor, CC BY 2.0. **M.** ©Aftabbanoori, CC BY 3.0. **N.** 'Surfina Summer Double Rose', ©Les Serres Fortier, CC By 2.0. **O.** 'Sweet Sunshine', ©3268zauber, CC By 3.0. **P.** ©Bradley West, CC BY 2.0.



Figure 6. Multiflora petunias, notable for abundant, medium-sized flowers. ©InAweofGod'sCreations (CC BY 2.0).



Figure 7. Grandiflora petunias, notable for very large flowers. P. Kratochvil (public domain).

such as development of floral structure, floral pigments and scent chemicals. Hundreds of research papers in these fields have been published. Among petunia's advantages for such studies are (1) simplicity of growth; (2) short life cycle (4 months from seed to seed); (3) large flowers, facilitating chemical sampling; (4) abundant seed production; (5) capability of both self- and cross-fertilization; (6) possession of an endogenous, very active transposable element system, facilitating genetic screening; and (7) ease of genetic transformation and regeneration from leaf disks and protoplasts.

Cultivation

Purchasing

The simplest way to obtain petunias for planting is to buy young material (plugs or young potted plants). As for all planting stock, look for young, vigorous, disease-free, pest-free plants in soil that is neither excessively wet nor dry. Short, compact plants will establish more readily than leggy, thin plants. Resist the tendency to buy the biggest plants with the most flowers, as these are slower to transplant. Read labels to learn of the plant's characteristics and maintenance requirements; if suitable information is not provided (often the case in supermarkets), purchase from a garden centre where expert advice is offered. Many of the most attractive cultivars are sterile or do not produce many seeds, and so are necessarily propagated from cuttings. Many cultivars are available that can be raised from seeds (10–12 weeks are required to establish seedlings before planting out; the tiny, dust-like seeds need light to germinate, so they should not be covered; warm temperatures (21–27°C, 70–80°F) are best until germination, cooler thereafter (18°C, 65°F day; 13–18°C, 55–65°F night). It should be understood that petunia seeds collected from plants in your garden may be sterile or may not come true to type since they are of hybrid origin (seeds from hybrids often produce plants that revert to the white or purple colours of ancestral plants).

Environment

Petunias are cold-sensitive, and should not be planted out until there is limited danger of frost. Petunias grow best: in moderately fertile soil, with a pH of 5.5 to 7.0, with good drainage (adding organic matter may be necessary to improve drainage); with soil maintained



Figure 8. Supertunia petunia, an example of the spreading class of petunias suitable as groundcover. ©Forrest and Kim Starr (CC By 2.0).



Figure 9. *Calibrachoa* "million bells" (a phrase used for cultivars of the genus, as well as a particular series of cultivars). ©Weissertier (CC By 2.0).

evenly moist but not waterlogged; in full sunlight (partial shade is tolerated but at least 5 hours of sunlight is recommended, although some shade may be preferable in very hot circumstances); in moderate temperatures (petunias prefer cool conditions and react poorly to extreme heat); in containers large enough to provide room for root development (e.g., depending on variety, a 10 inch pot can handle 4 plants, 7 can be placed in a 20 inch pot), or separated in the garden at spacing of about 30 cm (12 inches) for most cultivars, 15 cm (6 inches) for miniature types, or 45–60 cm (18–24 inches) for the vigorous spreading kinds.

MAINTAINANCE

Moderate fertilization (e.g. diluted, balanced fertilizer such as 10-10-10 every 2 weeks) and watering (deep watering once weekly in flower beds and borders during dry weather; when the soil surface becomes dry in containers) as required (petunias of the spreading class, planted in the ground, tend to need frequent watering). Older cultivars should be deadheaded (removal of faded or wilted flowers to prevent the plant's energy going into seed formation) or pruned back to stimulate setting of flower buds, unpleasant tasks since the foliage is sticky and spent flowers are mushy. Petunias produce new blooms at the ends of stems, so plants tend to become leggy and less productive of flowers as the season progresses, unless stems are cut back. Although newer cultivars may claim to be free of requirements for deadheading and pruning (which is mostly true for spreading petunias), some pinching back or shearing may be desirable in mid-season. Aphids are often present, and can be reduced by blasting with water.

Curiosities of Science and Technology

Luther Burbank (1849–1926) was a genuine but erratic horticultural genius (often called "the plant wizard") when it came to creating amazing new hybrid varieties of plants. One of his alleged creations was a hybrid between a tobacco species (*Nicotiana wigandioides*) and garden petunia that he called *Nicotunia*, which combined the large, attractive flowers of petunia and the large leaves of tobacco. The plant was sold in the 1890s, but subsequently disappeared. Whether *Nicotiana* and *Petunia* in fact can be hybridized by conventional sexual means is debatable. Some genetic transfer between the two genera is possible by modern technologies (see Glimelius and Bonnett 1986 and Hinnisdaels et al. 1991) but apparently not by conventional sexual means.



Figure 10. Lancelot Restaurant in Vail, Colorado, sumptuously decorated with hanging pots of petunias. ©rjones0856 (CC BY 2.0).

Among the most popular floral names for females are: Daisy, Daphne, Holly, Iris, Lily and Rose. Although "Petunia" is occasionally found, it has been considered to be rather eccentric, best known for the cartoon character Petunia Pig, the girlfriend of Porky Pig.

"Shanin," a floral preparation of *Petunia integrifolia* (*P. violacea*; one of the ancestors of garden petunias), has been claimed to have been used as a hallucinogen by Ecuadorian Indians. The report has not been validated, and probably represents confusion with some of the truly hallucinogenic species in the Solanaceae family, such as those of *Datura* and *Iochroma*. Nevertheless the rumour that garden petunias are hallucinogenic is widespread.

Petunia corollas, even those that are white, have been demonstrated to develop functional chloroplasts that provide small but significant photosynthetic reserves to the plant.

In 1990, geneticist Richard Jorgensen attempted to intensify the purple of petunia flowers by providing the plants with extra copies of a purple pigment gene. Counter-intuitively, some of the altered petunias were



Figure 11. Left. American horticulturist Luther A. Burbank (public domain photo, taken in 1915, from the U.S. Library of Congress Prints and Photographs division). Burbank claimed to have hybridized petunia and a tobacco (*Nicotiana*) species, respectively shown in the centre and at right, from: Whitson, J., John, R., and Williams, H.S. (editors). 1914. Luther Burbank: his methods and discoveries and their practical application. Luther Burbank Press, New York. Vol. 2.

white or had white patches. The phenomenon, an example of what is now termed "gene silencing," remained a mystery (sometimes dubbed the "petunia mystery") until 1998, when Andrew Fire and Craig Mello discovered that gene silencing often occurs by "RNA interference" (RNAi). In 2006 the pair received the Nobel Prize for Physiology or Medicine for their discovery. Gene silencing refers to forms of gene regulation, particularly the reduction of expression of certain genes, and is becoming extremely important for therapeutic purposes. RNAi is an important natural way that cells regulate gene expression, and may have evolved as a defense mechanism against cell invaders, such as RNA viruses. RNAi works by destroying messenger RNAs, which transport genetic information for protein synthesis. (See https://mcb.berkeley.edu/courses/mcb41/41-8.pdf for more information.)

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Acknowledgements

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Figure 12. Porky Pig and Petunia Pig at the 108th annual Golden Dragon Parade in Los Angeles in 2007. Sponsored by the Chinese Chamber of Commerce and celebrating Asian culture, the Disney characters were featured because this was the year of the pig. ©Jim Winstead (CC BY 2.0).

Major Invasive Alien Plants of Natural Habitats in Canada. 9. Smooth Brome, Brome inerme: *Bromus inermis* Leysser

Paul M. Catling[1,2], Gisèle Mitrow[1] and Amanda Ward[1]

Smooth Brome (*Bromus inermis*), also known as Awnless Brome and Hungarian Brome, was listed as number 8 in the prioritized list of 81 major invasive aliens of natural habitats across Canada. It was introduced in early settlement times and its impact on native biodiversity occurred well in advance of good documentation of ecological phenomena. It is a highly competitive invasive plant that forms a dense stand eliminating a diversity of native plants and animals. Tall early season growth, formation of a dense sod of roots and rhizomes and litter deposition which excludes light, are characteristics that make it a successful invader. It also serves as an alternate host for viral diseases and other pests of crops. On the other hand it is a very valuable forage and has other important uses in erosion control and land reclamation.



Figure 1. Flowering spikelets of Smooth Brome. ©Kristian Peters. (CC-BY-SA 3.0)

Classification and Identification

Like four other of the top 20 invasive aliens of natural habitats in Canada, Smooth Brome is a member of the Grass family. The family includes major economic plants as well as major weeds. Like some other grasses, Smooth Brome is both a valuable plant and a serious environmental pest. There are 160 species of *Bromus* distributed in temperate regions of the world.

The genus *Bromus* belongs to a group of grasses that have stalked spikelets containing several bisexual florets in a branching inflorescence and the glumes are shorter than the lowest floret (not including its awns). The lemmas are five-nerved, bifid at the apex, not entire as in Fescues (*Festuca*), and rounded on the back, not keeled as in species of Bluegrass (*Poa*). The spikelets are not crowded in one-sided clusters as in Orchard Grass (*Dactylis glomerata*) with which *Bromus inermis* often grows.

Meadow Fescue (*Lolium pratense*, previously *Festuca pratensis* and *Schedonorus pratensis*) and Tall Fescue (*Lolium arundinaceum*, previously *Festuca arundinacea*) are also sometimes misidentified as Smooth Brome. They differ in having a tighter inflorescence with smaller spikelets that have florets that successively decrease in size toward the spikelet tip. Their lemmas are not two-toothed at the summit. Their rachises are often bent and somewhat flattened. Tall Fescue has auricles with strong hairs. Also confused with Smooth Brome are some tufted (non-rhizomatous) Bromes noted in the key below.

Smooth Brome and its native relative, Pumpelly's Brome (*Bromus pumpellianus*), can be distinguished from other species of *Bromus* by the first glume with one distinct nerve, lemmas rounded on the back and flushed with purple near the margins and with relatively short awns less than 6 mm long, and the presence of rhizomes (except in Pumpelly's Brome which is sometimes merely tufted).

Within the genus *Bromus*, Smooth Brome belongs to *Bromus* section *Bromopsis* in which the perennials have the upper glumes 3-5-veined and/or the lateral veins of the lemmas not ribbed. Smooth Brome may be distinguished from other members of this section by its patch-forming rhizomes (the others grow in clumps) with the exception of three taxa outlined below.



Figure 2. *Bromus inermis* from Flora Batava, vol. 19: t. 1472 (1895), by Dutch Botanist Janus (Jan) Kops, 1764-1849.

[1]Science and Technology Branch, Agriculture and Agri-Food Canada, Saunders Bldg., Central Experimental Farm, Ottawa ON, K1A 0C6
[2]©Government of Canada. Verbatim redistribution for personal, non-commercial use is permitted.

KEY TO SMOOTH BROME AND CLOSE RELATIVES

1a. Plants tufted, without creeping rhizomes

... A large group of Bromes belong here. The one most commonly confused with Smooth Brome, when plant basal parts are not available, is the native Fringed Brome (*Bromus ciliatus*) which has lemmas that are smooth on the back but pubescent with stiff hairs on the sides, with entire apices and awns 3-5 mm long. Other Bromes, except the rare introduced Upright Brome (*Bromus erectus*) which has erect panicle branches and pubescent leaves, and rare smooth forms of Hairy Woodland Brome (*Bromus pubescens*), are hairy over the back.

1b. Plants forming patches, with creeping rhizomes ... 2a.

2a. Culms 30–90 cm long; rhizomes short and plants clumped; awns (3)4-8 mm; marginal leaf blade hairs robust and widened at the base; basal sheaths decaying to a pattern of fibres and cross-fibres ... *B. riparius* Rehmann, Meadow Brome

2b. Culms 50–135 cm long, single or few together; rhizomes short to long-creeping and plants forming patches or clumps; awns 0-7.5 mm; marginal leaf blade hairs absent or not robust and not widened at the base; basal sheaths decaying to a pattern of fibres oriented in the same direction … 3.

3a. Lemmas densely or sparsely hairy on the back and margins with long hairs 0.5 mm or longer; awns (1) 1.5-7.5 mm long. [glumes pubescent to glabrous, culms usually pubescent with long hairs adjacent to nodes or glabrous, leaves pubescent to pilose on upper surface, auricles well developed, plants with rhizomes or tufted] … *Bromus pumpellianus* Scribn., Pumpelly's (Arctic) Brome

3b. Lemmas glabrous or scabrous on the back, or only slightly hairy at the base and on the margins with short hairs; awns absent or up to 2.5 (3.1) mm long. [glumes glabrous, culms glabrous to scabrous at the nodes, leaves usually glabrous or scabrous on the upper surface, auricles poorly developed or absent, plants strongly rhizomatous] … *Bromus inermis* Leyss., Smooth Brome

Meadow Brome (*B. riparius*): This species has recently become popular for pasture and rotational grazing systems in the western Canadian Prairies, especially in Saskatchewan. Since it is non-rhizomatous, it and its hybrids, are considered to be much less aggressive than Smooth Brome. It is native to southeastern Europe and central Asia. It was introduced in the US in 1966 and the varieties "Fleet" and "Paddock", were developed by Agriculture and Agri-Food Canada and were released in 1987. Other varieties and hybrids were released later. The hybrid "Success" was described in 2006. A major advantage of these was their rapid regrowth after first cutting.

Pumpelly's (Arctic) Brome (*Bromus pumpellianus*): This native species has no negative impacts associated with it. It differs from Smooth Brome principally in being hairy (on the lemmas, nodes and leaf blades). In Canada it occurs only in the west in the prairies, mountains and arctic regions with disjunction into the northern Great Lakes. This of course makes identification of Smooth Brome easier in eastern Canada.

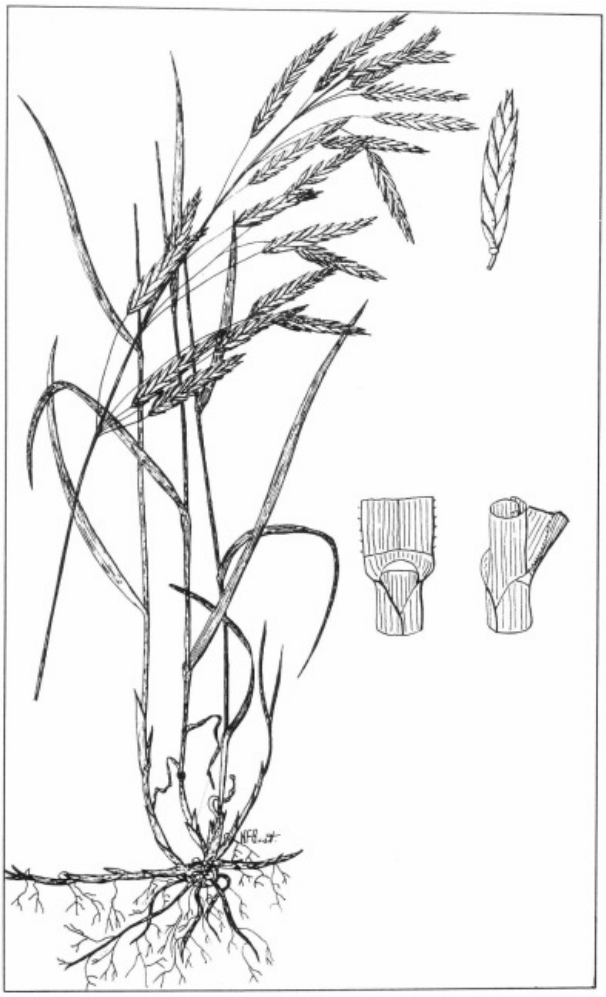


Figure 3. Smooth Brome. Drawing by K.F. Best from "111 range and forage plants of the Canadian prairies", page 39, 1983 (AAFC Research Branch Publication 1751).

Smooth Brome (*Bromus inermis*): The name "*inermis*" means without awns. The rhizomes, evident in the field as patches instead of clumps, as well as the short or non-existent awns and the lack of hair (on lemmas, and especially on the stems and leaves), and the purple color in the lemmas, are the most helpful features for identifying Smooth Brome. The panicle branches are usually ascending or spreading except in shaded situations. The general concept of the species includes plants with entirely smooth lemmas as well as those with scabrous lemmas and even short hair across the base of the lemmas and along the nerves. Plants of the latter type are sometimes considered hybrids involving *B. pumpellianus*, especially if there is hair on the leaves and joints. Hybrids of these two may occur where the ranges overlap such as the northern Great Lakes region and Rocky Mountains. There seems to be

a possibility that shortly hairy forms in Yukon and Northwest Territories are native. Plants from Goose Bay, Labrador, have been referred to forma *villosus*, but with hairy leaves and nodes, they could easily pass for *B. pumpellianus* if they had been collected in the northwest. Some of the meiotic irregularity and morphological variation in *B. inermis* has been attributed to introgression from *B. pumpellianus* and *B. erectus*, all of which can be hybridized to produce viable offspring. Hybrids with Meadow Brome may be difficult to identify as such but are generally not common outside of cultivation. Despite some difficulties that require further study, Smooth Brome is a largely distinctive, but variable taxon throughout much of its Canadian range. Considering all of the potential methods of transport, Canadian plants have probably originated throughout the European range and a large part of the genetic diversity of the species may be present outside of cultivation in Canada.

Infrataxa of Smooth Brome

More or less viviparous forms of *Bromus inermis*, or at least plants with leaves developing from spikelets (forming bulblets or leafy tufts), are rare. They may be called f. *proliferus* Louis-Marie. They have been found in Alberta (two locations), British Columbia (one location), Manitoba (one location), Ontario (four locations) and Quebec (3 locations).

In f. *villosus* ((Mert. & Koch) Fern., the lemmas are hairy. This is a characteristic of Pumpelly's Brome and other features of the latter species are presumably lacking in this rare form that requires more study with regard to the possibility some of the Canadian plants being better recognized as a hybrid.

Two other infrataxa, f. *aristatus* (Schur) Fern., where the lemmas are awned with awns up to 3 mm long and var. *divaricatus* Rohlena, with a lax and open panicle with widely spreading or reflexed branches, are rarely recognized, intergrade with more typical plants, and are without a distinctive geographical occurrence.

Description

Short to moderately tall, erect, rhizomatous, perennial 2-15 dm tall; leaves 1-2(4) dm long, (2)3.8-11.5(15) mm wide, smooth or occasionally somewhat hairy, margins serrulate, ligules membranous, 1-3.5 mm long, smooth and erose; panicles (5)6.5-22 cm long, 3.5-14 cm wide, open, branches erect to ascending often nodding at maturity, scabrous, usually longer than spikelets of which there are 1-5 per branch, the lowest node of the panicle with 3-7 branches; spikelets (1.5)1.7-3.2(4) cm long (including awns); glumes subequal, lanceolate, smooth, the lower 4.1-7 mm long, 1(3)-nerved, the upper 6-9.5 mm, 3-nerved; florets 7-10 per spikelet, the terminal floret often sterile; lemmas (7)10-13.5(16) mm long, 1.5-2.5(3) mm wide, smooth or scabrous across the base, mostly awnless or with awns up to 3 mm long; anthers yellow, 4-5.5(6) mm long: grains (5)6.5-8.2 mm long, 1.4-1.9 mm wide, hairy at the apex.



Figure 4. A herbarium specimen of the proliferating form of Smooth Brome. Photo by P.M. Catling (Ste. Foy, Quebec, 22 juillet 1963. A. Alarie, QFA).

Distribution

The native range of Smooth Brome includes southeastern Europe and central and northeastern Asia (France to Siberia), but it is now naturalized in all continents except Antarctica. It was introduced with and for livestock at an early stage in settlement of North America. In 1880 for example, 12 tons of seed were sent to the U.S. and then sent to state research facilities across the country. It was introduced to Canada as a forage around 1888 and the first plants to escape from cultivation were reported in 1903. In Quebec the oldest naturalized specimen is reported to have been collected in 1911. It likely spread from cultivation quickly throughout North America following accidental and purposeful introduction with livestock.

Smooth Brome is still being introduced. Recently it was grown successfully from seed sown at Wemindji at 55° north on the east coast of Hudson Bay as part of a study to determine what commercially available grasses could be used in the area. Smooth Brome has been introduced in North America from throughout its Eurasian native range. Some strains in the northern Great Plains originated from Siberia and some from further south in the Midwest and northeast originated from Hungary.

The maps illustrate where Smooth Brome has been

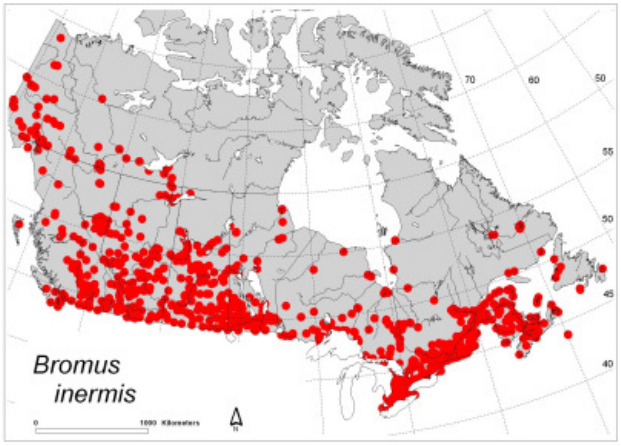


Figure 5. Distribution of *Bromus inermis* in Canada.

recorded outside of cultivation in Canada. The map is based on collections from ACAD, ALTA, CAN, DAO, LKHD, MMMN, MT, MTMG, NFLD, NFM, NSAC, NSPM, OAC, PMAE, QFA, QK, QUE, SASK, TRT, UAC, UBC, UNB, UPEU, UWO, V, WAT and WIN.

Ecology

A fast-growing, perennial, cool-season (C3), rhizomatous grass, Smooth Brome begins growth earlier in the year than native warm-season (C4) grasses. New shoots emerge in late March and April. It does well in areas of moderate rainfall and moderate temperature. Although it grows on silty and loamy soils it does best on light sandy soils of variable pH (mostly 6-7.5). It is drought resistant in part due to the deep penetrating roots which reach down to 5 ft. Habitats are always open and more or less dry, but otherwise diverse.

Flowering occurs from mid-June to July. Smooth Brome is open-pollinated and self-incompatible, the pollen being dispersed by wind. Midges and Chalcid flies may reduce viable seed. Seeds ripen in July and August. Viable seeds may be transported by birds and over short distances by ants, but the most significant dispersal is likely by adhesion to wet clothes, fur, in mud on animals and vehicles etc. Rhizomes transported by vehicles likely also provide significant dispersal. Seeds and rhizomes are also transported in hay. Smooth Brome may start to invade natural habitats from roadsides. Plants, including genetic variants not presently in a particular area, may be introduced for forage or landscape management, but introductions for such purposes are now discouraged in some areas.

Detrimental Aspects

Significance is suggested by the number of asterisks, 5 for highly significant. A large body of literature is available regarding the biology and response of Smooth Brome to conservation management designed to reduce its impact on native plants of open habitats, particularly native sand barrens, prairies and meadows (see reviews by Otfinowski et al. 2007, Salesman and Thomsen 2011).

(1) Negative effects on biodiversity *****

There is a very long list of species of flora and fauna that has been reported to be eliminated by Smooth Brome. The few examples below are a small fraction of the species impacted. There are also a very large number of references available documenting biodiversity decline as a result of invasion of Smooth Brome. Some of the losses are substantial such as a 70% decline in plant diversity after invasion in the Fescue prairies of Riding Mountain National Park in Manitoba.

In the prairies, Smooth Brome can eliminate all native prairie vegetation including the dominant native grasses. Among the many species that have been shown to decline in the presence of Smooth Brome is Prairie Crocus (*Anemone patens*), the provincial floral emblem of Manitoba (see CBA/ABC Bulletin 41(3): 64-68. 2008). A detailed population level study has indicated that this spectacular native plant can survive in patches of native grasses but will gradually be extirpated in stands of



Figure 6. Flowering Wild Rose, a species declining on the prairies due to the combined effects of Smooth Brome and the invasive alien Rose Stem Girdler Beetle. Denali National Park and Preserve, Alaska, 19 June 2012. ©Jacob W. Frank. (CC-BY-SA 2.0)



Figure 7. Sage Grouse declining as a result of various impacts of Smooth Brome on Sage habitat. ©Pacific Southwest Fish and Wildlife Service. (CC-BY-SA 2.0)



Figure 8. Mottled Sand Grasshopper is declining due to loss of open sand due to overgrowth of Smooth Brome. Pinhey Dune, Ottawa, 20 Sept. 2014. ©Marika Kors. With permission.



Figure 9. Henslow's Sparrow, a declining species that has benefitted from the use of Smooth Brome in the reclamation of old coal mines. Central Iowa, 10 May 2011. ©Dominic Sherony. (CC BY-SA 2.0)

Smooth Brome. The stems of Wild Rose (*Rosa acicularis*), the provincial floral emblem of Alberta (see CBA/ABC Bulletin 42(2): 51-57. 2009), have been destroyed in many parts of the prairies by the invasive alien Rose Stem Girdler Beetle (*Agrilus aurichalceus*). The plants are prevented from resprouting because of rapid colonization of damaged rose patches by invasion of Smooth Brome. These rose patches formerly provided for a large and complex prairie diversity.

Species of fauna that depend on particular plant species and vegetative structure are also eliminated by Smooth Brome. Replacement of native forbs and bunchgrasses with Smooth Brome seriously degrades Sage Grouse (*Centrocercus urophasianus*) habitat due to loss of required high forb diversity, decreased canopy area of Sagebrush, and decreased visibility in invaded areas. Many articles have reported substantial declines in bird diversity associated with Smooth Brome invasion, but some articles have reported increases in a high profile species (see below).

In declining sand barren and dune habitats across Canada, Smooth Brome can extend over open sand and eliminate habitat that is utilized by a very large number of remarkably distinctive and sand-adapted native insects and other fauna. Loss of habitat of the rare Mottled Sand Grasshopper (*Spharagemon collare*) in the Ottawa Valley provides an example.

(2) Pest and disease reservoirs for cultivated crops

Pests that can spread from Smooth Brome to cereal crops include a variety of insects specialized to grasses as well as fungal, bacterial and viral pathogens. Among these is Ergot (*Claviceps purpurea*), a fungus which produces black Ergot bodies (sclerotia) in place of developing grains. An Ergot body is a hard mass of fungal mycelium that contains poisonous alkaloids. Although no longer a major problem for humans in Canada due to the strict guidelines for allowable ergot bodies in grain, ergotism is still an important problem for livestock and can cause serious illness and death. Additionally its presence in cultivated grain results in rejection or downgrading.

Invasion-driven diversity reduction

Although we frequently use the terms such as "highly competitive", "smothering" and "excluding", it is sometimes based on anecdotal observations rather than comprehensive experimental studies. However, the application of such terms relating to invasion-driven diversity reduction has been investigated experimentally in the case of Smooth Brome, and the results are consistent with the idea.

Beneficial Aspects

(1) Forage *****

Smooth Brome was introduced for forage (hay, pasture, silage) and cultivars have been developed to improve particular qualities and/or growth in particular regions. Drought tolerance and rapid establishment are among the characteristics that make it a particularly good forage. Production of cultivars continues and some have been produced within the last decade. There are at least 34 cultivars derived from both Siberia and Hungary, with the former used in the northern Great Plains and the



Figure 10. An extended, blackened and curled Ergot body is characteristic of infection by the fungus. Photo by P.M. Catling from herbarium specimen (Ile Sainte-Therese, L. Deschamps, 21 Sept. 1966, MT).



Figure 11. *Bromus inermis* "Skinner's Gold" is not recommended for planting in some areas because the species is invasive. Courtesy of Plant Delights Nursery, Inc. http://www.plantdelights.com/

latter further south. Hybrids of *B. inermis* and *B. riparius* have good regrowth potential and are suited for both hay and pasture production and they maintain relatively high energy reserves for spring growth.

(2) Soil stabilization (Erosion control)***
Since it has an extensive root and rhizome system and forms sod, it can be used to stabilize soil and has been used effectively for this purpose on steep slopes.

(3) Revegetation of mine sites***
As a result of commercial availability and ease of establishment, landscape managers have used Smooth Brome to revegetate mine sites. Sometimes this has been done on a grand scale. Surface coal mining in the Midwestern U.S. has led to large areas of land being reclaimed with cool-season introduced grasses, particularly Smooth Brome. Although such reclamation may be done more profitably for biodiversity if native species were used, the extensive introduced grasslands have become home to declining Henslow's Sparrows (*Ammodramus henslowii*). Smooth Brome forms the dense vegetation and substantial litter associated with these birds. At 19 reclaimed sites in Indiana alone, a population of a few thousand Henslow's Sparrows was recorded. Some of the new grassland sites are over 2000 ha in extent and are long-lasting and require no management for maintenance of the sparrow.

(4) Food and cover for wildlife
Smooth Brome is used as food and cover by both native and non-native animals. It has also been used in mixes to provide food and cover for wildlife. Some beneficial results have been reported (see above) but some conservationists believe that landscape managers use commercially available seed without evaluating the consequences. USDA notes that it is no longer recommended for wildlife use in some states due to negative impacts on biodiversity.

(5) Ornamental Use
It has been suggested by some cities and towns that a variegated (yellow and green) cultivar of Smooth Brome called "Skinner's Gold" should not be planted because the plant is invasive. Although ornamental cultivars of Smooth Brome are available, they are not especially popular.

Management

There is no particularly effective method of control and biological methods have not been developed. The size and composition of the native seedbank is an important consideration for restoration. In their review of control methods, Salesman and Thomsen (2011) concluded that: "Late-spring burns timed to target smooth brome when root reserves are at their lowest have shown promise as a control strategy. Uncertainty remains, however, about the relative efficacy of fire, herbicide, mowing, or grazing to accomplish late-spring defoliation, the effect of repeated treatments, and the potential benefits of treatment combinations." Importantly these reviewers also noted that research on control methods would reduce costs and increase confidence in restoration.

Chemical Methods:
A standard treatment involves glyphosate at 0.5–1.1 kg/ha before flowering and early spring and fall applications are favoured. Glyphosate herbicides have the disadvantage of being non-selective. One interesting study suggested that herbicide combinations show potential for controlling Smooth Brome and allowing establishment of planted native species. Using herbicides it is possible to convert Smooth Brome-dominated plant communities to native plant communities, without first converting them to agriculture, decreasing the time for conversion and perhaps allowing more native flora to persist.

Manual and Mechanical Methods:
Close mowing when the plants are 18-24 inches tall in the "boot stage" (when the flowering head is still

Management - A specific and targeted approach

As is always the case, the situation with species interactions is complex and our knowledge is incomplete, despite the fact that ecology has been part of science for a relatively long time. The important management questions should relate to specific protection objectives involving biodiversity, rather than simple local elimination a plant with a bad reputation. Without effective control methods, without biocontrol, and with ubiquitous occurrence, as well as agricultural and other benefits, Smooth Brome provides a good example of the need to apply a specific and targeted approach.

enclosed in the sheath) followed by repetitions has produced good results. Mowing however, does not immediately consume biomass which remains present as litter which insulates the ground and reduces soil temperatures; conditions favourable to cool-season grasses. Digging up plants is difficult with rhizomatous species which grow back from cut rhizomes.

Fire

Fire has generally been an attractive management tool for prairies because it was a naturally occurring process. It has also been shown to promote biodiversity in prairie and to reduce increase in alien grasses such as Smooth Brome. With regard to Smooth Brome, it is most effective to burn at a time when the cool-season grasses are impacted but the native warm season grasses are not. Optimum burning time is in the “boot stage” from mid-April to mid-May. Early spring fire when tillers are emerging has limited effect. It has been suggested that Smooth Brome and Kentucky Bluegrass be considered together in control programs so that the control of one does not simply release the other.

Grazing

This is sometimes a favoured idea because grazing was also a natural process on the prairies and localized trampling disturbance and defecation caused gaps that may increase biodiversity. It is also favoured because it may be economically worthwhile. However, native mammals graze differently than livestock. “The information that is currently available suggests it is unlikely that conventional grazing will reduce Smooth Brome presence”. A few comparisons of grazing and fire have shown fire to be more effective. Since Smooth Brome is widely used as forage, it is not surprising that moderate grazing pressure is not harmful.

Prospects

Combination control methods have proven useful and research needs in control of Smooth Brome have been clearly stated (Salesman and Thomsen 2011). Information for prioritization of species and sites to save from smooth brome is generally available since what is left of many kinds of prairie and sand barren are geographically restricted remnants and relicts. Localized management of Smooth Brome to protect native biodiversity may become less costly and more effective. The spread and introduction of potentially harmful genotypes is being controlled in many areas. On the other hand Smooth Brome is still spreading into natural areas. Recent authors concluded that Western Canadian grasslands are seriously threatened by Smooth Brome and “a passive or hands-off approach to managing natural areas will eventually result in invasion.”

Believe it or not

- The fungus, Ergot, developing in pasture grasses like Smooth Brome, and cereal crops, can be very dangerous. Prior to the strict guidelines for allowable ergot bodies in grain, it was a serious problem for humans. Symptoms include impaired blood circulation, causing alternating burning and freezing sensations, followed by gangrene of extremities. This symptom was referred to as St. Anthony's Fire. Nervous convulsions can also occur and lead to eventual death.
- Brome is also a mouse who plays an important role in saving Martin (another mouse) in the relatively recent story of “Martin the Warrior.”
- “Ungulates in Yellowstone National Park utilized Smooth Brome growing in association with other graminoids and forbs, but did not graze Smooth Brome where it occurred in a monoculture”.
- The unusual form of *B. inermis* (“*inermis*” meaning without awns) with pointed awns called “*aristatus*” was described by Austrian botanist Philipp Schur (1799-1878) in his work on the flora of Transylvania.

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Figure 12. *Bromis inermis* from "Icones et descriptiones graminum austriacorum", vol. 1: p. 8, t. 9 (1801) by Austrian botanist Nicolaus Thomas Host (1771-1834) who was the personal physician of Holy Roman Emperor Francis II and after whom the genus *Hosta* is named.

The Lord of the Shore

David Garbary, Professor of Biology,
St. Francis Xavier University

(an ode in celebration of *Ascophyllum* and its symbionts)
(with apologies to JRR Tolkien)

The players are as follows:
- The fucoid host - *Ascophyllum nodosum*
- The fungus - *Mycophycias ascophylli*
- The rhodophyte - *Vertebrata lanosa*
- The slimy brown alga - *Elachista fucicola*
- The animal (a chironomid) - *Halocladius variabilis*

There are still at least two other eukaryotic symbionts in the community that includes an endophytic diatom and a parasitic red alga, but I haven't worked on these yet.

One animal to eat microalgae and slither on its host
A rhodophyte who grips the fucoid with penetrating ropes
A fungus that surrounds the cells and never lives free
A slimy brown alga, a cousin - but doubtful friend is she

With one plant to rule them all, and on the seashore bind them
On the cold North Atlantic where the land meets the sea

Four phyla come together, captured by the one
So here we have the players, and what will their roles be?

With one plant to rule them all, and on the seashore bind them
On the cold North Atlantic where the land meets the sea

Stay Tuned!
Next issue the CBA Bulletin will bring you full reports from the 50th Anniversary Congress at the Montreal Botanical Gardens this past summer!