

# The Canadian Botanical Association Bulletin

## Bulletin de l'Association Botanique du Canada

Vol. 51 Number 3, December/décembre 2018



Gerbera. See story on page 55 Source: Pixabay (public domain photo).

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### The Canadian Botanical Association Bulletin

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

### Information for Contributors

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: [www.cba-abc.ca](http://www.cba-abc.ca)

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### Next issue

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### 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 nature concernant 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'ABC à l'URL suivant: [www.cba-abc.ca](http://www.cba-abc.ca)

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### Prochain numéro

La date de tombée des textes du prochain numéro, le no 52(1), est le 1 mars 2019

# Announcements

## National Biodiversity Cryobank of Canada

The National Biodiversity Cryobank of Canada (NBCC), located at the Canadian Museum of Nature's (CMN) Natural Heritage Campus (1740 Pink Road, Gatineau, Aylmer Sector, Quebec), is the result of a donation by the Beaty family and officially opened in September 2018. The NBCC is a natural history biorepository of specimens from across Canada and abroad, with a capacity for over a million standard 2 mL cryovials. This state-of-the-art facility uses innovative LN 2 freezer technology and greatly enhances the CMN's ability to store frozen collections at -170°C.

The core objective of the NBCC is to provide excellent specimen care with easy access for scientific use. Storage is available for vouchers from research projects outside of the CMN. The collections may contain representatives from all kingdoms of taxonomic classification in the form of tissues, environmental samples, phenotype vouchers, and DNA extractions. As an extension of CMN's collection facility, the operation of the NBCC is compliant with all other policies and procedures for the CMN.

For more information about the facility, send inquiries to [nbcc-cnbc@nature.ca](mailto:nbcc-cnbc@nature.ca), visit our webpage ([nature.ca/en/research-collections/collections/cryobank](http://nature.ca/en/research-collections/collections/cryobank)), or write to National Biodiversity Cryobank of Canada, Canadian Museum of Nature, P.O. 3443, Station D, Ottawa, Ontario, K1P6P4, Canada.

## Cryobanque nationale canadienne de la biodiversité

Fruit d'un don de la famille Beaty, la Cryobanque nationale canadienne de la biodiversité (CNCB), a officiellement ouvert ses portes en septembre 2018 au Campus du patrimoine naturel du Musée canadien de la nature (MCN) (1740, chemin Pink, Gatineau [secteur Aylmer], Québec). La CNCB est un biodépôt de spécimens d'histoire naturelle de tout le Canada et de l'étranger. Elle peut stocker plus d'un million de cryovials standard de 2 mL. Cette installation à la fine pointe de la technologie utilise la technologie novatrice de congélation à l'azote liquide. Elle améliore grandement la capacité du MCN à entreposer avec la plus grande intégrité les collections congelées (à -170 °C).

La mission de la CNCB est de fournir d'excellents soins à nos spécimens et un accès facile à des fins scientifiques. Elle peut aussi accueillir les spécimens de référence provenant de projets de recherche menés à l'extérieur du MCN. Les collections peuvent contenir des représentants de tous les règnes de classification taxonomique sous forme de tissus, d'échantillons environnementaux, de spécimens témoins de phénotypes et d'ADN. Comme il s'agit du prolongement de notre entrepôt de collections, l'exploitation de la CNCB est conforme à toutes les autres politiques et procédures du MCN.

Pour obtenir de plus amples renseignements sur l'installation, envoyez vos questions à [nbcc-cnbc@nature.ca](mailto:nbcc-cnbc@nature.ca), visitez notre page Web ([nature.ca/fr/recherche-collections/collections/cryobanque](http://nature.ca/fr/recherche-collections/collections/cryobanque)), ou écrivez à Cryobanque nationale canadienne de la biodiversité, Musée canadien de la nature, C.P. 3443, succursale D, Ottawa (Ontario), K1P6P4, Canada.

# In Memory of Dr. Cynthia (Cindy) Marie Ross Friedman, PhD, FRSA

August 19, 1971 – December 24, 2018

*A shining light has been dimmed*

A life cut tragically short. Our dear friend and colleague, Dr. Cindy Ross Friedman suddenly passed away of an aortic dissection while visiting her family for Christmas in Penticton, BC. She was only 47 years old. According to her husband, Dr. Tom Friedman, president of the Thompson Rivers University Faculty Association, her death was sudden and unexpected. An aortic dissection or aneurism is difficult to detect and can be caused by genetics or high blood pressure.

Originally from Winnipeg, Cindy studied at the University of Manitoba, where she obtained a Ph.D. in Biological Sciences in 2002. Her Ph.D. supervisor was Prof. Michael Sumner, who kindly provided these insights:

I first met Cindy when she was a first-year student in Introductory Biology. She expressed an interest in botany and registered as an Honours student in the Department of Botany. That interest evolved into a passion, particularly in the area of plant anatomy. In May, following her graduation, David Punter and I set up a Ph.D. program for her focusing on the reproductive biology of Dwarf Mistletoe. However, an opportunity arose for her to expand her musical interests. She was given the opportunity to join the rock band *Rats for Friends* as a singer, songwriter and keyboardist. Her botanical career was put on hold for three months. We kept in touch over the summer. She missed the lab and the academic environment. She wrote, produced, and sang a number of songs for an album she entitled *Burning Bridges*, and returned to the University of Manitoba to pursue her Ph.D. The rest, as you all know, is history.

During her graduate years at the University of Manitoba, Cindy was a teaching assistant for multiple undergraduate courses in the Department of Botany, where she influenced numerous students to pursue a career in botany, including the current CBA-ABC President, Julian Starr.

After teaching at U. of M., she moved to Kamloops, BC in 2004 joining the newly coined Thompson Rivers University. Leaving TRU in 2017, she was recently teaching at the University of Alberta and Concordia University of Edmonton.

A passionate and productive botanist with over 47 publications, her research was predominately in plant anatomy, particularly seed development and the reproductive stages of the dwarf mistletoe *Arceuthobium americanum*, a parasitic flowering plant (Santalaceae) using the techniques of light, fluorescence, and electron microscopy. As a mistletoe expert, she published in the prestigious *Nature Communications*. Cindy also applied her diverse knowledge and expertise publishing in the fields of forest and urban ecology,



Cindy Ross Friedman. ©TruOmega.ca, used with permission

microscopy, mathematical biology, and physics (kinematics and electromagnetism). In addition, Cindy took great pride in mentoring and inspiring her students, many of whom co-published with her.

Her distinguished academic career was recognized through numerous awards for teaching, research and service. Cindy was inducted into the inaugural cohort of the Royal Society of Canada's College of New Scholars, Artists and Scientists in 2014, and was made a Fellow of the Royal Society of the Arts (U.K.) in 2016 in recognition of her commitment to social and environmental justice. She strongly believed scientists have a duty to effect change through public engagement, appearing twice on CBC Radio's *Quirks & Quarks* with Bob McDonald to discuss her research but also to act as a spokesperson for a coalition of concerned community groups opposed to the proposed KGHM Ajax mine near Kamloops.

Within the CBA-ABC, Cindy was a popular member. New delegates at CBA-ABC conferences quickly recognized Cindy for her bubbly, upbeat personality. We are eternally grateful for her many and varied contributions that made our association stronger. According to records from the *Bulletin*, Cindy served on the CBA-ABC Board as a Director – West from 2006-2012, and again from 2013-2015. She served as Vice-President in 2012-13 and, with Christine Petersen, co-chaired the successful Annual Meeting (“Thinking Plants” was the theme) at Kamloops in early June, 2013. From 2008-2011, Cindy chaired the large, active Teaching Section of CBA-ABC. Reflecting her own impressive teaching abilities, during that period she also received a Teaching Excellence Award from TRU [see 43(2): 24]. At CBA-ABC conferences, Cindy was often accompanied by her husband Tom; the *Bulletin* includes a photo at Peggy’s Cove during the Plant Canada 2011 at Halifax. Perhaps lesser known, for several years Cindy was an important voice for the CBA-ABC regional awards offered each spring for best student talk and/or poster pertaining to botany. These occasions included Cindy appearing at the awards ceremony at different campuses in British Columbia, to make presentations on CBA-ABC’s behalf e.g., 42(2): 42; 43(2): 32; 48(2): 42; 50(2): 32. Cindy’s own excellent conference presentations at CBA-ABC meetings – often involving exciting projects undertaken with students – could soon be found thereafter in published form within the botanical literature. Indeed, her extensive publication list at the end of this tribute also demonstrates Cindy’s active interest to publish regularly (10 times) in *Canadian Journal of Botany* (now *Botany*). She served reliably as an outstanding reviewer for that journal, as well.

Outside of her academic and community involvement, Cindy was an accomplished keyboardist and vocalist, performing in a rock band, solo and more recently with the Latin band *Caliente*.

Cindy Ross Friedman is survived by her husband Tom, stepsons Nathan and Benjamin, mother Rose Anne Ross, sister, Kelly Ross, brother-in-law Alex Lafreniere and extended family in B.C., Manitoba and Ontario.

A celebration of life ceremony was held on Saturday, Jan. 12, at 2 p.m. at Kamloops United Church, 421 St Paul St. The accompanying poem entitled *Camas Lilies* (by Lynn Ungar) was read by Christine at this service attended by many (standing room only). In lieu of flowers, people are encouraged to donate to a charity of their choosing although Cindy was a strong supporter of the SPCA due to her love of cats. Condolences can be left at the following link: [passages.winnipegfreepress.com/passage-details/id-260988/FRIEDMAN\\_CYNTHIA](http://passages.winnipegfreepress.com/passage-details/id-260988/FRIEDMAN_CYNTHIA)

#### Peer-Reviewed Journal and Chapter Publications:

47. Cheng X-L, Yuan L-X, Nizamani MM, Zhu Z-X, Friedman CR, Wang H-F. Taxonomic and phylogenetic diversity of vascular plants at Ma’anling volcano urban park in tropical Haikou, China: Responses to soil properties. *PLoS ONE*. 2018;13(6):1.
46. Zhou Y, Jiang J, Peng Z, Li J, Ross Friedman C, Wang H. (2017) Variation of Soil Bacterial Communities in

a Chronosequence of Rubber Tree (*Hevea brasiliensis*) Plantations, *Frontiers in Plant Science*.

45. Zhu Z-X, Zhang Y, Ross Friedman C, Wang H, Yang X-B. (submitted January 2017). Plant taxonomic, phylogenetic, and functional diversity are resilient in tropical forests despite the accelerated rate of forest dynamics.
44. Ziegler DJ, Ross Friedman C. (2017). Morphology and stomatal density of developing *Arceuthobium americanum* (lodgepole pine dwarf mistletoe) fruit: a qualitative and quantitative analysis using environmental scanning electron microscopy. *Botany*. DOI: 10.1139/cjb-2016-0187.
43. Zhu Z-X, Wang H-F, Cai G-Y, Lin Q-W, Qureshi S, Qiu J-X, Ross Friedman C. (Submitted 2016). Systematic environmental impact assessment for non-natural reserve areas: A case study of the Chaishitan water conservancy project on land use and plant diversity in Yunnan, China. *Frontiers in Plant Sciences*.
42. Zhu Z-X, Zheng T, Ross Friedman C, Wang H. (Submitted 2016). Tropical island endemic plant species and their conservation: Hainan case study in China. *Plant Ecology*
41. Zhou Y, Jiang J, Peng Z, Wang C, Li J, Ross Friedman C., Wang H. (Accepted 2016). Functional diversity of soil microbial communities in different-age rubber plantations- a case study of Hainan Province, China. *Journal of Rubber Research*.
40. Ziegler DJ, Ross Friedman C. (2016). Vegetative and floral development in the pistillate plant of *Arceuthobium americanum* (lodgepole pine dwarf mistletoe): an environmental scanning electron microscopy study of phenology and shoot organization. *Botany*. DOI: 10.1139/cjb-2016-0253.
39. Hampel LD, Cheeptham C, Flood NJ, Ross Friedman, C. (2016). Plants, fungi, and freeloaders: examining temporal changes in the “taxonomic richness” of endophytic fungi in the dwarf mistletoe *Arceuthobium americanum* over its growing season. *Botany*. DOI: 10.1139/cjb-2016-0240.
38. Mason C, Randhawa A, Watson K, Ross Friedman C, Cheeptham N (2016). Using scanning electron microscopy to study microbial communities in speleothem samples collected from Iron Curtain Cave. *Journal of Experimental Microbiology & Immunology* 2, 1-7.
37. Wang H, Qureshi S, Qureshi B, Qiu J, Ross Friedman C Breuste J, Xiaoke W (2016). A multivariate analysis integrating ecological, socioeconomic and physical characteristics to investigate urban forest cover and plant diversity in Beijing, China *Ecological Indicators*. 60: 921-929.
36. Wang H-F, Qureshi S, Knapp S., Ross Friedman C; Hubacek, K (2015). A basic assessment of residential plant diversity and its ecosystem services and disservices in Beijing, China. *Journal of Applied Geography* 64:121-131 .
35. deBruyn RAJ, Paetkau M, Ross KA, Godfrey DV, and Ross Friedman, C (2015). Thermogenesis-triggered seed dispersal in dwarf mistletoe, *Arceuthobium americanum*. *Nature Communications* 6, 6262 DOI:

- 10.1038/ncomms7262 (open access)
34. Wang, H-F, Ren, M-X, López-Pujol, J., Ross Friedman, C. Fraser, L.H., and Huang, G-X. (2015). Plant species and communities in Poyang Lake, the largest freshwater lake in China. *Collectanea Botanica*. 34(1): e004 DOI: 10.3989/collectbot.2015.v34.004
  33. Hartling I, Cinel B, Donkor K, Paetkau M, Ross Friedman C, and Church J. (2014). Tenderness effects of suckler beef production in British Columbia. *Canadian Journal of Animal Science* 94(2): 295-298 DOI: 10.4141/cjas2013-126
  32. Munro, K., Jackson JRM, Hartling I, Sumner, MJ, and Ross Friedman, C (2014). Anther and pollen development in the lodgepole pine dwarf mistletoe (*Arceuthobium americanum*) staminate flower. *Botany* 92: 203–214. DOI: 10.1139/cjb-2013-0276
  31. Wang H-F, Qiu J-X, Breuste J, Ross Friedman, C, Zhou, WQ, Wang XK (2013). Variations of urban greenness across urban structural units in Beijing, China. *Urban Forestry & Urban Greening*. 12: 554-561. DOI: 10.1016/j.ufug.2013.05.004
  30. Mosti S, Ross Friedman C, Pacini E, Brighigna L., and Papini A. (2013). Comparing nectary ultrastructure and secretory modes in three species of *Tillandsia* L. (Bromeliaceae) that have different pollinators. *Botany* 91(11): 786-798, DOI: 10.1139/cjb-2013-0126
  29. Friedman, B.M.C., Abraham, M.G., Paetkau, M., Taylor, S.R., and Ross Friedman, C. (2013). Use of a varying turn-density coil (VTDC) to generate a constant gradient magnetic field and to demonstrate the magnetic force on a permanent magnet. *The Canadian Journal of Physics*. 91(3): 226-230. DOI: 10.1139/cjp-2012-0405
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  26. Martin, L.L., Ross Friedman, C.M., and Phillips, L.A. (2012). Fungal endophytes of the obligate parasitic dwarf mistletoe *Arceuthobium americanum* (Santalaceae) act antagonistically in vitro against the native fungal pathogen *Cladosporium* (Davidiellaceae) of their host. *American Journal of Botany*. 99(12): 2027-34. DOI: 10.3732/ajb.1200189.
  25. Mostia S., Ross Friedman C., Piccolina F, Di Falco P. and Papinia, A. (2012). The unusual tegumental tissues of the *Lunaria annua* (Brassicaceae) seed: a developmental study using light and electron microscopy. *Flora*. 207: 828–837.
  24. Wang, H-F., Wang, Z-S., Ross Friedman, C and Lopez-Pujol, J. (2012). Conservation of the Cathay silver fir, *Cathaya argyrophylla*: a Chinese evergreen "living fossil". Invited book chapter (review). In: *Evergreens: Types, Ecology and Conservation*. Eds. Adriano D. Bezerra and Tadeu S. Ferreira. Nova Science Publishers, Inc. ISBN 978-1-61942-177-6.
  23. Ross Friedman, C.M. and Wang, H.F. (2012). Quantifying Meiosis: Use of the Fractal dimension, Df, to Describe and Predict Prophase I Substages and Metaphase I. Invited book chapter (original research). In: *Meiosis*. Ed. Andrew Swan. In Tech Publishers. ISBN 979-953-307-212-7 pp. 303-320.
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  3. Ross, C.M. (2005). A new way of thinking about meiosis: using the fractal dimension to predict the onset of metaphase I. *International Journal of Biological Sciences*. 1:123-125. [www.biolsci.org/v01p0123.htm](http://www.biolsci.org/v01p0123.htm)
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### Camas Lilies

Consider the lilies of the field,  
the blue banks of camas  
opening into acres of sky along the road.  
Would the longing to lie down  
and be washed by that beauty  
abate if you knew their usefulness,  
how the natives ground their bulbs  
for flour, how the settlers' hogs  
uprooted them, grunting in gleeful  
oblivion as the flowers fell?

And you – what of your rushed  
and useful life? Imagine setting it all down –  
papers, plans, appointments, everything –  
leaving only a note: “Gone  
to the fields to be lovely. Be back  
when I’m through with blooming.”

Even now, unneeded and uneaten,  
the camas lilies gaze out above the grass  
from their tender blue eyes.  
Even in sleep your life will shine.  
Make no mistake. Of course  
your work will always matter.

Yet Solomon in all his glory  
was not arrayed like one of these.

– Lynn Ungar  
used with permission



Cynthia Ross Friedman in 2015

## CAN marks Arctic digitization milestone

Big news from the National Herbarium of Canada (CAN) digitization team: in November 2018, we finished taking high resolution images of all vascular plant specimens from Nunavut, Northwest Territories and Yukon Territory, so that they can be shared on the web.

How long does it take to barcode and image about 80,000 specimens, and to perform all the taxon checking, database, and file management steps required to link them to the database? Over 11,000 person-hours, shared by two project staff and nine co-op / summer students, all pictured here.

We'd like to take this opportunity to thank these dedicated people, and everyone who's contributed to the

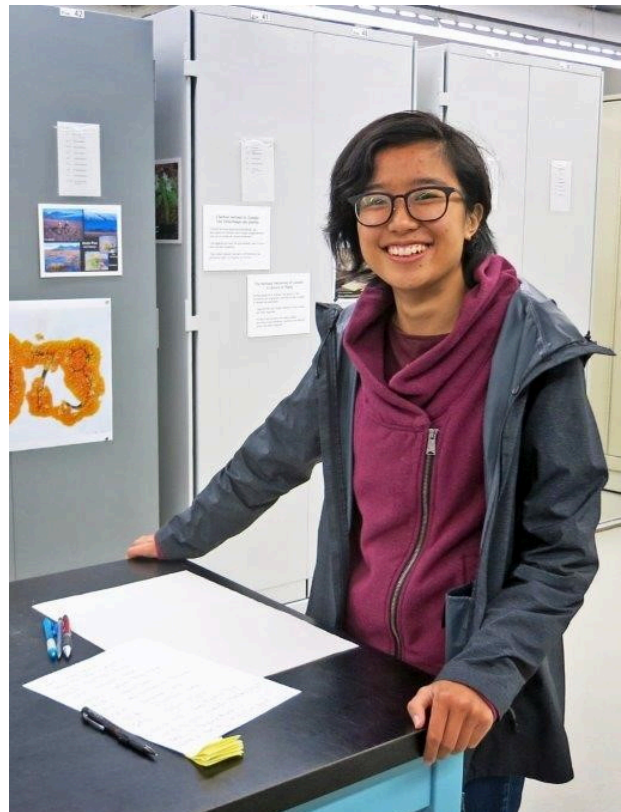
project so far. Especially, we owe deep gratitude to the Sitka Foundation for the funding that made it possible to move these resources beyond our cabinets, onto internet-connected devices in your office or pocket.

Please check out the results! The images are available via GBIF ([www.gbif.org](http://www.gbif.org)), by searching "Canadian Museum of Nature Herbarium". From here, viewers can browse the gallery, or create a search by clicking "Explore". When you find mistakes (there are still many), please send them in: updates and new images / data are posted weekly.

What's next? After clinking our coffee cups the day the last photos was taken, we moved straight on to northern lichens, bryophytes and algae. Stay tuned!



Annie Dicaire, University of Ottawa



Jasmine Lai, University of British Columbia

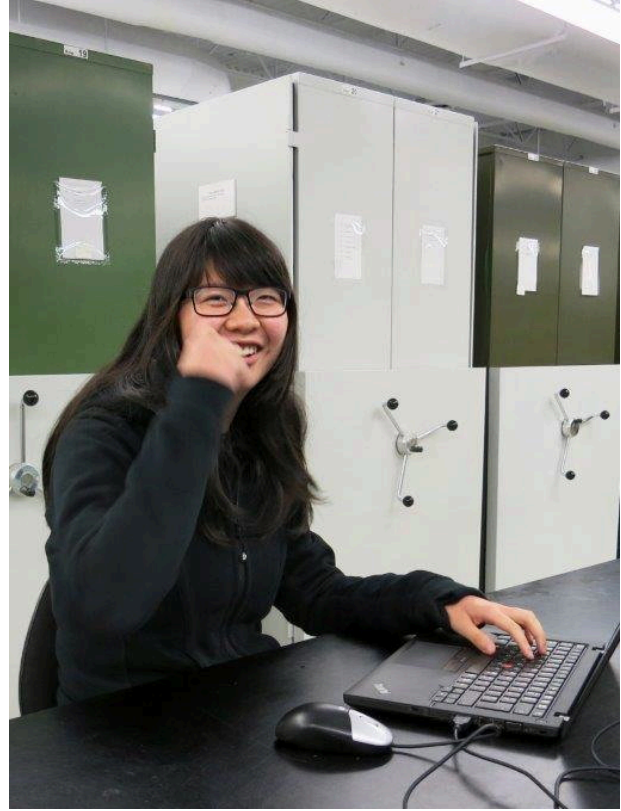


Erin Howard, University of Waterloo





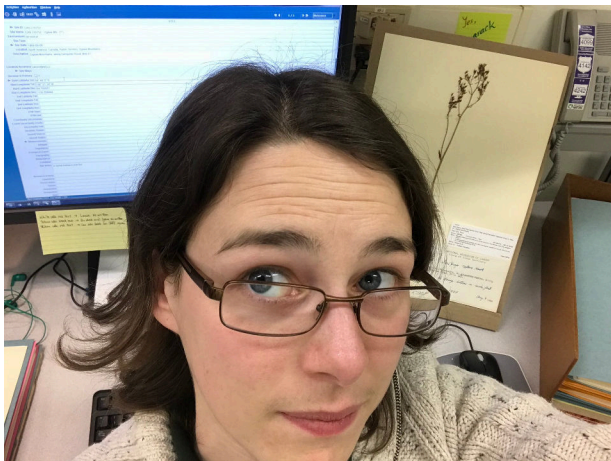
Kevin Kang, University of Waterloo



Emily Dang, University of British Columbia



Rachel Bergeron, University of Ottawa, and Lyn Vakulenko, Carleton University



Cassandra Robillard, Canadian Museum of Nature



Lisa Gualtieri, Canadian Museum of Nature



Wilson Wang, University of British Columbia



Brigid Christison, Carleton University

# Top Canadian Ornamental Plants. 21. Gerbera

Ernest Small<sup>1,2</sup>

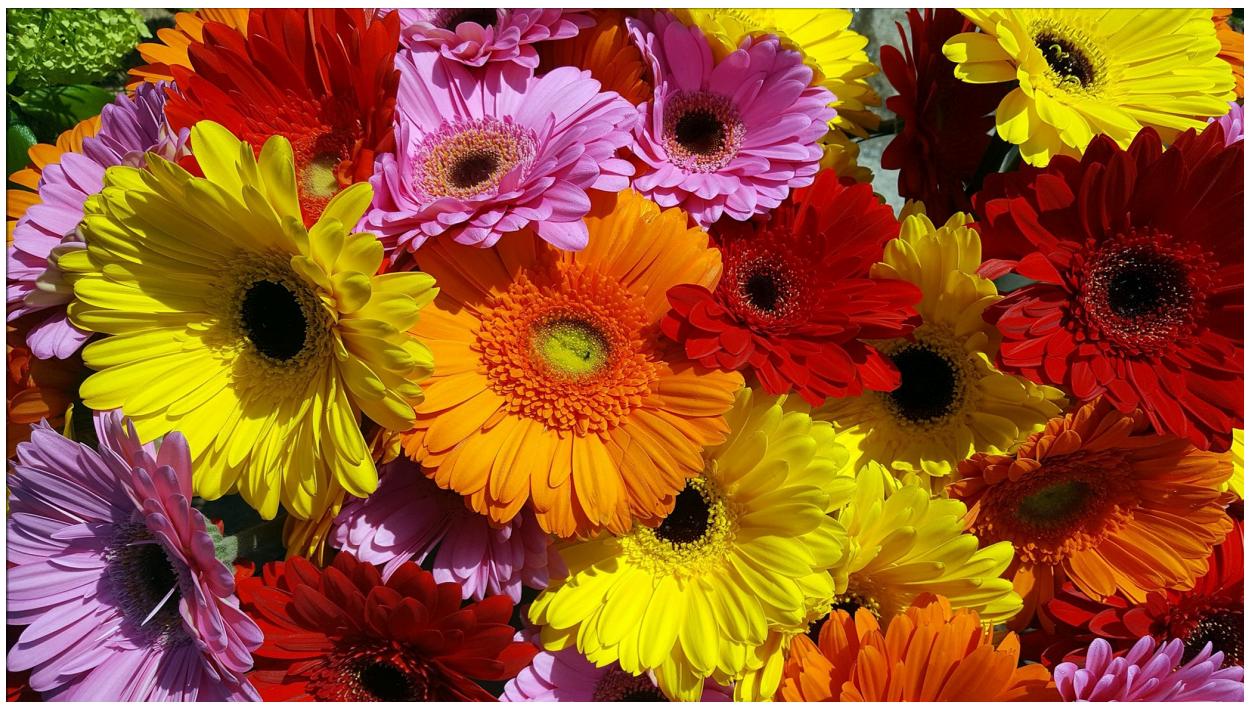


Figure 1: A colourful array of gerbera flowering heads. Pixabay (public domain).

**G**erbera is one of the stars of the ornamental floral industry, ranking among the top ten cut flowers in the world, and also commonly sold as a potted plant. As a cut flower, only roses and tulips outrank gerbera in annual sales in Canada. Gerberas are also among the five most popular indoor potted plants sold in Canada. The flowering tops are very beautiful, available in a wide range of spectacular colours, and are long-lasting both in vases and pots. As a sales commodity, gerberas are one of the leading supermarket plants, appealing strongly to impulse buyers as well as to more experienced purchasers who have become familiar with these attractive flowers.

**Scientific names:** The genus *Gerbera* was named by the Dutchman Jan Gronovius in 1737 to commemorate the German medical doctor and naturalist Traugott Gerber (1710–1743).

**English names:** Gerbera, African daisy (other members of the Asteraceae are also called African daisy, particularly cultivars of *Osteospermum* and *Arctotis*, which have flowers resembling those of *Gerbera*). Common names for *G. jamesonii*, the main ancestor of domesticated forms, are often employed for *Gerbera* cultivars, regardless of their parental species. These include Barberton daisy (Robert Jameson, a Scotsman for whom the species was named, was a prominent Durban merchant who collected specimens in around Barberton, a mining town in South Africa), Transvaal daisy (the species is endemic to the Transvaal region of South Africa), flame-ray daisy, veldt daisy.

**French name:** Gerbera, gerbéra, marguerite gerbera (*G. jamesonii* = le gerbera de Jameson, gerbéra de Jameson).

### Symbolism

The flag and coat of arms of Mpumalanga (a province of South Africa) depict a stylised *Gerbera jamesonii*, which is endemic to the region. Gerberas have a relatively limited history as cultivated flowers, and unlike most major ornamentals there are very few symbolic associations. Nevertheless, websites of flower merchants commonly present fabricated inspiring associations for gerberas simply to increase sales.

### Wild *Gerbera* species

Thirty to 40 species of *Gerbera* have been recognized, but the delimitation of the genus requires reassessment. The species are native to South Africa (at least 15 species) and Asia. Two South American endemics have recently

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**Figure 2:** Early paintings (public domain) of the two parental species of most *Gerbera* cultivars. **Left:** *G. jamesonii*. Source: Hooker, J.D. (ed.) 1889. Curtis's Botanical Magazine, Plate 7087. L. Reeve & Co., London. **Right:** *G. viridifolia*. Source: Pole-Evans, I.B., Phillips, E.P., and Dyer, R.A. 1923. Flowering plants of (South) Africa, vol. 3: t. 85. South African National Biodiversity Institute, Pretoria, South Africa.

been transferred to *Gerbera*, but this is questionable. Gerberas mostly inhabit temperate and mountainous regions. The plants are herbaceous, developing from perennial rootstocks (which can become somewhat woody with age). They produce a basal rosette of leaves and one to several long leafless “stems” each bearing a solitary flower head. The “stems” are, technically, scapes and peduncles (*Gerbera* does not produce significantly tall true stems, and is often described as stemless).

Asteraceae flowers are arranged in composite (“daisy-like”) inflorescences (“heads”) classified as capitula (singular: capitulum). The flowering heads are usually simply called “flowers” by non-botanists, and indeed by the floral industry. The *ray flowers* on the periphery (outermost whorl) of the head have a prominent asymmetrical (zygomorphic) corolla which mostly appears as a single strap-like petal (this, the *ligule*, consists of 3 fused petals). The *ray flowers* of *Gerbera* are large – up to 8 cm in length. The central *disk flowers* have comparatively inconspicuous actinomorphic corollas with five evident petals. *Trans flowers* are located between ray and disk flowers. They have shorter, less conspicuous corollas than the ray flowers, and towards the centre of the inflorescence their corollas gradually become less prominent and more symmetrical (actinomorphic). In *Gerbera* the central disc flowers of the capitula are hermaphroditic while the marginal ray and intermediate trans flowers are female (the anthers aborting during flower development). Although the large corollas (ligules) of the ray flowers serve to attract pollinators, only the central disk flowers produce functional pollen, and pollinators congregate only on the disk flowers.

The South African *G. jamesonii* was formally recognized by the botanist J.D. Hooker in 1889, and is considered to be the most important ancestor of modern gerbera cultivars. Numerous horticultural publications today identify gerbera cultivars by the name *G. jamesonii*, although other species (as noted below) are usually involved in their parentage.



**Figure 3:** Pots of “mini” gerberas (with relatively small but numerous flowering heads). ©Serres Fortier (CC BY 2.0).

*Gerbera jamesonii* is endemic to Transvaal and Swaziland in southern Africa. It occurs in bushveld (mixed woodland) and steep slopes, on dolomitic and stony clay soils, and on burned ground, and in dry, shaded habitats.

*Gerbera viridifolia* is considered to be the second most important ancestral species of modern cultivars. It is rather polymorphic, a number of alleged species now included in it. *Gerbera viridifolia* ranges along eastern Africa, occurring in open grassland with stony soil.

### Domesticated *Gerbera* species

Breeding of gerbera started at the end of the 19th century in England, with the crossing of two South African species, *G. jamesonii* and *G. viridifolia*. The hybrid was originally called *Gerbera cantebriensis* (“of Cambridge,” where the cross was made), but is often known today as *G. × hybrida*. Most cultivars originate from crosses of these two species. By the beginning of the 20<sup>th</sup> century, gerbera was grown in much of Europe and North America. Today, the Netherlands is the centre of breeding of gerbera cultivars, but the U.S., Canada, Israel, Japan, Korea, Brazil, China, India, and other countries are also involved in creating new cultivars. It has been estimated that thousands of cultivars have been released in the last 125 years. Today, more than 1000 gerbera cultivars are produced commercially, about a quarter of them on a large scale.

Houseplant potted gerberas are usually less than 60 cm (24 inches) high and spread laterally no more than 45 cm or 18 inches. Some gerbera cultivars produce heads up to 15 cm (6 inches) in diameter, but “mini” cultivars with small (less than 10 cm or 4 inches) but numerous heads have recently become very popular. Cultivars used for cut stems have long stems and large foliage (both characteristics considered undesirable in pot cultivars).

*Gerbera* flowering heads consist of one to several whorls of ray flowers, and several whorls of trans and disk flowers. In wild gerbera flower heads, there is just one whorl of large peripheral ray flowers. Some cultivars have acquired “doubled” or “crested” heads. Most so-called doubled ornamental flower species simply have extra petals in each flower. However, in doubled gerbera heads, individual



**Figure 4:** A highly "doubled" form of gerbera flowering head (i.e., the number of whorls of ray flowers has been increased). Source: Pixabay (public domain photo).

flowers retain the same number of petals, but the corollas of additional whorls of flowers (particularly trans flowers) have become as large as the outermost whorl of ray flowers. Some doubled cultivars produced heads with as many as 500 of the large ray flowers. "Spider flowers" (the plants are sometimes called "spider daisies") have a lacinated (split or notched) corolla, so that the heads appear lacy or fringed.

Gerbera cultivars are available in a wide array of brilliant flower colours, including shades of cream, lavender, orange, pink, purple, red, salmon, scarlet, violet, white, and yellow. True blue and green flowers are not yet available, and flowers with such colours have been dyed. The centre of the heads (often called the "eye" of the flower) is often a contrasting darker colour (commonly greenish, cream, or dark brown). Since the disk flowers have very small corollas, the colour is usually due to the accumulation of anthocyanins in the pappus bristles at the base of the disk flowers. Bi-coloured flowers have also been selected based on differently coloured whorls of ray flowers, or on different colouration of the ligules.



**Figure 5:** "Spider" forms of gerbera flowering head (i.e., the ligules of the rays are slim and long, like a spider's legs). **Left:** Source: Robinson, W. (ed.) 1910. *The garden. An illustrated weekly journal of horticulture in all its branches.* Vol. 74. **Right:** © Rhinooji (CC BY SA 2.0).

### Economic value

On a world basis, gerbera ranks fifth in the cut flower industry, exceeded in importance only by rose, carnation, chrysanthemum and tulip. Gerbera is now produced commercially in over 80 countries. In the U.S., cut flower sales of gerbera have exceeded \$30,000,000 annually, for about 100 million stems. Recent sales in Canada are about 90 million stems annually (additionally about 4 million potted plants are marketed). Gerbera is well adapted to be a cut flower, as the harvested stems have excellent keeping qualities, rehydrate rapidly, and withstand the rigours of transportation well.

### Edibility and toxicity

Cultivars of gerbera are not considered to pose a poison threat to children or pets, but are not generally viewed as edible. However, in their native areas, species of *Gerbera* are sometimes employed in cooking and medicine. In indigenous communities of Southwest China, *G. piloselloides* is employed as a spice for meat and distilled beverages, and as a traditional herbal remedy for various conditions.

### Maintaining Cut Flowers

Stem end blockage of water transport ("vascular occlusion") due primarily to bacterial contamination is the chief cause of short vase life of most cut flower species, including gerbera. Cut flowering gerbera stems typically deteriorate within 5 days, but properly managed they may last 10 days or so. Cut stems should be recut 2.5–5 cm (1–2 inches) from their bases at an angle with a sharp knife before being placed in a clean vase with lukewarm water, along with a preservative (which can be purchased from floral shops if not provided with the bouquet). Recutting the stems every 2 or 3 days and changing the water will prolong the life of the flowers. The level of water should be shallow. Bright light (but not direct sunlight) and cool temperatures (13°–24°C or 55°–75°F) are recommended.

### Propagation

Those wishing to grow gerberas from seeds should realize that they will require 4 to 5 months for flowers to develop, and up to a year to produce a plant the size of those that can be purchased relatively cheaply. The seeds are sensitive to dryness, and while germinating they should be kept moist, for example by placing plastic wrap over the pot of



**Figure 6:** Gerbera flowering heads with bi-colored ligules on the ray flowers. **Left:** ©ForestWander (CC BY SA 3.0). **Right:** Source: Pixabay (public domain).



**Figure 7:** Commercial production of cut-flower gerberas in the Netherlands. **Top:** A greenhouse full of gerberas. © Alias 0591 (CC BY 2.0). **Bottom:** Greenhouse workers preparing bouquets. Note the very long stems, typical of cut-flower cultivars. © Sander van der Wel (CC BY SA 2.0).

soil containing the seeds. Often attractive plants are clones, and their seeds will not reproduce true to type.

Although several decades ago gerberas were mostly reproduced commercially by seed, they are now usually propagated vegetatively. Gerberas can be grown from cuttings, but clumps are more commonly simply divided. Micropropagation has been the main approach to establishing cut-flower gerberas since the 1970s.

### Maintaining potted plants indoors

Gerberas are grown outdoors as perennials in public landscape and private residential flowerbeds, borders, and rock gardens, but only in frost-free climates, which excludes Canada (although the plants may withstand a short, mild freeze). Gerberas can be employed as potted patio plants so long as the weather remains warm. Most container-grown gerberas are purchased for short-term indoor residential use, and discarded in a few months after the current flowering display is completed. Gerberas will last longer if kept in bright light (although they are shade plants in their native habitats, the Canadian climate rarely provides excessive brightness for indoor gerberas) and cool temperatures (under 24°C or 75°F, preferably 7°C–18°C or 45°F–65°F) are best. Spent blooms should be removed (cut off at the flowering stem base) to prevent energy being diverted into seed production, and to improve appearance. Gerberas are considered to be relatively difficult indoor plants, but with careful treatment and good exposure to sun, they can last for several years. If transplanting to a larger pot, maintain a pH of 5.5 to 6.5. Gerberas benefit from slow-release fertilizers, preferably balanced or high in potassium, and prefer a moist but not waterlogged substrate. As with African violets, avoid placing water on the foliage.

### Curiosities of Science and Technology

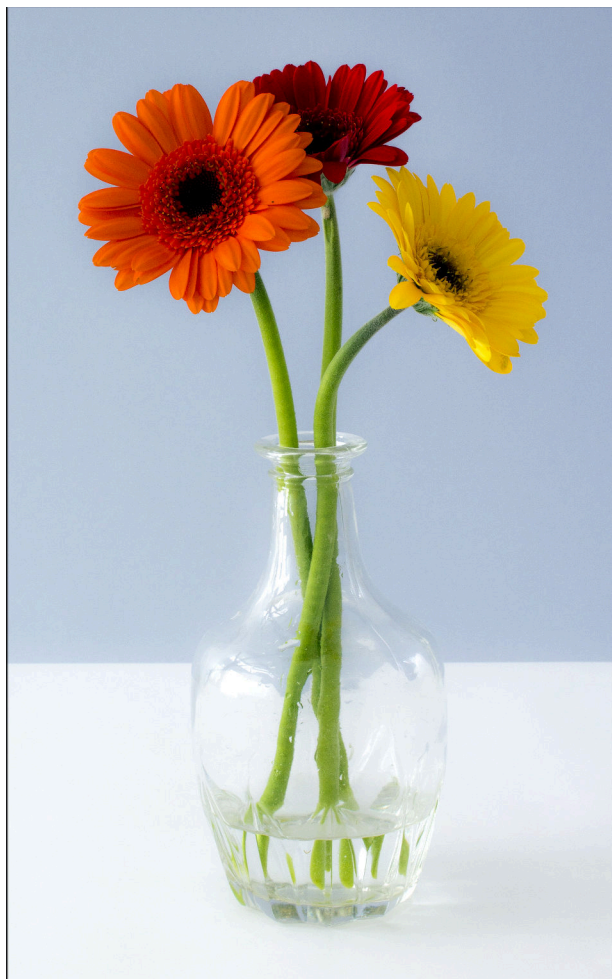
- Tracing particularly to a 1989 U.S. National Aeronautics and Space Administration study

([ntrs.nasa.gov/search.jsp?R=19930073077](https://ntrs.nasa.gov/search.jsp?R=19930073077)) seeking to find plants that could reduce air pollution in space stations, several common houseplants, including gerbera, have been claimed to have the ability to reduce indoor air pollutants, such as benzene, formaldehyde and trichloroethylene. However, evidence for this is weak (Dela Cruz et al. 2014).

- A study of the effect of spaceflight on *Gerbera* seeds indicated that they germinated more quickly (Liu et al. 2006)
- In southwestern China, the leaves of *G. delavayi* are traditionally employed as a source of fiber for weaving and clothing by ethnic minority tribes.
- Gerbera is a “daisy” (African daisy, Transvaal daisy) a term tracing to the Old English *dæges ēage*, interpreted as ‘day’s eye’ because the petals of some species open at dawn and close at dusk. The flower head of Asteraceae is so recognizable that numerous species have been termed daisies, and as a result the word has become part of many phrases, such as: oops-a-daisy & whoops-a-daisy (an expression of encouragement, such as to a child who has fallen or is being lifted), fresh as a daisy (to be eager and enthusiastic), pushing up daisies (to be dead), daisy chain (a series of connected events, activities, or experiences; also a pornographic term), and daisy cutter (a type of fuse designed to detonate an aerial bomb at or above ground level, also a bomb used in the Vietnam war).

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**Figure 8:** A vase of cut gerbera flowering stems. Source: Skitterphoto (public domain photo).

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**Figure 9:** Potted gerberas. Left: ©Kor!An (CC BY SA 3.0). Right: Source: Pixabay (public domain).