# The Canadian Botanical Association Bulletin

# Bulletin de l'Association Botanique du Canada

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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

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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 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'ABC à l'url suivant: www.cba-abc.ca

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## Prochain numéro

La date de tombée des textes du prochain numéro, le no 51(2), est le 1 septembre 2018

# President's Message

Warmest greetings from Saskatoon where over the first weekend of March, 25-30 cm of snow have fallen, returning the city to winter wonderland. High boots, snow shovels, and cross-country skis that sat idle for a while quickly have been pressed back into service. Hopefully the winter weather in your part of Canada has been abating such that first signs of spring flowers will soon be appearing!

From **July 21-25, 2018**, this year's **54th Annual CBA-ABC Meeting** takes place jointly with the Botanical Society of America and affiliated societies, in Rochester, Minnesota. This year's theme is "Thriving with Diversity" and the program will feature no less than 6 symposia and 13 colloquia on a very wide variety of botanical topics that promises to deliver a very stimulating and educational conference. The abstract submission deadline is April 3rd, and the early-bird registration deadline is June 1st, 2018. The conference website can be accessed here: http://www.botanyconference.org/.

Our thanks are extended to John Markham who has been our association's liaison, and even trekked south from Winnipeg for a site visit in October 2017, to join the conference's local organizing committee. All reports about the venue and program for this year's conference in north-central U.S.A., are excellent. It is going to be a lot of fun, so I am looking forward to seeing many of you there!! Please remember to indicate your membership with CBA-ABC when you register for the conference.

Thanks to those individuals who submitted or endorsed the various nominations received for consideration of this year's major CBA-ABC awards. The Awards Committee has begun the review of applications and I look forward to the award presentations in Rochester. Also at that time, the beneficiary of the second-annual competition for the CBA-ABC's Special Project Fund will be announced.

Just a reminder that there are several ways to get involved in the CBA-ABC. The Association's activities and various opportunities can be gleaned by a visit to our website: www.cba-abc.ca. Note that the CBA-ABC continues to welcome new members, including botanically inclined students who of course represent a vital sector for the Association's future. Also, thanks to all who have already renewed their annual membership fees that generate a major portion of CBA-ABC's operational funds for the year ahead.

Another significant way to encourage CBA-ABC's growth is by making a financial contribution to the funds promoting the our numerous awards for best student publications and research, and for assisting student travel costs to the annual meeting. Full details about membership benefits, how to join, and how to donate to CBA-ABC awards, are also available at the Association's website link, above.

To put a point on this topic, there are significant opportunities ahead to become even more active in CBA-ABC's activities, by joining the CBA-ABC Board. There will be several positions (Secretary, Treasurer, plus 3 directors, namely 1 for the East, 1 for the West, plus 1 student representative from the West) coming full-term and hence vacated at the



CBA-ABC's Annual General Meeting in Rochester. Please see the separate announcement from John (Past-President) on page 4 of this issue and let us know if you wish to make a nomination or let your own name stand for nomination. If you are unsure and wish to know more about what each position entails, John or I can provide you with "the official" job description from CBA-ABC's policy manual. We look forward to hearing from you!

The annual "Fascination of Plants Day" is scheduled for **Friday, May 18** (or between May 3-31, if May 18 is unsuitable). Assembling a display or other activity focused on the universal importance of plants would be an excellent way to enlighten the staff and general public on our institutions' campuses, for example. There are many ways that this can be done enthusiastically, such as including displays of local plants of importance, plant growth and movement, plant reproduction, plants of economic benefit, and the like. Check out the website plantday.org/home.htm that provides examples of activities from around the globe, and please remember to take a few photos that can be incorporated into a future *Bulletin*, and/or for the CBA-ABC website, later this year. I look forward to hearing about your experiences with "Fascination of Plants Day"!

As this President's Message marks my final one, I just wanted to thank the many botanists of our wonderful association for this opportunity that has become a very rewarding period in my career and life. I'm looking forward to the next stage – the 2-year term as Past-President – and to having Julian Starr as our Association's next President.

In closing, here's a clever botanical saying passed along to me by the late Prof. Emeritus Taylor Steeves who, besides being a preeminent expert of plant-developmental patterns, was also a notable pun-master. Over the years since then, this adage typically has evoked a good laugh during lecture among the 2nd-year students of a "Survey of Land Plants" course. It goes like this: "With fronds like these, who needs *Anemone*?". See you in Rochester!!

Respectfully,

Art Davis
University of Saskatchewan

# Announcements

## New Topics at Botany 2018

Dear colleagues,

I am writing to you as the Program Director of the American Society of Plant Taxonomists, to tell you about two new topics available for contributed oral presentations at the upcoming "Botany 2018" conference in Rochester, Minnesota. We have added Taxonomy, and Floristics, as stand-alone categories to which you and your graduate students may submit abstracts. These are in addition to the recently added topics Biodiversity Informatics, and Herbarium Digitization.

In previous years, any contributed papers representing traditional taxonomic studies, nomenclatural issues, presentations of classifications, or related investigations generally outside the purview of phylogenetics or higher-level studies, were plugged into the broad Systematics category in the appropriate current APG lineage. The few floristics papers were inserted into a Miscellaneous category. We are testing the efficacy of stand-alone "homes" for papers focusing on traditional taxonomic pursuits or floristic analyses of geographic areas by creating these two additional topics, with the hope that we will gain additional conference participants. The Taxonomy category would also be an appropriate place to submit abstracts for integrative taxonomic studies at the population and species levels, new taxonomic resources, or evaluation of alternative species concepts on particular groups. The Floristics category would be a great place to present ecological niche modeling papers and investigations of climate change with a more taxonomic than ecological focus. Of course, contributors may still elect to submit their abstracts to the broader Systematics category.

Please distribute this message to all faculty, staff and graduate students who might be interested in contributing a talk to the Taxonomy or Floristics categories. Help us highlight traditional taxonomic and floristic studies as integral yet autonomous components within the interdisciplinary field of plant systematics sensu lato, at upcoming "Botany" conferences

Best,

Harvey Ballard
ASPT Program Director

## Mycology Section News

The thoughts of spring are becoming an obsession for some of us, and it looks like in Northern BC, the snow available will delay gardening for a long while, not to mention the morel season. The silver lining with all this snow is possibly a diminished fire season and, along with the huge forest fire season in 2017, a magnificent fire morel season.

The Mycology Section is taking a pause in organizing a Weresub lecturer for the upcoming BSA meeting in Rochester. We will start thinking of the possibilities for 2019.

The Mycology section will soon ask for submissions for the competition for the Luella K Weresub Award for best student paper in fungal biology published in 2017. The review committee is always bursting in anticipation of the array of top-quality contributions submitted. This year, our review committee (Shannon Berch, Hugues Massicotte, Greg Thorn, Jonathan Cale) is seeking new membership as Faye Murrin, who served on the committee for many years, has retired. Many, many thanks to you, Faye, for your many contributions!

Shannon Berch and Hugues Massicotte
Mycology Section Co-Chairs

**P.S. Last minute Breaking News:** We are delighted to announce that Dr. Sarah Hambleton, a research scientist with Agriculture and Agri-Food Canada, has agreed to serve on the Weresub Award Committee!

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## The CBA Needs You!

This year we have openings for five positions on the Board of Directors — we need a new secretary, treasurer, teaching section chair, representatives for both the East and West, and a student representative for the West. Directors attend Board meetings at the annual meeting, and at least one conference call in the winter. Terms are two years. This is a great way to get involved with the CBA/ABC, meet other botanists, and have a voice in botany at the national level. Nominations will be confirmed at the Annual General Meeting, which will take place at the annual meeting in July, in Rochester. If you would like more information about the role of Directors or would like to nominate someone or volunteer as a Director, please contact the Past President, John Markham, at: john.markham@umanitoba.ca.

## CBA Student Paper Awards

Deadlines for the 2018 CBA student awards are approaching, make sure you get your applications in! Porsild-Consaul (systematics and phytogeography), Stan Rowe (ecology) and Weresub (mycology) applications are due April 15, and the Taylor Steeves (plant development) is due April 1. More details are in the last issue of the Bulletin (50(3)), and on the CBA website, www.cba-abc.ca/awards.htm.

# Canadian Society of Plant Biologists and CBA Joint Western Regional Meeting

The Joint Western Regional meeting of the Canadian Society of Plant Biologists and the Canadian Botanical Association took place from Decemeber 10 – 12 in Winnipeg. There were 85 delegates from both societies, with attendees from all the western provinces, as well as one attendee from Prince Edward Island. Mark Belmonte from the CSPB took the lead in organizing the conference, and he, along with the rest of the local organizing committee, are to be congratulated in pulling together a successful meeting on a tight timeline. Talks and posters were contributed by students (giving over half of the presentations), faculty members, and scientists from government and NGOs. Presentations covered a broad range of topics. Jill Hamilton from the University of North Dakota gave the keynote address "Teasing apart the genetic basis of adaptation in a changing climate", and there were Plenary talks by Belay Ayele and Bruce Ford. The conference received generous financial support from the a large number of institutions and businesses (http://cspb-cba-wrm-winnipeg2017.weebly.com/program.html).

The following students received awards for presentations:

### Best Oral Presentations

Ian Willick (University of Saskatchewan). Discovery of an extraorgan freezing strategy in cold acclimated winter-wheat and rye crowns

Austein McLoughlin (University of Manitoba). The application of RNAi biotechnology to control fungal necrotrophs *Sclerotinia sclerotiorum* and *Botrylis cinerea*

### Plant Canada Oral Presentation Award

Steven Anderson (University of Manitoba). Latitudinal trends in pollination success of the rewardless orchid, *Cypripedium candidum*, and associated changes in the plant and insect community

### CSPB Director's Oral Presentation Award

Laryssa Halat (UBC). Creating links among signalling pathways: the connection between microtubules and hormones in sustaining cell proliferation

### Honourable Mentions for Oral Presentations

Jeremy Morris (University of Calgary), Maryam Nourimand (University of Saskatchewan)

### Best Posters

Azizah Altharthy (University of Manitoba). Role of RAE1 in *Arabidopsis thaliana* heat tolerance

Nathalie Hoffman (UBC). Spatial regulation of laccases and peroxidases during lignification in *Arabidopsis thaliana*

### Honourable Mentions for Posters

Paige Anderson (University of Manitoba), Kenny So (University of Manitoba)



Best Presentation Winners: Mark Belmonte (CSPB), Austein McLoughlin (Best Talk), Geoffrey Wasteneys (CSPB President), Ian Willick (Best talk), with John Markham (CBA Past-President)



Maryam Nourimand and Xiojing Wei ©John Markham



Sylvie Renault and Mark Belmonte (conference organizers), Jill Hamilton (keynote speaker), and Geoffrey Wasteneys (CSPB president) ©John Markham

# Usher Posluszny (1947-2017)

Jean Gerrath

Members of CBA/ABC will be saddened to learn that Usher Posluszny, long time faculty member at University of Guelph, passed away suddenly and unexpectedly at his home in Guelph on Oct. 8, 2017. He was born in Hof, Germany on July 20 1947. His family moved to Israel shortly after, and settled in Montreal in 1952. Usher received all of his schooling in Montreal, and attended McGill University where he received his BSc in 1969 and his PhD in 1975. After he received his doctorate he was a Cabot Fellow at the Harvard Forest, Harvard University for about 18 months, and subsequently became a Life Science Fellow at Hebrew University. He accepted a faculty position in the Botany and Genetics Department at University of Guelph in 1977, and retired from the Department of Molecular and Cellular Biology in 2011. He was a Fellow of the Linnaean Society, and an Emeritus Professor in the College of Biological Sciences.

Usher once told me that originally he planned to study ecology, but that Rolf Sattler's course in philosophy of biology at McGill changed his plans completely. He became a technician in Rolf's lab, which used epi-illumination light microscopy to compare the surface features of microdissected plant meristems in the days before scanning electron microscopy. Usher became superbly skilled at using this technique, and his work is acknowledged in Rolf's Lawson medal-winning 'Organogenesis of Flowers: A Photographic Text-Atlas', published in 1973. Subsequently, Usher became a graduate student, and his PhD thesis work was a comparative study of floral development in species of three aquatic monocot genera in the Alismataceae.

Usher's Cabot Fellowship at the Harvard Forest was with Barry Tomlinson, where he continued to study marine monocots and introduced epi-illumination light microscopy to the lab. He and Barry collaborated on projects throughout the rest of Usher's life. His Life Sciences Fellowship at the Hebrew University was in Tsvi Sach's lab, where he planned to learn experimental techniques with which he could further study seagrasses. However, shortly after his arrival in Jerusalem a teaching position at University of Guelph arose, and he began his career at Guelph in the fall of 1977.

At Guelph he was responsible for teaching the large introductory botany course for agriculture students. As the number of agriculture students at Guelph declined, courses were combined and reorganized, but Usher continued to teach some aspect of introductory botany throughout his career. He taught other courses, including Plant Morphology at both the graduate and undergraduate level, and Economic Botany. He was interested in trying new teaching techniques, and employed several of them in his labs and lectures over the years.

Usher, several of his students, and Alan Charlton at University of Manchester continued the comparative studies of the vegetative and floral development of other members



Montreal CBA Meeting June 2014 — Usher Posluszny, Jean Gerrath, Ron Dengler

of the Alismatales, a thread which remained throughout his career. In the mid-1980's, he was a participant in a successful NSERC Strategic grant, which was to look at the biology of grapes with a view to improving viticulture in Ontario. Using much the same comparative approach as he had for the Alismatales, Usher and many of his students examined the vegetative and floral development of the Vitaceae (grape family), and much of this work is summarized in a book he co-authored with myself and Lewis Melville in 2015, 'Taming the Wild Grape: Botany and Horticulture in the Vitaceae'. Altogether, Usher supervised 19 graduate students (including four PhD students) and 2 post-doctoral fellows. Many of them went on to have very successful academic careers in universities around the world.

Usher was an active member of CBA/ABC. He served as Editor of the Bulletin from 1989 to 1991, and was President-Elect and President from 1991 to 1994. In 2006 he received the Mary Elliott Award. He participated fully and enthusiastically in several local groups within the Guelph community, including local running, bonsai, wine-tasting, calligraphy, and tennis clubs. He was a volunteer at the Art Gallery of Guelph and a supporter of local art and artists. He loved opera, and traveled to New York and Santa Fe on opera forays, as well as being a season ticket holder of Canadian Opera Company productions. Usher loved to discuss politics, current events, and the arts, with the morning 'Coffee Group' — the remains of the Botany department at University of Guelph. He will be missed by many friends and colleagues, and is survived by his sister Ruth (Avi) Poremba, two nieces (Netta and Karin), and a nephew (Noam).

A memorial fund to dedicate a tree to Usher in the University of Guelph Arboretum has been established. Donations can be made at uofg.convio.net/site/TR?fr_id=2192&pg=entry.

# Fixing What's Bracken: Visitor-turned-volunteer Accomplishes Critical Taxonomic and Organizational Update to the Fern Section of the National Herbarium

Erica Eason[1] and Jennifer Doubt[2]

The monilophytes (horsetails, whisk ferns and ferns) and lycophytes (clubmosses, spikemosses and quillworts) in the National Herbarium of Canada (CAN) at the Canadian Museum of Nature, have seen a lot of action in the last three years! This saga began in 2014, with a herbarium visitor searching in vain for specimens of *Aspidotis densa* (a native Quebec fern species) that were "hidden" in folders bearing the species' former names (e.g., *Cheilanthes densa*, *Pellaea densa*). Decades had passed since the collection was last aligned with any particular classification system. A "shuffle" to bring the collection into line with current concepts was overdue.

Inspired by the visitor and the hunt, curator Jennifer Doubt came up with a plan to reorganize the monilophyte and lycophyte section of the herbarium to reflect present understanding of their classification. First, she turned the visitor, Erica Eason, into a volunteer: the power to drive the rest of the plan (Figure 1). CAN Botany Technicians Lyndsey Sharp, Kim Madge, and Cassandra Robillard supported every step of the journey that followed.

The first milestone achievement was re-labelling the specimen folders (the individual specimens would come later) for all the Canadian monilophytes and lycophytes. Each Canadian folder at CAN holds specimens of only one species or infraspecific taxon (subspecies or variety), collected in one province or territory. Current nomenclature accepted in VASCAN, the database of the vascular plants of Canada (data.canadensys.net/vascan/search), guided the update, to be consistent with the nomenclatural standard for many of the seed-bearing plants at CAN. VASCAN does not attempt to provide an exhaustive list of synonyms, so ascertaining the correct name for the oldest specimens (many collected in the 1800s) involved searching additional online databases (e.g., The Plant List, www.theplantlist.org; International Plant Names Index, www.ipni.org; Tropicos, www.tropicos.org/Home.aspx) and tapping historical books and key expertise at the Canadian Museum of Nature, within the National Capital region, and across the country.

Erica then turned to nomenclature for specimens from the USA and the rest of the world. Changes in nomenclature based on genetic analyses come fast and furious, whereas it takes time to discern which proposed nomenclatural changes will become accepted by the botanical community. Dr. Robbin Moran, Curator and pteridophyte specialist at the New York Botanical Garden, generously took time to recommend the phylogenetically-based classification of Christenhusz *et al.* (2011). For taxa not native to Canada, that family- and genus-level nomenclature was followed. In addition to the resources mentioned above, the comprehensive species-level synonymy on the World Ferns website (worldplants.webarchiv.kit.edu/ferns) was extremely useful in providing nomenclature consistent with Christenhusz' classification. Even Google was a helpful source of information on obscure names, since pertinent clues sometimes turned up in old books that have been scanned and shared on the web.



**Figure 1:** Two years into a massive update to the monilophyte and lycophyte collection, CAN volunteer Erica Eason remains undaunted.

Although the herbarium has fewer international specimens than Canadian ones, the number of genera and species represented by international specimens exceeds the number of Canadian taxa: whereas the updated collection includes 43 genera and about 200 species or infraspecific taxa from Canada, international specimens represent 207 genera and about 1500 species. Progress slowed, as each specimen was investigated in order to accurately map the name on its label to its currently accepted name. A significant proportion of specimens in the collection changed family as well as genus in the update; several genera disappeared completely, with their species reclassified into a number of different genera. To illustrate one of the challenges: *Gymnocarpium dryopteris* (Linnaeus) Newman turned up in our collection under eight different names (Table 1) in seven different genera!

Often, no authority was cited for scientific names on older specimen labels, which complicated matters in instances of homonymy (two or more names with identical spellings based on different types). In cases where the same name has been applied to two or more species over the years, the later homonyms are illegitimate, according to the International Code of Nomenclature for algae, fungi and

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| **Accepted name** |
|---|
| *Gymnocarpium dryopteris* (L.) Newman |
| |
| **Synonyms appearing on CAN specimen labels** |
| *Aspidium dryopteris* (L.) Baumb. |
| *Dryopteris linnaeana* C. Chr. |
| *Dryopteris pulchella* (Salisb.) Hayek |
| *Lastrea dryopteris* (L.) Bory |
| *Phegopteris dryopteris* (L.) Fee |
| *Polypodium dryopteris* L. |
| *Thelypteris dryopteris* (L.) Sloss. |

**Table 1:** List of names from labels of *Gymnocarpium dryopteris* specimens in the National Herbarium of Canada (CAN), which includes eight of the 23 listed in the World Ferns database. Annotating and grouping these specimens together under one current, accepted name makes it easy find and accurately file them in the future, preventing problems like the one that inspired the project. Mission accomplished!

plants (Melbourne Code); only the first valid application of the name is legitimate. For example, *Asplenium radicans* has been applied to at least five taxa by different authorities (Linnaeus, Swartz, Schkuhr, Pritchard, Baker). However, according to the Melbourne Code, the name is legitimate for only one taxon (the one described by Linneaus, in this case). Different names must necessarily apply to the remaining four, but without a cited authority, one must determine which authority was likely *intended* before the appropriate current name can be traced.

In such cases, manuals and images from various sources, including photos of type specimens, were helpful in ruling out most applications of a given name. Examples of web sources referenced to find images include Tropicos, World Ferns, plantsystematics.org, and the digital image banks of Paris (science.mnhn.fr/institution/mnhn/collection/p/item/search) and Kew (apps.kew.org/herbcat/navigator.do) herbaria. Even Google Images was often useful, because it compiles a large number of image bank resources. Referencing multiple examples and prioritizing recently-identified material allowed for greater confidence. Once the most likely authority for the name was identified, it became possible to track down the appropriate current nomenclature, and apply a label documenting the decision. Although this, in turn, allowed the specimen to be filed correctly with respect to the name on the specimen label, it is still left to the knowledge-holders who use the herbarium in future years to verify that the identification is correct, or update it accordingly!

In concert with nomenclatural updates to the international specimens, a geographical update was implemented. Specimens in blue folders (formerly grouping together specimens from beyond Canada and the USA) were divided among four more geographically-specific folder colours, corresponding to broad world regions: Africa, Eurasia, Oceania and the Pacific Islands, and Central and South America. When the location of collection could not be determined because of lacking or limited information on the specimen label, the distribution information provided by World Ferns often suggested a likely world region. It was not possible to be certain in all cases, but at the end of the day, each specimen needed to be placed somewhere.

Throughout the process, each taxon in the collection (including its label name prior to the update, its current name, and the references supporting the decision), was tracked in a spreadsheet. After changing all the names now considered 'synonyms' to comply with our nomenclatural standard, CAN's monilophyte and lycophyte collection includes 1850 different species in 213 genera, representing 42 of the 48 families in the Christenhusz *et al.* (2011) classification.

Up to this point, although updated specimens were progressively moved to reflect their current names (with liberal use of cross-references on the shelves, and religious tracking in the spreadsheet), the order of families in the collection remained unchanged. With information on the taxa making up the collection finally in hand, it was time to physically reorganize everything according to Christenhusz *et al.* (2011). Starting with the Excel file used for tracking nomenclature, an up-to-date 'map' listing each cabinet's holdings was created. This painstakingly-crafted reference provided the original and updated genera and species, and infraspecific taxa, shelf by shelf, across 400 cabinet shelves (Figure 2). New family names and numbers (as per Christenhusz *et al.* 2011) were added for each genus in the map. Finally, the file was sorted according to the new family numbers, keeping genera arranged alphabetically within families. Presto! This resulted in a new map, indicating where each shelf's contents should be moved. Knowing where specimens were overcrowded allowed for adjustments to ensure a more even distribution. This meticulous preparation minimized the period between the 'before' and 'after' states. Instead of weeks of disrupted access, with no unified system for locating taxa, the shift was complete in just two days of bending, stretching and lifting.

Naturally, cabinet labels needed replacing. The herbarium's alphabetical directory of vascular plant genera and families also had to be updated, adding the new names while including and cross-referencing the old names for search and filing purposes.



**Figure 2:** Over three years and across 400 shelves, CAN's monilophyte and lycophyte cabinets, folders and specimens were relabeled, families were reorganized, and new regional folders were added. University of Ottawa co-op student, Rachel Bergeron, removes specimens from part of the newly-updated collection.

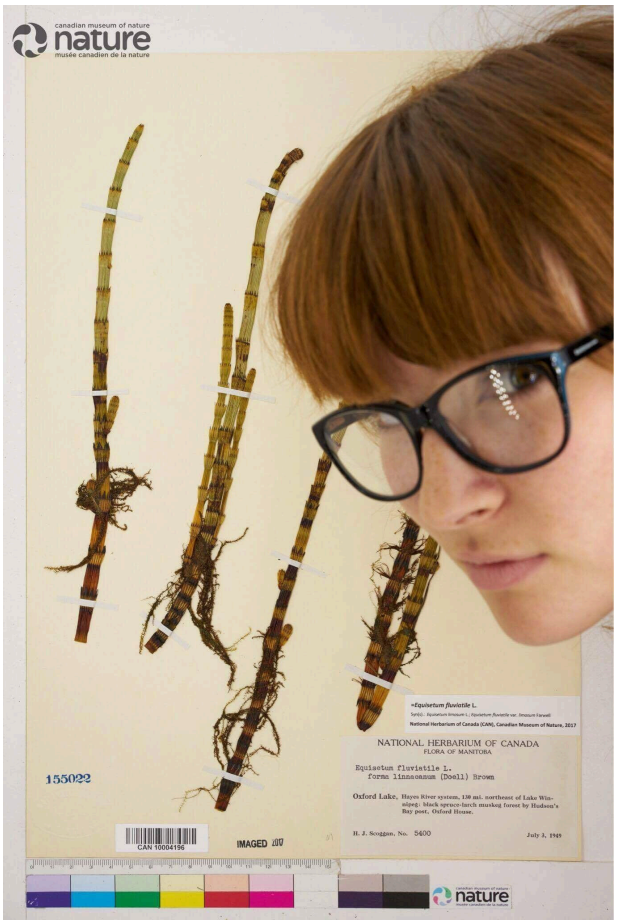



**Figure 3:** The Museum's Arctic digitization effort was one of the first beneficiaries of the re-vitalized monilophyte and lycophyte collection. Carleton University summer student, Brigid Christison, posed with a horsetail specimen as the project got under way. All freshly-annotated Arctic specimens (note 2017 label), imaged and will be shared on-line.

This update project provided many important benefits to CAN and its team: valuable type specimens were discovered, holdings became less crowded and more accessible, and crucial knowledge of our collection was recorded. The list of CAN monilophyte and lycophyte taxa, alone, represents an enormously valuable, unprecedented resource for everyone who manages and uses the National Herbarium, where a complete database of all specimens remains a future goal. No sooner was the update complete, when a generous donation from the Beaty Foundation to the Canadian Museum of Nature kicked off a dedicated effort to digitize (barcode, image and database) the herbarium's Arctic holdings, starting with the spore-bearing vascular plants (Figure 3). Perfect. Timing.

What's next? Checking species identification for Canadian species that were subdivided since the last annotation, annotating each Canadian specimen to current names that match the updated folder labels, and then digitizing and imaging the non-Arctic Canadian specimens. Jennifer wonders if Erica might someday become interested in conifers…

The National Herbarium welcomes visitors during business hours, and sends loans for study throughout the international herbarium network. Anyone interested to access the collection – including its logically and lovingly reorganized monilophyte and lycophyte section – should contact the curator (jdoubt@mus-nature.ca).

## References

Christenhusz, M.J.M., Zhang X.-C., and Schneider H. 2011. A linear sequence of extant families and genera of lycophytes and ferns. *Phytotaxa* 19:7-54.

# Top Canadian Ornamental Plants. 19. African violets

Ernest Small[1,2]



**Figure 1:** Potted plants of African violet (*Saintpaulia ionantha* hybrids). **Left:** © Bff (CC BY SA 3.0). **Right:** © Ibolya (CC BY 2.0).

In modern throw-away, planned-obsolescence times, ostentatiously-flowering ornamentals like chrysanthemums, roses, and poinsettias have become the leading stars of the potted houseplant industry. However, they are intended to last for only a few weeks before being discarded. By contrast, a considerably more modest plant – the African violet – has become the world's most popular flowering potted plant maintained indoors, which is a considerable accomplishment since it was virtually unknown to science a little over a century ago, and currently is being eliminated from nature at an alarming rate. African violets are dainty, fitting on windowsills, mantels, tables and desks where almost all other ornamentals would take too much space. They are also unusually well adapted to indoor conditions that are too challenging for most plants. For their small size, they are remarkably appealing, developing compact rosettes of velvety leaves and colourful flowers which bloom for months. While modern cultivars do not deserve the former reputation of the plant as being difficult to grow, they nevertheless will not thrive unless their particular requirements are satisfied, as outlined in this review.

## Names

**Scientific names:** The genus name *Saintpaulia* commemorates Baron Walter von Saint Paul-Illaire (1860–1940), district commissioner of Tanga province, Tanganyika (now Tanzania) who collected African violets in 1892, in what was then a German colony called German East Africa. *Saintpaulia ionantha* is the most prevalent cultivated species. The specific epithet *ionantha* in the name is based on the Greek adjective *ion* meaning violet and the noun *anthos*, flower.

**English names:** African violet (based on the African origin of the plants, and the superficial resemblance to true violets, species of *Viola*), saintpaulia.

**French names:** Saintpaulia, violette du Cap, violette d'Afrique, violette africaine.

## Symbolism

African violets are linked with motherhood, and are a common gift on Mother's Day. They are also associated with Easter and Valentine's Day. Since the plants have been known in cultivation for not much more than a century, these symbolic associations are quite recent, and have been generated mostly by the retail floral industry, which benefits from increased sales of flowers for sentimental reasons.

## Wild *Saintpaulia* species

Phylogenetic studies have shown that *Saintpaulia* is nested within *Streptocarpus* subgenus *Streptocarpella*. Nishii et al. (2015) formally reclassified *Saintpaulia* as part of *Streptocarpus*, transferring ten species formerly in *Saintpaulia*. For purposes of this review, the traditional recognition of the genus *Saintpaulia* is maintained, simply because the new nomenclature is scarcely known. *Saintpaulia* species are small, short-stemmed perennial herbs with succulent, dark-green, soft-hairy ("velvety"), evergreen leaves usually borne in a rosette. The bilaterally symmetrical flowers have a small calyx, a five-lobed corolla, and a pistil with a long style. There are two perfect (fertile) stamens each with two prominent thecae (anther lobes), and the two anthers are connate (stick together). There are also two or three staminodes. The tiny seeds are produced in a capsule. All wild species have blue-violet (rarely white) flowers. The number of species in the genus has been debated. From six to 25 have been recognized. Most populations are interfertile,

[1]Science and Technology Branch, Agriculture and Agri-Food Canada, Saunders Bldg., Central Experimental Farm, Ottawa ON, K1A 0C6
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**Figure 2:** Walter von Saint Paul-Illaire, German colonial officer stationed in eastern Africa, after whom *Saintpaulia* was named. Drawing (public domain) from: Allers, C.W., and Kraemer, H. 1895. Unser Bismarck. Stuttgart: Union. Page 113.

contributing to the difficulty of delimiting species. Many of the "species" recognized are in fact assignable to *S. ionantha*. *Saintpaulia* is endemic to the Eastern Arc Mountains of Eastern Africa. It ranges from the south of Kenya to eastern Tanzania, with the centre of diversity in the Usambara Mountains of northeast Tanzania. The species are often found in small populations at altitudes from lowlands to 2000 m (6600 feet). They grow in a variety of forest types, on hills, rocky mountain peaks, cliffs and in gorges; in moss and on wet rocks; and occasionally as epiphytes. Although often in cloud forests, some species are relatively drought tolerant. Crassulacean acid metabolism, often associated with drought tolerant succulents, has been reported in *S. ionantha*. Habitat degradation and climate change are having devastating effects on *Saintpaulia*. It is ironic that in little more than a century, horticultural selections of *Saintpaulia* have been spread to offices and homes around the world, while in their homeland in Kenya and Tanzania several of the wild species, including *S. ionantha*, are on the brink of extinction.

## Domesticated *Saintpaulia* species

*Saintpaulia* species were brought to Europe in the late 19$^{th}$ century, and were grown in subsequent decades in limited numbers. Hardier and fancier hybrids became available in the 1960s, considerably expanding the popularity of African violets as houseplants. *Saintpaulia ionantha* and its hybrids dominate the African violet industry. Thousands of cultivars, including some transgenic forms, have been bred. The flowers of modern cultivars may be single or double, and can be white or shades of pink, red, blue, purple, lavender, bi-coloured or multi-coloured. The yellow anthers of the two stamens are responsible for the prominent yellow centres of the flowers of numerous cultivars. Some selections have ruffled, star-shaped or fringed petals, and the flowers can even look like highly doubled rose blooms. Individual flower clusters can last 3 to 6 weeks, and plants can be maintained in a more or less continuous state of flowering. The leaves may be oval to heart-shaped, spooned, or pointed, and the margins ruffled, fringed or scalloped. Cultivars with variegated leaves (with areas or spots that are white, cream or pink) are available. Some forms have trailing stems. Although the plants are relatively small, there are very small cultivars called miniatures, minis, or sometimes "tea cup plants." 'Mickey Mouse' is a popular miniature. On the other hand, since the plants grow clonally, experienced growers sometimes produce impressively large specimens growing in single pots.

## Economic value

Unlike numerous flowering ornamentals, African violets have no associated cut-flower market, and at least in temperate regions they are rarely grown in gardens, although occasionally cultivated outdoors in warm climates, African violets are mainly sold as gift or personal plants for home




**Figure 3:** A vintage (public domain) valentine card showing Cupid pulling a bouquet of African violets.



**Figure 4:** *Saintpaulia teitensis* (Taita African violet). This "Critically Endangered" endemic, with less than 2500 individuals outside of cultivation, is confined to an area less than one $km^2$ in southern Kenya. A shade-loving plant, it grows in sheltered spots on rocks, among tree roots and occasionally on the lower trunks of moss-covered trees. **Left:** A cultivar by Daderot (Public Domain). **Right:** Wild plants sprawling over a boulder. ©Gerard D. Hertel (CC BY 3.0).

and office use. Although sales of throw-away flowering pot plants such as chrysanthemum and poinsettia exceed those for African violet, the latter occupies a special niche as the most popular of the flowering potted plants intended for long-term cultivation in relatively limited personal spaces where small, compact, long-flowering specimens that bloom at any time are ideal. As with most potted plants commonly marketed, commercial outlets prefer cultivars producing impressive flowering displays at time of sale. These pretty little plants are especially attractive to impulse buyers who see them on display in supermarkets, but they are also staples of dedicated enthusiasts. African violets are addictive for many, and hardcore hobbyists often maintain hundreds of plants, spending considerable sums on indoor gardening supplies. Sales statistics in Canada for African violets are not available, but in the U.S. the annual retail value exceeds $25,000,000.00.

## Edibility and toxicity

The flowers of true violets (*Viola* species) are often candied and consumed, but African violet flowers are not suitable for culinary purposes. African violets are "pet-safe" and are one of the houseplants recommended where companion animals and children might contact them. Neither the flowers nor the foliage are considered toxic to dogs, cats, birds, horses or people, although contact dermatitis has rarely been recorded.

## Cultivation

### Purchasing and Propagating

When buying plants, ensure that they are free of insects. Some pests such as thrips are very difficult to eliminate, and African violet specialists isolate new plants for more than a month before adding them to their collection to ensure that insect eggs are not present. African violets are usually propagated vegetatively, since most attractive cultivars are hybrids which will not reproduce true from seed. Plants with variegated foliage are chimeras, and are most reliably propagated by splitting plants (plantlets produced from leaves as described in the following may or may not reproduce the variegation). Commercial reproduction may be by tissue culture (including micropropagation), and "artificial seeds" (encapsulated tissue cultures) are also available. For home growers, a plant may simply be divided. Mature plants occasionally develop small plantlets or shoots from the side, which can be removed and potted. A portion of leaf or petiole will produce one or more new plantlets if left in a moist chamber (such as a plastic bag) or on moist sand for 6 weeks or so (immersion in water is not recommended). Leaves for propagating are best chosen between the outermost and innermost leaves of the rosette. Senescent leaves and flowers should be removed. Plants should be repotted annually, keeping in mind that they grow best in proportionately small pots, and a larger pot is only necessary when the plant has become strongly root-bound. In theory, an African violet clone is immortal, and some hobbyists have reported potted plants that endured for more than a decade, but a given crown eventually runs down and is best perpetuated vegetatively. A rough rule of thumb is that, when repotting, the new pot should have a width of about a third of the diameter of the rosette of leaves. Experienced hobbyists strongly recommend plastic over clay pots, which require more frequent watering. If not washed away, accumulated salts on clay pots can harm contacted stems or foliage.



**Figure 5:** A range of ornamental forms of *Saintpaulia ionantha*. **Upper left**: ©Bff (CC BY SA 3.0). Remaining photos ©Walrus 36 (CC BY 2.0).

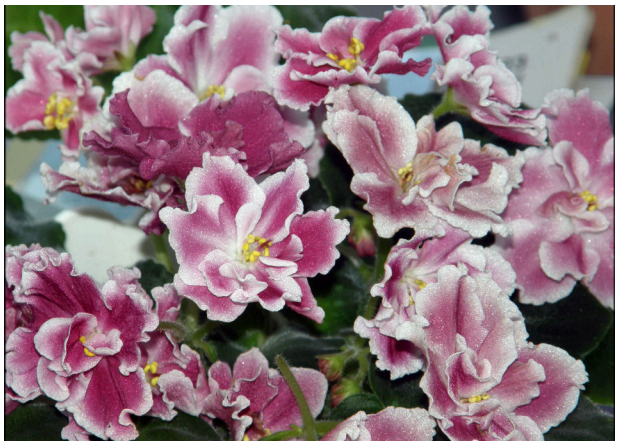


**Figure 6:** Spectacular blooms of a specimen of *Saintpaulia ionantha*, with bi-coloured (white and pink), doubled flowers (extra petals and extra stamens), and petals with scalloped margins. ©Andrew Butko (CC BY SA 3.0).

**Soil & moisture conditions**

Appropriate soils are porous and well-drained but have a high humus content (a soilless preparation formulated for African violets is ideal). The crown of the rosette should be about even with the top of the pot. To promote drainage from the crown, the soil should slope down at the edge to about 1.3 cm (0.5 inch) below the rim. Tolerated pH ranges from 5.5 to 7.0 (recommended range is 6.4–6.9). A soluble house-plant fertilizer (preferably formulated specifically for African violets) may be applied every 2 weeks. Some African violet specialists recommend liquid fertilizers high in K and P (high N encourages foliage growth at the expense of blooms), others simply prefer balanced N:P:K. Many state that commercial fertilizers should be diluted (e.g. quarter strength) from their recommended amounts. The soil should be maintained moist but not wet. Soft water is best (rainwater or demineralized water may be substituted for hard or limy (calcareous) tap water). Commercial growers recommend an ambient humidity of 50 to 70%. Placing the pot on a humidifying tray filled with moist pebbles can promote humidity around the plant, and some advise placing pots on moist sand. Although sometimes the foliage of African violets is misted with warm or tepid water, this practice is inadvisable because the fuzzy foliage tends to retain water, which may cause decay or discolouration. Cold water can promote foliage fungi, and in contact with leaves often causes white spots; water at room temperature is best. Commercial growers commonly irrigate African violets by placing them on capillary mats (spongy pads saturated with water), or by drip irrigation, both of which keep the foliage dry, preventing leaf spotting. There are innumerable systems marketed in garden supply stores for watering African violets in the home. Although bottom watering is recommended, this can eventually result in harmful buildup of salts in the soil, which should be flushed thoroughly with clear water every month or two.

**Location**

African violets grow well in the average home or office, but it is advisable to be aware of conditions that are most suitable. Air currents, such as from air conditioning vents or drafty doors, can be very harmful, as can contact of foliage with windows. Occasionally, African violets are grown in terraria, which protect the plants against such influences, but humidity is harder to control.

**Light**

The light meters that most people are likely to possess are calibrated in foot-candles or lux to indicate the density of light falling on a surface (average indoor lighting ranges from 100 to 1,000 lux, and average outdoor sunlight is about 50,000 lux). More accurate quantum PAR (photosynthetically active radiation) meters measure the micromoles of photons per square metre per second ($\mu$mol/m$^2$/s), and still more useful meters also integrate exposure over a day. Typically for African violets, about 1,000 foot candles (5,000 lux or 8 mol day$^{-1}$m$^{-2}$) is adequate. Plants flower poorly or remain vegetative when maintained in a location receiving 500 foot-candles maximum light level at noon on a sunny day (which roughly provides a daily photon flux of less than 1.5 mol day$^{-1}$m$^{-2}$). Light intensity above 1400 foot-candles (280 $\mu$mol s$^{-1}$m$^{-2}$) causes bleaching or burning of the foliage. At least 12 hours, but preferably 14 hours is needed (up to 18 hours has been recommended under fluorescent lights), and longer times of light availably compensate for lower light intensity. For window-sill growers, light from an east window may be needed to promote flowering, light from a north window may be inadequate, and a west



**Figure 7:** A variegated-leaf form of African violet. © Mk2010 (CC BY SA 3.0).



**Figure 8:** A leaf of *Saintpaulia ionantha* that was inserted in soil, resulting in the generation of plantlets at the base of the petiole. © RobertoMM (CC BY SA 3.0).

window may require filtering curtains to tolerate a hot afternoon sun. Serious home growers of African violets tend to raise them in fluorescent light stands, and although standard cool whites can be satisfactory, balanced spectrum (daylight) bulbs are better and the colour of the plants appears optically to be more intense. Typically, fluorescent lights are placed 30–38 cm (12–15 inches) above the foliage, or 15–30 cm (6–12 inches) above the flowers.

**Temperature**

A daytime temperature between 22°–24°C (72°–75°F) and a night temperature of 17°–18°C (62°–65°F), not less than 18°C (65°F), is appropriate (although some cultivars will tolerate 16°C (60°F) for brief periods).

## Curiosities of Science and Technology

- All species of *Saintpaulia* are enantiostylous. "Enantiostyly" has been defined as the strong deflection of the style to the left or right of the main floral axis at anthesis, with flowers of different morphs occurring at the same frequency within a plant. ("Left" and "right" are arbitrarily defined for the bilaterally symmetrical flowers of *Saintpaulia*, with respect to the stamens and from the view that the flowers are facing). The left and right hand flowers are essentially mirror images of each other. In the Gesneriaceae, enantiostyly seems to always involve both morphs occurring in one plant or inflorescence. At least a dozen families of plants have independently evolved enantiostyly. This feature is often linked to buzz pollination (which has been observed by bees on saintpaulia flowers), and is known to promote outcrossing.

- As pointed out earlier, misting the foliage of African violets is inadvisable because the fuzzy foliage tends to retain water, encouraging fungal infection. However, in the droughty cloud-forest habitat where many of the species occur, the ability of the velvety hairs to trap suspended water particles is advantageous, allowing the plants to obtain scarce moisture from the air.

- The popularity of the African violet is reflected in the wide usage of the phrase as a name for diverse entities, including cities, race horses and pets. "African violet" is also used as a colour designation, and is employed for paint, lipstick, markers, crayons and eyeshadow.

- "Pane-sill murder" is a colourful phrase designating the death of ornamental plants such as African violets located on window sills, that die when residents go on vacation, leaving them home alone to die from freezing or desiccation.

- In 1984, 25,000 African violet seeds were transported into space by the NASA space shuttle, and became part of the experiments in the "Long Duration Exposure Facility" testing the effects on living things of long-term cosmic radiation and lack of gravity. After orbiting Earth for 6 years, the seeds were found to have acquired mutations, and became the basis of new commercial varieties sometimes called "space violets" (www.optimara.com/everfloris.html).

- Tactile mechanical stress ("thigmomorphogenesis") such as brushing sometimes toughens and benefits plants (for example, brushing tomatoes makes them less leggy). The velvety foliage of African violets tempts people to stroke their leaves. However, Brotton and Cole (2009) found that caressing African violets, especially when hand lotions have been used recently, damages them.

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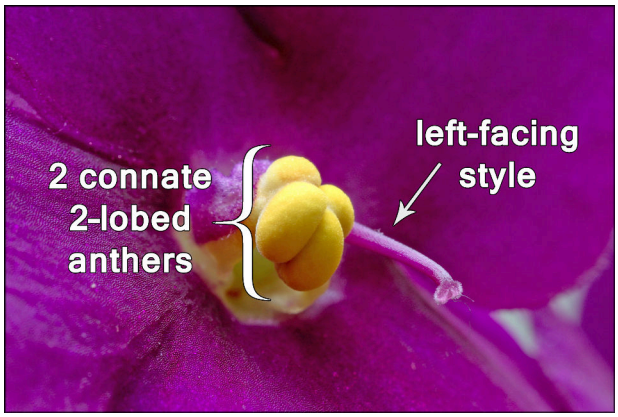




**Figure 9:** Sex organs of *Saintpaulia ionantha*. As pointed out in the text, the style is bent in one direction in half the flowers of a given plant, and in an opposite direction in the other half of the flowers ("left-facing" is from the perspective of the flower, not the viewer). © Calimo (CC BY SA 3.0).




**Figure 10:** Postage stamps issued by Canada Post© in 2010, showing Canadian-bred cultivars of African violets. **Left:** 'Decelles Avalanche'. **Right:** 'Picasso'.

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**Figure 11:** Painting (public domain) of *Saintpaulia ionantha* from Curtis's Botanical Magazine, vol. 121 [ser. 3, vol. 51]: t. 7408 (1895).

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## Key websites

Note: There are hundreds of African violet societies (most major cities in Canada have one).

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