

Contents  
Table des matières

President's Message /  
Message du président  
Vipen Shawhney  
pages 1-2

About Good Finances  
page 2

Next Meeting's Affairs /  
En vue du prochain congrès

J. S. Rowe Award  
Dianne Fahselt  
page 3

Call for nominations /  
Appel de candidatures  
Liette Vasseur  
page 3

Lionel Cinq-Mars and  
Iain and Sylvia Taylor Awards /  
Les prix Lionel-Cinq-Mars et  
Iain-et-Sylvia-Taylor  
Christian Lacroix  
page 4

Paper / Article



Poorly Known Economic  
Plants of Canada - 44.  
Red Mulberry (*Morus rubra* L.)  
P.M. Catling and E. Small  
pages 5-11

Erratum in CBA/ABC Bulletin 37(4)  
page 11

Announcement / Annonce

Seed Development Symposium  
page 12

# The Canadian Botanical Association Bulletin



## Bulletin de l'Association botanique du Canada

March / Mars 2005 • Volume 38 No. / N° 1

### President's Message

Hello everyone!

The spring is approaching fast and that means, in addition to starting to think of your garden, there are a number of CBA/ABC-related activities to get ready for.

Firstly, as you all know we are meeting in Edmonton this year as part of Plant Canada 2005 conference. The dates of the meeting are **June 15 to 18**. This is the first time six plant-related societies are meeting together under the umbrella of Plant Canada. The organizers expect a big turn out and are putting together an excellent program with three Plenary Sessions and five special Symposia (global food security and biotechnology, plants, Canada and climate change, roots and the underground environment, shoot apical meristems: structure and function, horticultural crop quality and human health, and nutrient use efficiency). CBA/ABC is organizing two symposia; one on "Shoot apical meristems" and the other on "Arctic and Alpine plants". There is an impressive list of speakers and it looks like it will be a fantastic Plant meeting. Early Registration deadline is **March 31, 2005** and for further information on the conference please visit the website: <http://www.plantcanada2005.ca>. I encourage you all to attend this meeting and present your exciting research.

Secondly, as you may know CBA/ABC offers travel bursaries to students for attending and presenting their research at the annual meetings. The "**John Macoun Travel Bursary**" is open to all Canadian students and is available for the Plant Canada meeting. For eligibility and procedures for applications, please go the CBA/ABC website: <http://www.usask.ca/biology/cba/>. The deadline for these applications is **April 15, 2005**, the same date as for submission of abstracts.

Thirdly, there are several awards offered by different Sections of the Association for papers published by students, i.e., the **Alf Erling Porsild Memorial prize** (Taxonomy and Phytogeography Section), **Stan Rowe award** (Ecology Section, see on page 3 in this issue), **Taylor A. Steeves award** (Structure and Development Section), and the **Luella K. Weresub Memorial award** (Mycology Section). The deadline for application for these awards is **May 1, 2005** and application material should be submitted to individual Section Chair. For procedures of application and other information on these awards, please visit the CBA/ABC website (as above).

You may have noticed that we have a new website. This website, albeit temporary, was developed with the help of Mr. Gordon Holtslander of the University of Saskatchewan, Biology Department. We will be obtaining an independent URL for CBA/ABC but in the meantime please send comments on the website to me at: [sawhney@admin.usask.ca](mailto:sawhney@admin.usask.ca) or to Gordon at: [holtslander@sask.usask.ca](mailto:holtslander@sask.usask.ca).

(continued on page 2)

## Canadian Botanical Association



### Bulletin

The CBA Bulletin is issued quarterly (in theory in March, June, September, and December) and sent to all CBA members. Comments or suggestions about the Bulletin should be directed to the Editor at the address below.

### Information for submitting texts

Texts and illustrations for the Bulletin should preferably be sent to the Editor as electronic documents, nevertheless any medium is acceptable. Any format for texts or illustrations are welcome. Please make sure that scanned pictures are done with a very good resolution (say 300 dpi). The pictures should be made available separately from the text. If you have any question about text submission, please contact the Editor.

For general info on CBA, go to the web site:  
<http://www.usask.ca/biology/cba/>

## Association botanique du Canada



### Bulletin

Le Bulletin de l'ABC paraît quatre fois par année, normalement en mars, juin, septembre et décembre. Il est envoyé à tous les membres de l'ABC. Tout commentaire concernant le bulletin est apprécié par le rédacteur.

### Directives aux contributeurs

Les textes et les images sont de préférence envoyés sous forme électronique, néanmoins, tous les supports de même que tous les formats imaginables sont acceptables. Les fichiers graphiques doivent être de très bonne définition (au moins 300 dpi) et disponibles indépendamment du texte. N'hésitez pas à contacter le rédacteur pour toute information.

Infos générales sur l'ABC à l'url suivant:  
<http://www.usask.ca/biology/cba/>

### Editor / Rédacteur

Martin Dubé  
Campus d'Edmundston  
Université de Moncton  
Edmundston, NB  
CANADA E3V 2S8

Téléphone / Phone (506) 737 5154  
Télécopieur / Fax (506) 737 5373  
Courriel / E-mail :  
CBA\_ABC\_Editor@hotmail.com

### Next issue / Prochain numéro

Texts for the next issue, **38(2)**, must be received before May 7<sup>th</sup>, 2005.

La date de tombée des textes du prochain numéro, le no **38(2)**, est le 7 mai 2005.

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### President's Message (continued from page 1)

Finally, I hope you have sent back the postal ballot form concerning the adoption of four motions to modify the bylaws. If not, please do so by the **April 15, 2005** deadline. Thanks.

I look forward to seeing you all in Edmonton in June.

Vipen Sawhney, CBA/ABC President



## Message du président

Bonjour tout le monde!

Le printemps approche à grands pas. Ne pensez pas qu'au jardinage mais aussi aux nombreuses activités de l'ABC/CBA qui vous attendent.

D'abord, vous savez tous que le congrès annuel se tient à l'occasion de l'événement Plante Canada 2005 qui se déroule du 15 au 18 juin. Pour la première fois, six associations de botanistes se réunissent sous la bannière de Plante Canada. Les organisateurs s'attendent à une manifestation majeure comprenant trois séances plénières et cinq symposiums (sécurité alimentaire et biotechnologie, les plantes et le changement climatique au Canada, les racines et le milieu édaphique, la structure et la fonction des méristèmes apicaux de tige, pratiques horticulturales et santé humaine, efficacité d'utilisation des éléments nutritifs). L'ABC/CBA organise deux symposiums; l'un sur les méristèmes apicaux de tige, l'autre sur les plantes arctiques-alpines. La liste des conférenciers est imposante et d'ores et déjà, ce congrès s'annonce fabuleux. La date limite pour la pré-inscription est le **31 mars 2005**. Pour plus d'informations, visitez le site web au <http://www.plantcanada2005.ca>. Je vous encourage tous et chacun à assister au congrès et à présenter le résultat de vos recherches.

En second lieu, comme vous le savez, l'ABC/CBA offre les **bourses de voyage John Macoun** aux étudiants canadiens pour leur participation au congrès annuel. Pour connaître les conditions d'éligibilité et la marche à suivre pour soumettre une candidature, visitez svp le site web de l'Association au <http://www.usask.ca/biology/cba/>. La date limite pour présenter une demande et pour envoyer les résumés de communication est le **15 avril 2005**.

Troisièmement, rappelons que plusieurs prix sont remis par les différentes sections de l'Association pour récompenser les meilleurs articles publiés par des étudiants. Il s'agit du **prix Alf-Erling-Porsild** (section Taxonomie et phytogéographie), du **prix J.-S.-Rowe** (section écologie, voir page 3 dans ce numéro), du **prix Taylor-A.-Steeves** (section Anatomie-morphologie), et du **prix Luella-K.-Weresub** (section Mycologie). Les candidatures doivent être soumises aux présidents de section au plus tard le **1er mai 2005**. Pour les détails, consultez le site web de l'ABC/CBA mentionné ci-haut.

Vous aurez sans doute remarqué que nous avons un nouveau site web. Ce site temporaire a été préparé par M. Gordon Holtslander du département de biologie, Université de la Saskatchewan. Nous aurons éventuellement un url bien à nous mais, en attendant, vous pouvez envoyer vos commentaires à propos du site soit à moi-même ([sawhney@admin.usask.ca](mailto:sawhney@admin.usask.ca)) ou à Gordon ([holtlander@sask.usask.ca](mailto:holtlander@sask.usask.ca)).

Pour finir, j'espère que vous avez répondu au vote postal concernant l'adoption de quatre propositions de modification aux statuts. Si non, veuillez svp le faire d'ici le **15 avril 2005**.

En espérant vous rencontrer tous à Edmonton en juin.

Vipen Sawhney, président de l'ABC/CBA

Traduit par le rédacteur



## About good finances

All the accounting for the last Annual Meeting is now complete and we are ready to distribute the surplus funds. I am pleased to tell the Board that CBA/ABC will receive \$2,000 in addition to the return of the seed money.

David Punter, former Vice-President

# J. S. Rowe Award for the Best Student Paper in Plant Ecology

This annual award was established to honour the contributions of Professor J. Stan Rowe who was the first chairman of the Ecological Section of the CBA. Professor Rowe contributed much to the advancement of ecology in Canada through this initiative to encourage Canadian plant ecologists to join the CBA and to foster communication with their colleagues from around the world. He is well known for his seminal research on the relationship between land form and forest communities and as an enthusiastic and dedicated teacher.

Applications should be sent **before May 1, 2005** to:

**D. Fahselt**, Chair of Ecology Section  
Department of Biology, University of Western Ontario, London, ON N6A 5B7  
phone: (519) 661-2111 ext. 86480; fax:(519) 661-3935; e-mail: dfahselt@uwo.ca

## TERMS OF REFERENCE FOR THE AWARD

1. All students who have graduated from or are currently enrolled in a Canadian university, or Canadian students who have studied abroad are eligible.
2. The award is for work published while the author is still a student or based on work done while a student and published within two years of graduating. This makes allowance for students who do not write a paper until after thesis (graduate or undergraduate) completion and for journal publication delays.
3. Students need not be CBA members to be eligible.
4. No candidate may submit a paper for more than one award (Rowe, Steeves, Weresub and Porsild).
5. The student must be the sole or first author of the paper.
6. The paper must have been published during 2004. However, papers published in late 2003 but not available in reprint form in time for the deadline of last year's competition will also be considered eligible.
7. Joint papers must be accompanied by a statement on university letterhead, signed by all the authors, estimating the percentage responsibility of each author for:
  - a) the ideas that led to the initiation of the project;
  - b) the actual research skill demonstrated;
  - c) the writing of the manuscript.
8. All applications should include four copies of each of the following:
  - a) a reprint of the paper (or a proof copy of the paper plus a letter from the editor of the journal stating that this paper is in press with a 2004 publication date);
  - b) the candidate's curriculum vitae, including current address and e-mail information;
  - c) a statement indicating that this student is currently enrolled in a degree program, or has completed such a program during the calendar year for which the award is to be made (except for extenuating circumstances with respect to timing of publication as noted above in (2))
  - d) a statement from the supervisor, the student, and any co-author, establishing responsibility for the paper as outlined above in (7).
9. Student award winners receive a one (1) year's membership in the CBA.
10. Applications and supporting document must be sent **before May 1, 2005** to the selection chair responsible for the prize.

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## Call for Nominations

Dear members :

It is the time of the year to think about your involvement in the Association. Are you interested in becoming a Director or being involved in the Executive Committee? This year, we have to find a new Secretary as Christine Maxwell (who has done a wonderful work for the past 5 years) is going to complete her mandate. I therefore would like to receive before April 15th 2005 nominations for this position. Finally we also need ... Directors.

The role of a director is mainly to promote the Association and help encourage young students to become botanists. With the inclusion of the Regional Undergraduate Awards, it is also expected that they will link with associations for the presentation of these awards in their regions.

Please, send your nominations (including the names of two members who support the nomination) to:

**Dr. Liette Vasseur**  
Associate Vice President – Research  
Laurentian University  
935 Ramsey Lake Road  
Sudbury, ON P3E 2C6  
Fax: (705) 673-6522  
E-mail: lvasseur@laurentienne.ca

## Appel de candidatures

Chers membres,

C'est le temps de l'année pour considérer votre participation dans l'association en devenant un directeur ou directrice régional(e) ou en vous impliquant dans le comité de gestion. Cette année nous devons trouver un(e) secrétaire puisque Christine Maxwell (qui a fait un excellent travail dans les 5 dernières années) va bientôt compléter son mandat. Finalement, nous avons besoin de ... directeurs ou directrices pour représenter nos régions. Le rôle des directeurs et directrices est de promouvoir l'association et d'encourager les étudiants et étudiantes à devenir botanistes. Avec la venue des prix régionaux pour les meilleures présentations botaniques au premier cycle, nous espérons que ceux-ci et celles-ci puissent se lier aux associations où les prix peuvent être présentés dans leurs régions.

Nous vous prions d'envoyer vos nominations (incluant les noms de deux personnes appuyant la nomination) à l'adresse suivante :

**Liette Vasseur**, Ph.D.  
Vice-rectrice associée à la recherche  
Université Laurentienne  
935 Chemin du Lac Ramsey  
Sudbury, ON P3E 2C6  
Télécopieur: (705) 673-6522  
Courriel: lvasseur@laurentienne.ca

## Lionel Cinq-Mars Award Iain and Sylvia Taylor Award

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I encourage all student presentors to let their name stand for the Lionel Cinq-Mars award for best presentation or the Iain and Sylvia Taylor award for best poster. As coordinator of the judging for CBA student presentations, I look forward to finding out about your research. (see information below).

**Christian Lacroix**, CBA President-Elect



### Lionel Cinq-Mars Award

In 1976 the CBA/ABC established a cash award "for the best oral presentation by a student of his or her own research, as a contributed paper at the Annual Meeting".

Any bona fide student enrolled at a Canadian institution of higher learning is eligible, as well as Canadian students at foreign institutions, both undergraduate and graduate. Every effort will be made to ensure that each student in the competition has a fair evaluation and an equal chance of winning the award.

Oral presentation will be evaluated by a panel of judges (at least one from each of the sections of CBA) which is chaired by the President-Elect (Dr. Vipen Sawhney). The merit of each paper will be judged on the basis of content (60%) and presentation (40%). Abstracts should be submitted for the 2005 Annual Meeting **before April 15th**. Please contact Roisin Mulligan (roisin.mulligan@ualberta.ca) for any extra information.

### Iain and Sylvia Taylor Award

The Canadian Botanical Association gives an award for the best student poster presented at the CBA Annual Meeting.

Any bona fide student enrolled at a Canadian institution of higher learning is eligible, as well as Canadian students at foreign institutions, both undergraduate and graduate. Every effort will be made to ensure that each student in the competition has a fair evaluation and an equal chance of winning the award.

Posters will be evaluated by a panel of judges chaired by the Vice-President of CBA/ABC (Dr. Roisin Mulligan). Abstracts should be submitted for the 2005 Annual Meeting **before April 15th**. Please contact Roisin Mulligan (roisin.mulligan@ualberta.ca) for any extra information.

## Les prix Lionel-Cinq-Mars et Iain-et-Sylvia-Taylor

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J'encourage tous les étudiant(e)s qui désirent présenter leurs résultats de participer à la compétition pour le prix Lionel-Cinq-Mars pour la meilleure communication ou le prix Iain-et-Sylvia-Taylor pour la meilleure affiche. À titre de coordonnateur du comité de juges pour les communications étudiantes de l'ABC, j'espère avoir la chance de me renseigner sur vos projets de recherche. (voir l'information ci-dessous).

**Christian Lacroix**, président élu de l'ABC



### Prix Lionel-Cinq-Mars

Créé en 1976, ce prix en argent récompense la meilleure présentation orale par un(e) étudiant(e) de sa propre recherche durant le congrès annuel de l'Association.

Tous les étudiants sérieux inscrits dans une institution canadienne d'enseignement supérieur ou dans une institution à l'étranger sont éligibles à ce prix, qu'ils soient au premier ou au deuxième cycle. Aucun effort ne sera ménagé pour garantir une évaluation juste et équitable des étudiants participant à cette compétition.

La présentation orale sera évaluée par un jury (comportant au moins un représentant de chacune des sections de l'Association) présidé par le président élu (M. Vipen Sawhney, Ph.D., en l'occurrence). Les présentations sont notées sur le contenu (60%) et sur la forme (40%). Les résumés devraient être soumis à l'organisation du congrès annuel **avant le 15 avril 2005**. Pour toutes questions, vous pouvez rejoindre la vice-présidente Roisin Mulligan à l'adresse suivante: roisin.mulligan@ualberta.ca.

### Le prix Iain-et-Sylvia-Taylor

Ce prix récompense la meilleure présentation par affiche exposée durant le congrès annuel de l'Association.

Tous les étudiants sérieux inscrits dans une institution canadienne d'enseignement supérieur ou dans une institution à l'étranger sont éligibles à ce prix, qu'il soient au premier ou au deuxième cycle. Aucun effort ne sera ménagé pour garantir une évaluation juste et équitable des étudiants participant à cette compétition.

La présentation par affiche sera évaluée par un jury présidé par la vice-présidente de l'Association (Roisin Mulligan, Ph.D., en l'occurrence). Les résumés devraient être soumis à l'organisation du congrès annuel **avant le 15 avril 2005**. Pour toutes questions, vous pouvez rejoindre Roisin Mulligan à l'adresse suivante: roisin.mulligan@ualberta.ca.

# Poorly Known Economic Plants of Canada - 44.

## Red Mulberry (*Morus rubra* L.).

**P.M. Catling and E. Small**

National Environmental Program, Biodiversity Section, Agriculture and Agri-Food Canada, Saunders Bldg., Central Experimental Farm, Ottawa ON K1A 0C6

Native berries are becoming increasingly popular as highly nutritional foods that help to maintain and restore health, and red mulberry is potentially valuable in this respect. In addition, it can be used to produce silk, medicine and fibre, and also serves as food and cover for wildlife. Unfortunately native populations are endangered in Canada.

### Latin Names

The genus name *Morus* is Latin for mulberry. This name may have been derived from the Latin *mora*, delay, a reference to the tardy expansion of the buds in the spring. It may also be associated with the Celtic, *mor*, meaning black, in allusion to the colour of the fruits of some species, probably the European black mulberry (*M. nigra* L.). The Latin *rubra* refers to the red fruit (which turn dark purple or black when fully ripe).

### English Name

Red mulberry. The name “mulberry” comes from the Old English *morberie*, berry, + *mor*, from the Latin *morus*, mulberry.

### French Name

Mûrier rouge.

### Morphology

The red mulberry is a deciduous shrub or tree to 15 or occasionally 20 m tall (Figure 1). The furrowed, gray-brown bark has flat ridges. The red-brown or light green branches are smooth. Dark-brown ciliate scales are characteristic of the ovoid buds, which are 3-7 mm long. Leaves are alternate, broadly ovate and serrate. They may be unlobed (Figure 2), in which case they resemble basswood leaves, or may have two to five major lobes (Figure 3). Tips of entire leaves and leaf lobes are distinctively long-tapered to a point (acute to acuminate). Leaves turn yellow in the autumn. Both leaves and twigs contain a milky sap. Red mulberry plants can be male, female or both, with greenish, 4-parted flowers arranged in catkins 1-2 cm long. The male flowers are 2-2.5 mm long, the female flowers 1.5-2 mm long. The “berries” are elongate, cylindrical, about 1 cm wide and 2.5-4 cm long. They are initially green, turning red and becoming black or deep purple when fully ripe.

To attract animals for seed dispersal, fleshy fruits have evolved in many different ways. The red mulberry “berry” (in this case a multiple fruit, technically a syncarp) is derived from many flowers, each with fleshy sepals surrounding a single flat, yellowish achene 2 mm long. The edible flesh is mostly derived from the sepals. For comparison, the edible flesh of a strawberry is mostly derived from the top of the flower stalk (receptacle), and a raspberry is a mass of



Fig. 1. Red mulberry (*Morus rubra*), from Loudon, J.C. 1844. *The trees and shrubs of Britain*. Longman, Brown, Green, and Longmans, London, U.K. (vol. 7, p. 227).

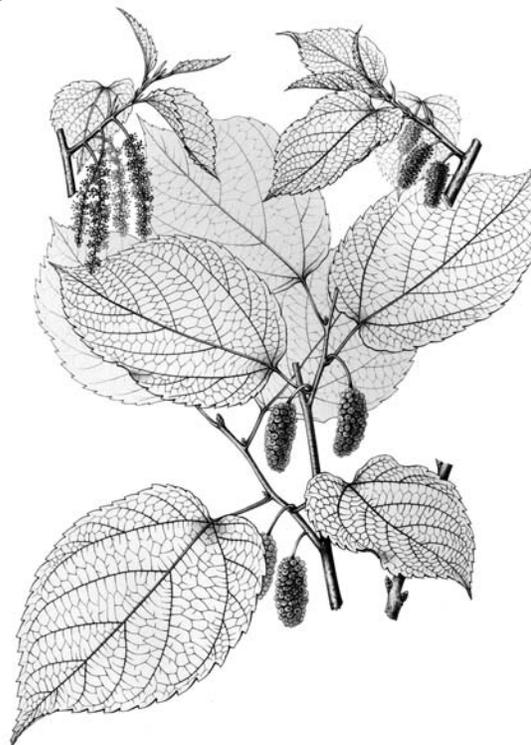


Fig. 2. Red mulberry (*Morus rubra*), from Sargent, C.S. 1890–1892. *The silva of North America*. Houghton, Mifflin and Company, Boston, MA. (vol. 7, plate 220). Upper left, male flowering branch; upper right, female flowering branch; below, fruiting branch.

ovaries (both of the latter fruits are derived from a single flower).

Considerable variation in leaf shape (extent of lobing) occurs among trees, indeed even among the leaves of a given branch. Moreover, the leaves produced by a given tree in one year often differ dramatically from the leaves produced in the next year. Early rapid development is associated with the production of more lobes while later slower growth is characterized by leaves with fewer lobes.



Fig. 3. A specimen of red mulberry in the AAFV vascular plant herbarium (DAO) collected by W.G. Stewart at Point Pelee, Essex County in 1953. The specimen has the deeply lobed leaves seen sometimes in *M. rubra*, but leaves of this kind are more characteristic of *M. alba*. William G. Stewart of St. Thomas (the collector) is well known for his work on the flora of southwestern Ontario (see <http://www.eman-rese.ca/eman-rese.ca/botanists/StewartWG.html> and also obituaries in *The Cardinal* No. 168:20-21, Aug. 1997, and *Field Botanists of Ontario Newsletter* 10(2), Summer 1997).

Removal of leaves results in new leaves with less lobing whereas removal of branches results in new branches with leaves that are more lobed. Botanists have proposed various hypotheses for the adaptive value of leaf shape in plants, for example, that narrower leaves radiate heat better than broader leaves, that lobed leaves facilitate air circulation and gaseous exchange, and that dissected leaves mimic damage and accordingly discourage further attack by insects. Just why red mulberry leaves are so variable in shape is not clear. Leaf lobing is better

developed in young plants, which usually develop in open, periodically dry and warm sites. By the time the trees mature, the habitat has become somewhat shaded and less extreme, and under these circumstances unlobed leaves may be more advantageous.

### Classification and Geography

Mulberry belongs to the mulberry family (Moraceae), which is represented in tropical and temperate regions throughout the world. It includes about 75 genera, some trees with edible fruit such as the figs (*Ficus* spp.) and breadfruit (*Artocarpus altilis*), and valuable timber such as Osage orange (*Maclura pomifera*, widely used as a living fence half a century ago) and African teak (*Chlorophora excelsa*, which unfortunately produces a poison ivy-like dermatitis in woodworkers). Most of the species in the group produce a milky latex. The latex from figs and some other species was once used for manufacturing rubber.

The genus *Morus* (Moraceae, mulberry family) includes about 10 species, found in the temperate and tropical regions of North America, Europe and Asia. Red mulberry occurs throughout the eastern and Midwestern United States (Figure 4) reaching its northern limit in the Carolinian zone of southern Ontario (Figure 5).

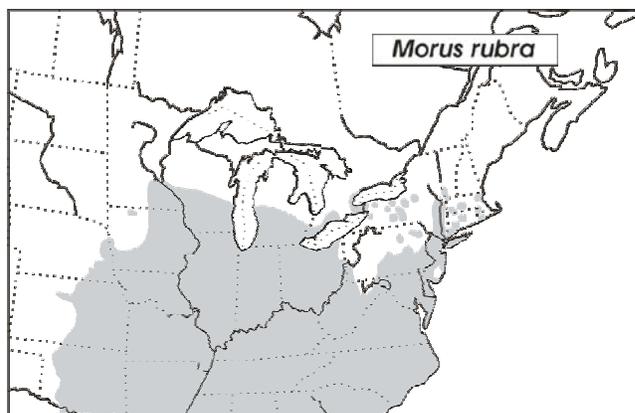


Fig. 4. Distribution of red mulberry in northeastern North America.

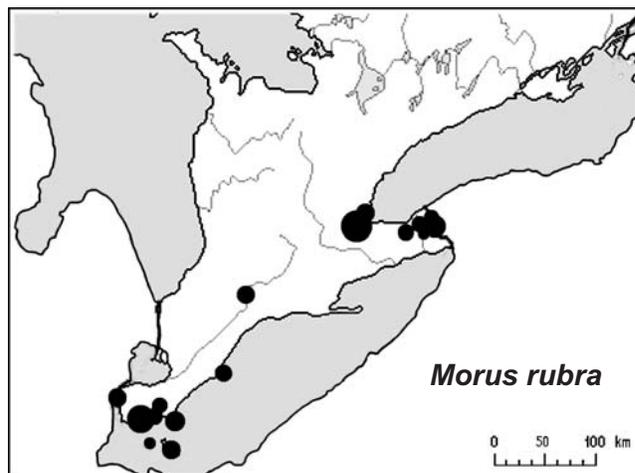


Fig. 5. Canadian distribution of red mulberry (*Morus rubra*), from Canadian Wildlife Service (2004; see Sources of Additional Information).

In addition to the red mulberry, white mulberry (*Morus alba* L.) is widely established as an escape from cultivation throughout the eastern United States and is spreading in southern Ontario north to northern Lake Huron. Similar to red mulberry, it is a shrub or small tree (Figure 6) to 15 m, but sometimes attains 25 m in height. The berries are red when immature, later becoming black, purple or nearly white. This has led to confusion (because people expect white mulberry to have only white berries, red mulberry to have only red berries, and black mulberry to have only black berries). Red and white mulberries can be distinguished using the key below. Both can have either entire or deeply lobed leaves and are somewhat variable in pubescence. Hybridization leads to intermediate leaf characteristics and one recent study has found that plants that appear to be red mulberry on the basis of morphological characteristics are actually hybrids based on chemical markers.

**KEY TO CANADIAN SPECIES OF *Morus***

Leaves smooth or roughened beneath but with hairs only on the main veins or in tufts in vein axils; lateral leaf lobes when present usually obtuse; immature fruit red, becoming white to dark purple.....*Morus alba*

Leaves hairy beneath and with hairs between the main veins; lateral leaf lobes when present usually acute to acuminate; immature fruit red, becoming black or dark purple.....*Morus rubra*



Fig. 6. White mulberry (*Morus alba*), from Loudon, J.C. 1844. *The trees and shrubs of Britain*. Longman, Brown, Green, and Longmans, London, U.K. (vol. 7, p. 226).

Black mulberry was introduced into North America from Asia in early pioneer times. It has been reported as an escape from cultivation in many parts of the southern United States but these reports were apparently based on dark-fruited plants of *M. alba*. Black mulberry is not documented as an escape in Canada. It is less hardy than the peach, but may be grown with protection as far north as New York and New England in the United States, and southern Ontario and southern British Columbia in Canada.

Another species sometimes confused with red mulberry is the widely cultivated paper mulberry (*Broussonetia papyrifera* (L.) Vent.) which differs in having leaves densely gray-hairy below, branches with spreading hairs, globose

(instead of cylindrical) pistillate inflorescences and unbranched (instead of 2-branched) styles. This small tree, a native of China and Japan, is widely naturalized in the U.S. and occasionally cultivated in southern Canada. It is widely planted in the Far East for its bark, used to manufacture paper, rope and clothing.

**Ecology**

Red mulberry occurs as an understory tree or shrub in moist deciduous forests, and is also found on forest edges and in open habitats. It is characteristic of slopes and ravines in the Hamilton - Niagara area. Further southwest it is established on sand spits and in bottomlands. It often is found in successional habitats and the high phenotypic plasticity reported has been interpreted as an adaptation to changing and disruptive environments.

The pollen is carried by the wind and not surprisingly flowering occurs in the spring (27 May to 14 June in Ontario) during the expansion of the leaves. At a later time the leaves would obstruct pollen transfer. Fruit ripens from mid-July to late summer. The berries provide food for grouse, turkeys, squirrels, raccoons, opossums, foxes, coyotes, bears and many kinds of songbirds. All of these animals serve to spread the seeds. The seeds may germinate soon or remain dormant in the soil.

Dispersal of seeds by fruit-eating fish is well documented in some tropical regions, but it was unknown in North America until 2003 when it was reported that channel catfish (*Ictalurus punctatus*) consume red mulberry fruits in the floodplain forests of the Mississippi River. The catfish move into periodically flooded habitats and are believed to defecate seeds in habitats suitable for germination when flooding subsides. Seeds excreted by the catfish have a higher germination rate than seeds that accumulate beneath trees.

It is not only the fruits that are important food for wildlife. Although woodchucks are reported to climb trees occasionally to avoid predators or to rest and sun, a recent study has suggested that they climb mulberry regularly to browse on the highly palatable leaves. Many native insects also feed on mulberry.

**Conservation**

Red mulberry has declined in many parts of its range and may be one of Canada's most endangered tree species. It is known from only 18 locations, and there are less than 300 individuals in Canada.

It appears that the genetic diversity of the rare native red mulberry is being threatened by that of the more common invading alien, white mulberry, as a result of hybridization, leading to "genetic swamping." In this process the genes of the rarer species become incorporated into the genetic background of the more common species, there potentially to be lost through selection or drift. The invading species also interferes with reproduction by usurping ovules of the rarer species thereby reducing conspecific fertilizations. This can lead to a decrease in the frequency of the rarer species in each successive generation.

As well, the ecological niche of the red mulberry is being occupied by the more aggressive white mulberry and the white × red hybrids. This will likely also contribute to the red mulberry becoming increasingly rare. The impact is easily underestimated because hybrids are not always obvious. Twenty-two percent of 54 Ontario apparent red mulberries tested were found to be hybrids. Habitat loss has also played a role in decline and recruitment has been minimal over the past several years.

At Point Pelee National Park a number of trees have been lost due to a fungus disease and young seedlings are extensively grazed by snails. The extent to which introduced white mulberry pathogens have contributed to red mulberry decline remains to be explored, but in Canada the only pathogens so far identified are opportunistic and can only damage already weakened hosts.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has officially designated red mulberry as endangered. It is feared that this potentially valuable tree will be lost as a distinct species in Canada due to a combination of hybridization with white mulberry, loss and degradation of habitat, disease, and lack of recruitment. In an attempt to avoid such loss, a recovery plan has been developed, resulting in experimental transplants, studies of hybridization and its impacts, demographic monitoring, population viability analysis and culling of white mulberry in core red mulberry populations. The long term goal is to establish new self-sustaining populations of red mulberry within its traditional range in agricultural landscapes, urban parks and transportation and utility corridors. Possibly this should be an immediate goal.

Consideration should also be given to restricting cultivation of white mulberry because of the threat to red mulberry. Canada has legislation protecting economically important plants by restricting cultivation of alien species (e.g. European barberry, *Berberis vulgaris*, the alternate host of wheat stem rust, is subject to Ontario's Weed Control Act and national legislation controlling seed and plant importation). Similar protection should be afforded to endangered native species, and red mulberry may be a candidate.

### Use as Food

**WARNING:** Mulberries stain your clothes and skin purple. Kids who like red mulberries are purple much of the time! The unripe berries and milky sap in the leaves are toxic. Touching the leaves and stems can produce dermatitis in susceptible people.

Red mulberry fruits are juicy and sweet. They can be consumed fresh, stewed, made into syrup, preserves, jelly, wine and liqueur, or incorporated into pies and tarts. Mulberry gin (made from black or red mulberries) is said to be better than sloe gin. To make a purple mulberry milkshake add 2 cups vanilla ice cream, ½ cup milk, 1 cup mulberries and blend. "Rosolio" (pronounced roh-so-leh-o) is an Italian liqueur made with black mulberry or cherry juice. Both red and black mulberries can be frozen or dried for later use. The berries are conveniently harvested by spreading sheets under the tree and shaking the branches (but the sheets will become purple). Although its berries are tastier than those of the white mulberry, some consider the fruit of red mulberry inferior to that of black mulberry. Others consider the fruit to be just as good. There are several red mulberry cultivars used for fruit, but the species is not as well developed as a food source as the black mulberry, which has been considered a delicacy since Roman times.

Black mulberry has been subject to centuries of cultivation and selection to produce fruit of good quality. There are numerous cultivars, some with fruits that are thought to be the largest, juiciest, and finest of any species in the genus. A very long-lived tree, Black mulberry (Figure 7) has been grown since antiquity in the Old world as a source of fruit and is referred to in the Bible, and by classical Greek and Roman writers. It is currently widely cultivated for its black fruit throughout southern Eurasia and at higher altitudes in the tropics.

The fruit of mulberries (both red and black) gradually darkens and sweetens as maturity is approached, and should not be picked until completely ripe. At full ripeness, mulberries are juicy with a musky, slightly acid, distinctive flavor. Some find mulberries to be too sweet. They bruise easily during handling and do not store well. Consequently

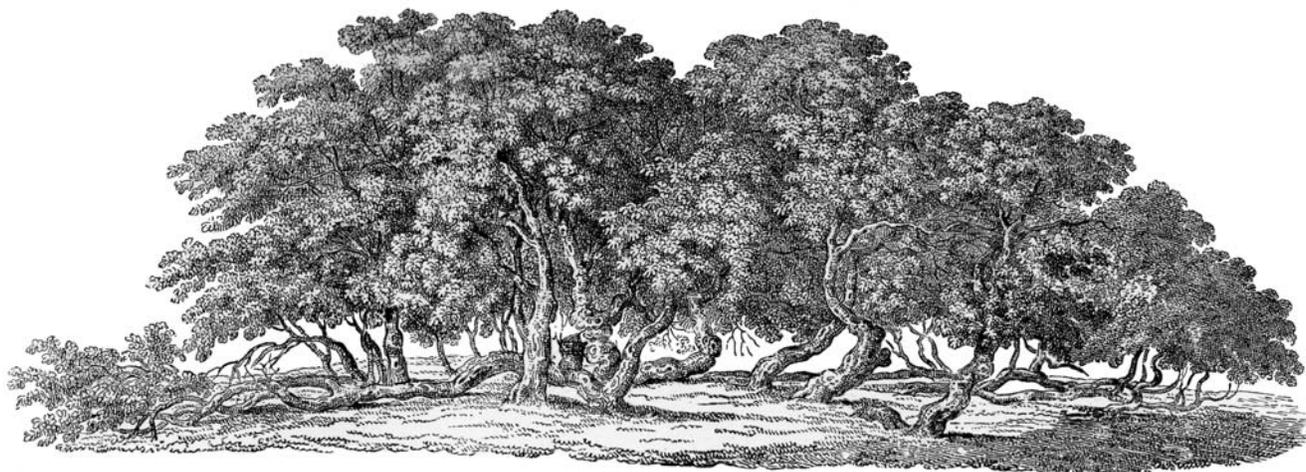


Fig. 7. A 300 year old clump of black mulberry (*Morus nigra*), showing 15 trunks which arose by spreading from one original tree, from Loudon J.C. 1844. *The trees and shrubs of Britain*. Longman, Brown, Green, and Longmans, London, U.K. (vol. 7, p. 224).

mulberries are largely home grown and not extensively marketed.

### Non-Food Uses

#### *Mulberries and Silk*

Mulberry leaves are the principal food of the mulberry silk moth (*Bombyx mori*), the primary source of silk thread. It has been shown that a higher output of silk can be achieved by feeding silkworms leaves of red mulberry than by feeding them leaves of some varieties of white mulberry, the traditional silkworm food plant. Silk moths have been raised for production of silk (sericulture) for thousands of years. During this long period of domestication involving selection for certain characteristics that optimize silk production the moth has become flightless, blind, and unable to eat or drink. It looks very different from its nearest wild ancestor (*Bombyx mandarina*), which has caterpillars resembling bird droppings and adults resembling tree bark. The silkworm is one of the few examples of an insect that has been domesticated. The honey bee is the other insect best known to have been domesticated. However, in contrast to the honeybee, the silkworm can no longer survive without human care, and indeed it is the only such insect in the world.

One hectare of mulberry yields 10 metric tons of leaves which can be processed into 100 kg of raw silk. It takes 110 cocoons to make a silk tie and 630 to make a blouse. The silk is obtained from a single continuous thread 600-900 m long, which the caterpillar spins around itself prior to entering a resting stage from which the moth will emerge. The covering and the resting stage inside is called the cocoon. Before weaving the outer covering of the cocoon, the caterpillars increase rapidly in size by feeding voraciously on mulberry leaves. To remove the silk the cocoons are killed by high temperature and the tightly woven filaments are loosened in hot water. A thread of silk is formed by twisting together 5-8 filaments. In China, silk was used as currency, people paying with lengths of silk. It was also used for fishing lines, bowstrings, musical instruments and rag paper.

For thousands of years in China, silk clothing was a royal luxury and its method of production was a tightly guarded secret. By 600 AD the Persians had acquired the secret of silk production. It is said that the moths were smuggled from China in bamboo canes. Within decades the secret arrived in Europe and became the basis for the European silk industry, which has existed for 1,400 years. Annual world production is believed to be 600 billion cocoons, weighing 100,000 tons. About 70% of the world's silk still originates in China, with 12% from India. In addition, Brazil, Korea, Russia, Thailand and Vietnam also produce silk. Most European silk now comes from Italy. Since the supply from Asian countries is insufficient to meet world demand, silks are being produced by other species of moths in other parts of the world, such as Africa where the moth employed feeds on acacia and in India where several plants are used by a variety of silk moth species.

#### *Other Non-food Uses*

Native people used infusions of red mulberry bark as a cure for dysentery and as a laxative and purgative. Sap rubbed

directly on the skin was used to treat ringworm, a skin infection caused by a fungus in the genus *Tinea*. Root infusions were taken to cure urinary problems and as a general tonic. The bark was used to expel tapeworms. Other closely related species of mulberry (*M. alba* & *M. rubra*) have numerous traditional uses in Chinese and European medicine.

In North America, native Choctaw women are said to have made cloaks from fibre obtained by beating and drying the inner bark. The bark fibre was also used by native North Americans to make rope. The young twigs of Eurasian mulberries have been used to obtain fibre for weaving and to make paper. In the southeastern U.S. the durable and water-repellant wood of red mulberry has been used for fence posts, barrels, boats and furniture. The purple-staining liquid from the ripe berries has been used as ink.

Since the trees grow quickly, are of limited size and strong, they are often planted in gardens. Weeping cultivars are particularly popular in landscaping, especially the 'Pendula' cultivar. Some attractive plants grown as ornamentals are potentially very damaging to the natural environment, because they escape and dominate native ecosystems, displacing native species. Purple loosestrife is a familiar example. The popular weeping cultivars of white mulberry are also a concern in this respect. Unfortunately female plants are capable of setting fruit. Fruitless male trees are often preferred for ornamental plantings because the purple stain on sidewalks, patios and people is avoided. However, these trees produce pollen, leading to the problem of genetic swamping of red mulberry discussed above.

In the Cotton Belt and southern corn belt areas of the United States, farmers used to plant a row of mulberry trees along the south side of their hog lots. Berries falling from the trees were gobbled up by the pigs, but also by flocks of birds which bombed cars and drying laundry with their inky droppings. The bird nuisance gradually led to the abandonment of the system.

### Agricultural and Commercial Aspects

Red mulberries grow well and quickly. They do best in full sun and should be planted at least 5 m apart. Deep loamy soils are preferred. Since they are somewhat drought tolerant, water is usually not limiting. Seedling plants require about 10 years to reach the stage of fruit production. Optimal fruiting is between 30 and 85 years. Most propagation is by grafting or cuttings. It may be necessary to grow males and females together to ensure sufficient fruit production, but some plants are bisexual, and some cultivars ('Tufts' and 'Hicks') are parthenocarpic (from the greek words *parthenos* meaning virgin, and *carpic* meaning fruit), producing fruit without fertilization. Pruning is not required except to develop main branches. Excess pruning is to be avoided because mulberries tend to "bleed" more than other trees and shrubs. Diseases are few but red x white hybrids are prone to "popcorn disease," a fungus which expands and destroys the fruit. Several sources (see below) provide extensive information on cultivation of white and black mulberry, which should also apply to the closely related red mulberry.

### Cultivars and Germplasm

Hybrids of red and white mulberry such as 'Illinois Everbearing' and 'Collier' have been promoted for cultivation because they produce large, flavourful and nearly seedless berries and are hardy and vigorous. These cultivars may be invasive, escaping to natural habitats and displacing the native red mulberry.

Red mulberry receives a degree of *in situ* protection in Rondeau Provincial Park, Point Pelee National Park, and in some conservation areas. The Ontario populations are at the northern range limit and are presumably adapted to Canadian pests and pathogens. It is fortunate that protection efforts have reached the stage of active recovery action, but a comprehensive plan to protect native germplasm *ex situ* remains to be developed. Given the rather pessimistic forecast for *in situ* protection, an *ex situ* plan is particularly important.

### Prospects

The potential economic value of native red mulberry has been largely overlooked. It is another example of the neglect of promising native species, while looking to familiar Old World plants as starting material for the development of North American agriculture. This relates to the old pioneer notion that North America was a hostile wilderness where successful agriculture could only be ensured by transplanting European crops. However, red mulberry has desirable agricultural characteristics. It is generally resistant to pests and grows rapidly. Some of the limitations to address in developing it as a crop include the fact that the berries fall and become soft soon after ripening and they also produce a relatively persistent stain. Although mulberries do not ship well when fresh, freezing and drying could extend their use. In some regions of Afghanistan, dried mulberries, frequently mixed with ground almonds, are a dietary staple.

Red mulberry not only has potential as a food crop but also as a source of medicine and possibly silk. The failures to develop a silk industry in North America in the past resulted from inability to compete with Asian production. With appropriate technological innovations, it may well be possible to develop a silk industry in North America based on red mulberry. Protection of the endangered native wild germplasm is important for potential crop development in Canada.

### Myths, Legends, Tales, Folklore, and Interesting Facts

- According to Greek legend, the berries of white mulberry turned red when its roots were bathed in the blood of two lovers. There are a number of variations of the story, but essentially Thisbe and Pyramus of Babylon were deeply in love but forbidden to see each other. They were limited to expressing their love, as best they could, through a chink in the wall that separated their homes. They arranged to meet under a white mulberry tree at the tomb of Ninus, outside of the city gate. Thisbe arrived early, but was frightened by a lion and fled, dropping her veil. The lion, jaws dripping blood from a recent kill, sniffed the veil, smearing it with blood. Pyramus arrived and was horrified

and filled with despair at the sight of the bloody veil. Thinking his lady-love had been devoured, he slew himself. Soon after, Thisbe, returned, and equally distraught on viewing the scene, stabbed herself. The blood of the lovers stained the white fruit of the mulberry tree red. Pyramus and Thisbe are the classic forerunners of Shakespeare's *Romeo and Juliet*.

- Numerous streets are named "Mulberry Street," especially in areas where early settlers tried their hand at rearing silkworms. Since mulberry plants can live for over 200 years, these same streets may still have several mulberry trees growing vigorously.
- According to Chinese legend, in 2640 BC Lady Xi Ling Shi, 14 year old bride of Chinese Emperor Huang Tsi, was sitting under a mulberry tree when suddenly a cocoon of a silkmoth dropped into her tea. The fibres unravelled and she used them to create a yarn for weaving, starting an industry that China has dominated ever since.
- Silk from the Mulberry Silk Moth is stronger than cotton or wool and is even stronger than steel of the same thickness. In fact silk is the strongest of all natural fibers. It is also highly elastic and will return to its original shape after stretching. Silk garments are very light in weight, and are warmer than cotton, linen, or rayon clothing. Dyed silk cloth is richer in appearance than most other dyed fabrics.
- Mulberry paved the way for one of the longest overland trading routes in the world. Silk, from the moth that fed only on mulberries from China, was a major item traded with Europe for many centuries. Extending for several thousand miles, The "Silk Road" linking China to Damascus was longer than Canada is wide. It was also an important route for the exchanges of knowledge, ideas and philosophy. (For more information on the Silk Road see <http://www.humboldt.edu/~geo309i/ideas/raysilk.html>)
- King James I (1566–1625) made considerable efforts to establish a silk industry in Britain: in 1606 a million mulberry trees were imported to England; in 1609, he ordered that 162 ha of mulberries be planted in St. James Park in London. All of this work came to nothing. Attempts to raise silk in the New World were even more disastrous. The king tried to compel the London Company to raise silk in Virginia, which in 1623 imposed a fine of 4.5 kg of tobacco on every planter who did not cultivate at least 10 mulberry trees for every 40 ha of estate, and presented a reward of 50 times as much tobacco as the weight in silk. Similar attempts were made in Carolina and Georgia after they were founded. As colorfully described by one Georgia historian (cited in Bailey, L.H. 1898. The evolution of our native fruits, Macmillan) the trustees of Georgia had three goals: "to provide an asylum for the poor debtor and persecuted Protestant; to erect a silk, wine and drug-growing colony; and to relieve the mother country of an overburdened population." For several years the New World produced hundreds of kilograms of silk annually, and in 1735 over 4,500 kg were exported from Georgia. Silkworm production waxed and waned, but in 1826 an astonishing resurrection of interest occurred, following a Congressional report which recommended the preparation of a practical manual on the industry. The manual was

produced in 1829, and resulted in a contagious desire to produce silk. This was heightened with the introduction of the *multicaulis* variant of the white mulberry (*M. alba* var. *multicaulis* (Perrott.) Loud., sometimes called the Philippine mulberry), thought to be the source of the best Chinese silk. Multicaulis mulberries reached America about 1826, and over the next 10 years were marketed with incredible success. But the industry quickly collapsed, with the loss of fortunes, and the end of commercial silkworm culture in North America. Before the American mulberry industry collapsed, enough silk was manufactured to weave the coronation robe of English King Charles II (1630–1685), worn in 1660.

#### Sources of Additional Information

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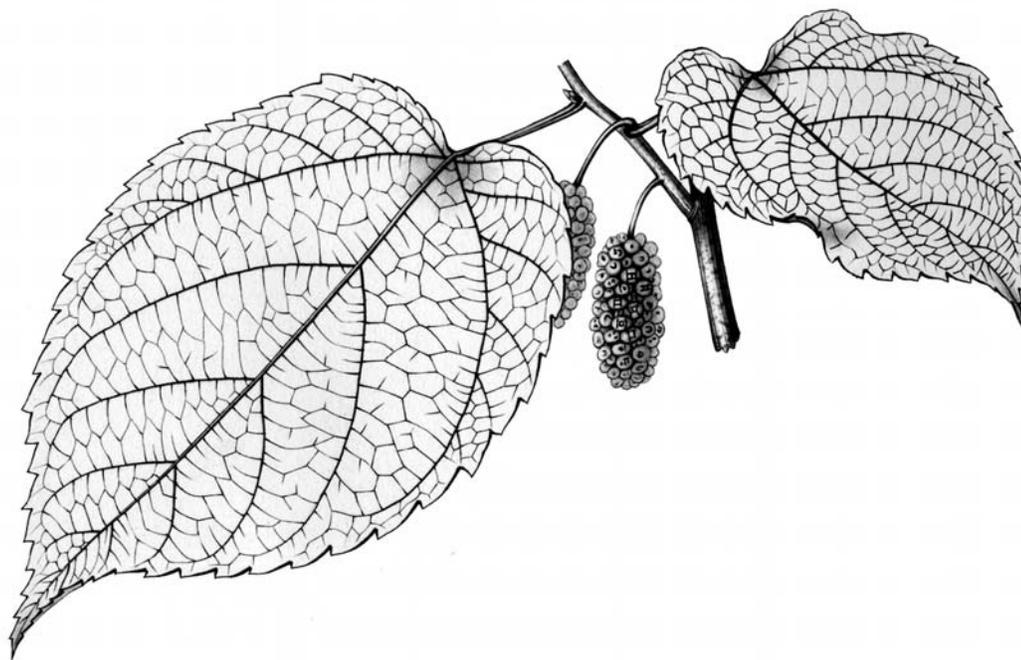
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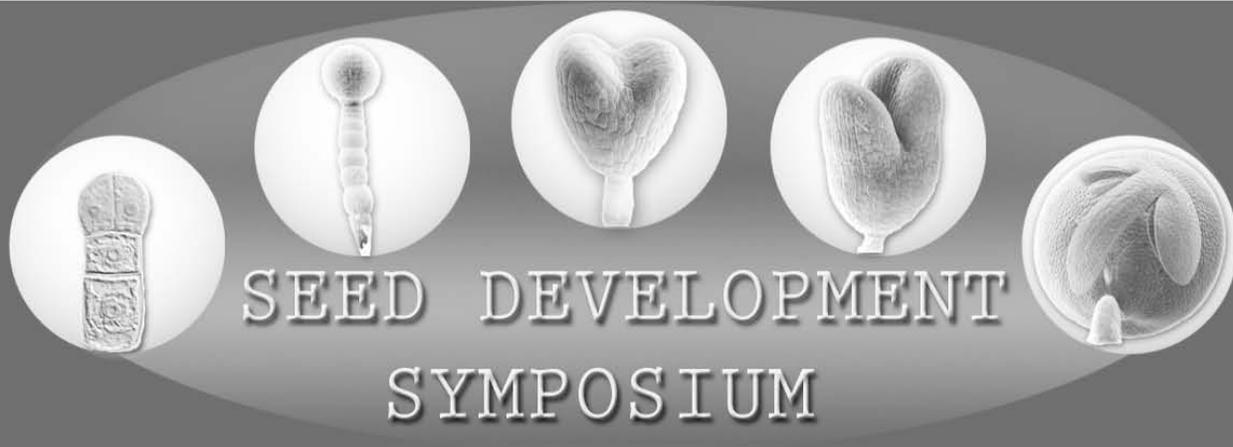
#### Acknowledgments

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#### Erratum

In the article on Chive by Small and Catling in the previous issue (CBA/ABC Bulletin 37(4): 64-67.), the information concerning the origin of Figures 1 and 3 should be interchanged.



**University of Saskatchewan, Saskatoon  
Biology Department, Biology Room 106  
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***The symposium will focus on molecular mechanisms which underlie seed development and will feature the following speakers:***

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Cell fate decisions in the early *Arabidopsis* embryo

**Dr. John Harada, University of California, Davis**  
Dissection of embryo and seed development in higher plants

**Dr. Robert Fischer, University of California, Berkeley**  
Regulation of gene imprinting in *Arabidopsis*

**Dr. David W. Meinke, Oklahoma State University**  
Indispensable genes required for seed development in *Arabidopsis*

**Dr. Raju Datla, National Research Council Canada**  
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