OREGON FLORA *Newsletter*

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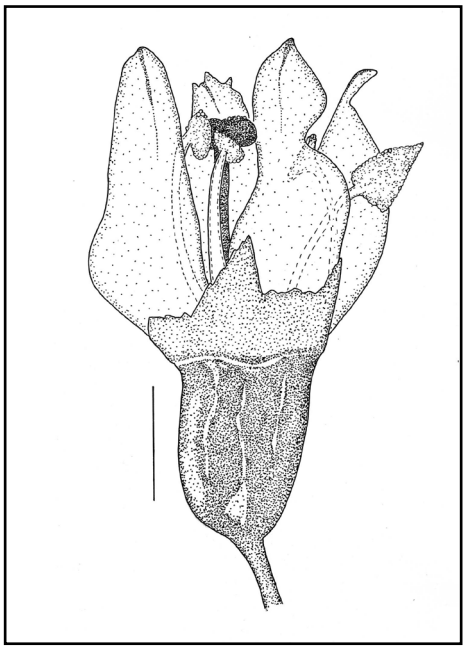
A dogwood ancestor from the Age of Dinosaurs

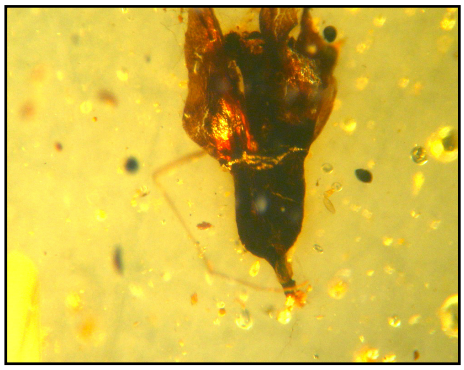
by Kenton L. Chambers

This article is a change of pace from our usual discussions of modern-day Oregon flora. Instead, it offers a rather mind-bending journey into the ancient past of a familiar group of plants, the dogwoods (Cornaceae). I am fortunate to have been involved in studying and describing a fossil flower, embedded in Burmese amber from the Early Cretaceous Period (Poinar *et al.* 2007). Amber, which is fossilized resin secreted by trees such as pines, araucarias, and arborescent tropical legumes, is well known to contain the remains of organisms of various kinds. The fresh resin acts as a trap for insects, spiders, flowers, seeds, leaves, bits of wood, pollen, and even larger animals like frogs and lizards. Gradually, through the passage of time, the resin hardens to become amber, still containing the perfectly preserved fossil organisms. There is an interesting book by OSU professor George Poinar and his wife Roberta, telling how they reconstructed the life of a long-ago tropical Caribbean forest, based on fossils discovered in amber millions of years old (Poinar & Poinar 1999). Amber is resistant to decay and has lasted far longer than the forests that produced it. Since the days of Rome and before, it has been sought after and mined as a semiprecious stone, to be used for jewelry and other decorative objects.

Because the amber containing our flower has been dated as Upper Albian, ca. 100 to 105 million years before present (mybp), the fossil is a true relic from the Late Mesozoic, the "Age of Dinosaurs." Its most prominent feature, as shown in the photograph and drawing, is its inferior ovary. Because the placement of sepals and petals in such flowers is termed "epigynous," we have named the plant *Eoëpigynia burmensis*, meaning "early epigynous (flower) from Burma." In the scheme of angiosperm classification, an inferior ovary is often associated with evolutionarily advanced families like the Apiaceae (carrot family), Caprifoliaceae (honeysuckle family), Rubiaceae (coffee family), Valerianaceae (valerian family), Orchidaceae (orchid family), and that largest one of all, Asteraceae (sunflower family). However, the feature is known to have evolved independently many times, even in less advanced families such as Nymphaeaceae (water-lily family), Aristolochiaceae (wild ginger family),

See Dogwood ancestor, *page 8*





Eoëpigynia burmensis *drawing and photograph. The anther at the right is covered by a triangular mass of pollen held together by fungal mycelium. Scale bar = 0.34 mm.*

Dogwood ancestor, *continued from front page*

Portulacaceae (portulaca family), Rosaceae (rose family), and Saxifragaceae (saxifrage family). In one recent analysis of angiosperm floral evolution, it was estimated that the change from superior to inferior ovary had occurred at least 64 separate times. Nonetheless, our fossil does document a very early date for at least one example of this morphological floral advancement.

Careful examination of *Eoëpigynia* reveals that it has four similar petals, four equal stamens, a single style with a bilobed stigma, and a short, irregularly fused calyx. The wall of the ovary is thickish and wrinkled, suggesting that it may have formed a berry-like fruit. In our discussion, we tentatively placed the fossil in family Cornaceae (dogwoods), because this floral pattern is so common in modern species of that group. We even found pollen grains resting on the stigma and anthers, which under microscopic study showed three germination pores and paired wall thickenings similar, in general terms, to pollen of modern Cornaceae.

Evolutionary botanists are making great strides towards building a phylogenetic chart for all angiosperms, with DNA sequence comparisons of nuclear and chloroplast genes providing the strongest evidence of relationships (APG I. 1998). As more and more data for hundreds of genera are brought forward, the evolutionary connections of angiosperm families are being extended back in time with increasing confidence. The major group to which Cornaceae belong, informally termed the Euasterids, includes orders Ericales (heaths, phloxes, primroses, etc.), Apiales (umbels, etc.), Dipsacales (honeysuckles, etc.), Asterales (sunflowers, etc.), Gentianales (gentians, dogbanes, milkweeds, etc.), Solanales (nightshades, morning-glories, etc.), and Lamiales (mints, scrophs, plantains, verbenas, broomrapes, etc.). The **pattern** of relationship and divergence of this large group of dicotyledon families is revealed by their DNA, but the **dating** of this pattern depends on two further analytical steps—molecular clock and reference fossils.

Molecular clock refers to estimates of age based on the rate at which genes mutate and evolve. Because these rates vary from one gene to another and may themselves change over time, such estimates always contain an error factor—a spread of confidence limits, in other words. Sophisticated computer programs have been developed to calibrate the molecular clock, according to DNA differences between the families and genera whose genes have been sequenced. From this, dates (in mybp) are estimated for the branching points in the phylogenetic tree of genetic relationship. Reference fossils are fossils of known age that can be placed on one or another of the proposed evolutionary lines—*i.e.* those which are believed to be ancestors of the modern families.

If we are correct that *Eoëpigynia* is ancestral to modern Cornaceae, it will be a significant reference fossil for future molecular clock studies. A review of Euasterid phylogeny by Bremer *et al.* (2004), using six other reference fossils, has estimated the age of the Cornales family cluster (the so-called "crown age") to be ca. 112 mybp. Cornales have a basal position in Euasterid phylogeny, but many of the related orders (mentioned above) also diverged at nearly this same time. That is, the estimated DNA phylogeny for the Euasterids shows rapid branching and diversification in the final 10-20 million years of the Early Cretaceous Period, prior to 100 mybp.

In these studies of fossils and phylogenies, there necessarily are many "ifs" and "maybes." The classification of fossils may be uncertain, and the techniques for estimating molecular clocks need to be further developed. Nonetheless, paleontology still relies on the discovery and description of fossils to calibrate DNA phylogenies, and in this respect, *Eoëpigynia* is a worthwhile contribution to knowledge of angiosperm evolutionary history.

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Erythronium oregonum logo and masthead designed by Tanya Harvey.

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The serviceberries: "much perplexity"

by Rhoda Love

Because we are all able to recognize our beautiful spring-blooming rosaceous shrub *Amelanchier alnifolia*, the serviceberry, the reader may wonder at the use of the word "perplexity" in my title. However, here are the 1946 words of Merritt Lyndon Fernald, then Director of The Gray Herbarium at Harvard: "No genus in North America, except of course *Rubus* and *Crataegus*, has offered so much [taxonomic] perplexity and has such contradictory treatment as *Amelanchier*."

Before we dig deeper into the *Amelanchier* problem, I might mention that there is a plethora of common names for these handsome shrubs. In various parts of the U.S. they are known as shadbush, serviceberry, juneberry, Saskatoon, shadblow, shadwood, sugarplum, and wildplum. The word "serviceberry" is said to be a corruption of "sorbus berry"; "Saskatoon" comes from a Cree Indian word "misaskwatomin"; and "shadbush" arose because the serviceberry often blooms at the time of the shadfish runs in U.S. rivers. (Incidentally, there are also *Amelanchier* species in Europe, East Asia, and North Africa as well as North America.)

M. L. Fernald used the word "perplexity" to describe the state of *Amelanchier* taxonomy sixty years ago. I cannot speak with authority about eastern species, but here in the West, Abrams (1944) recognized seven species for the Pacific states; Peck (1961) recognized four species for Oregon; and Hitchcock (1961) recognized two species for the Pacific Northwest, with five varieties of *Amelanchier alnifolia*. Among just these three authors, the list of names is long: *Amelanchier glabra*, *A. cusickii*, *A. covillei*, *A. florida*, *A. gracilis*, *A. utahensis*, *A. pallida*, *A. florida* var. *florida*, *A. florida* var. *gracilis*, *A. florida* var. *cusickii*, *A. alnifolia* var. *pumila*, *A. alnifolia* var. *humptulipensis*, *A. alnifolia* var. *alnifolia*, *A. alnifolia* var. *semiintegrifolia*, and *A. alnifolia* var. *cusickii*. Happily, all three authors are in agreement that *Amelanchier utahensis* is a good species that differs significantly from other western serviceberries.

The confusing tangle of serviceberry names must now be dealt with because new floras are presently being written. *Flora of North America* (FNA) is appearing at the rate of two volumes per year, and the Rose Family volume is in the planning stages now. Closer to home, the Oregon Flora Project is about to publish online its Checklist of accepted names for all Oregon taxa, and I have been asked to prepare the treatment for the serviceberries. Since I am far from an expert on the genus, I have turned for help to the authors of the draft FNA treatment of the genus, Chris Campbell, Alison Dibble, C. T. Frye, and Michael Burgess. Campbell *et al.* recognize approximately 20 species of serviceberry in North America north of Mexico. These workers make it clear in their January 2007 draft, that polyploidy, hybridization, and apomixis all play a part in the confusing overlap of characteristics in the genus. (In simplest terms, apomixis results in egg cells that are formed by a failure of meiosis and therefore have the somatic, not the gametic, number of chromosomes. Seeds formed asexually by apomixis grow into adult plants that are genetically identical to the parent.) Serviceberry species are known to hybridize when species come together, and these hybrids may reproduce via apomixis. If hybrids repeatedly reproduce in this way, the swarm of resulting offspring may be mistaken for a distinct species unless genetic analysis is undertaken.

Pacific serviceberry, Amelanchier alnifolia *var.* semiintegrifolia*, from a meadow near Bigelow Lakes, Josephine County. Photographed June 1994 by Glenn and Barbara Halliday.*

The above sequence of events has been demonstrated in *Amelanchier* in the eastern United States via DNA studies carried out by Campbell *et al.*; however our western species have not yet been studied at the molecular level. How then am I to decide which taxa of serviceberries to recognize for Oregon? Chris Campbell and his co-authors of the draft FNA treatment agree with the Jepson Manual and our earlier authors that *Amelanchier utahensis* is a good species and represents the low-growing, hairy-leaved, small-flowered serviceberry found occasionally in drier parts of southern and eastern Oregon.

This leaves the more typical serviceberries with which we are familiar in the Willamette Valley, the Cascades, the Columbia Gorge, the Blue Mountains, southwestern Oregon, and widely scattered in mesic locations in many eastern Oregon counties. One solution might be to call all these *Amelanchier alnifolia*. But after some correspondence with Chris Campbell, I have decided to follow part of the Hitchcock treatment and recognize three varieties of *Amelanchier alnifolia*: var. *alnifolia* from the east Cascades foothills to the Great Plains; var. *pumila*, relatively rare in Oregon but reported from several southern counties; and var. *semiintegrifolia*, the

See Serviceberries*, bottom of page 10*

Hooray for our OFP Volunteers!

by Linda Hardison

The Oregon Flora Project could not exist without the help of many hard-working volunteers. We rely on individuals of all backgrounds and skills to share their expertise, and we are immensely grateful for their contributions. This article salutes one such hard-working volunteer, Charlene Simpson of Eugene. She has devoted significant time through the years in helping the OFP complete its Vascular Plant Checklist, which will be made public in early 2008. Charlene's work for us has been a natural extension of her long-time interests. In 1993 she and other Emerald Chapter Native Plant Society of Oregon members envisioned a plant checklist for Lane County. Charlene convened a nine-member Lane County Checklist Group, and has overseen the development of their work into a published list. Early in the project, she found a willing collaborator in Scott Sundberg, then Director of the OFP. The Lane County Checklist Group published their annotated list in 2002. [To purchase a copy of the Checklist, see Editor's Note.]

The Oregon Flora Project's creation of a synonymized statewide Checklist for the vascular plants of Oregon is, as it was for the Lane County Checklist Group, an undertaking that has demanded accuracy and a broad focus. Adding to the challenge is the fact that the field of plant taxonomy is dynamic; new research can result in realignment of a plant's relationship to others in a species, genus, or even family, coupled with subsequent changes to its scientific name. The goal of the Oregon Vascular Plant Checklist is to provide names and synonyms for Oregon's vascular plants that take into account the most recent taxonomic research.

One key reference whose taxonomy we track is the *Flora of North America North of Mexico* (1993+, Oxford University Press, New York and Oxford). Work on this 30-volume set has been under way in its current form since 1993, with volumes appearing as work is completed. Charlene has taken on the significant task of comparing the currently accepted Oregon Flora Checklist names and synonyms with those in *Flora of North America* (FNA). This entails reviewing every volume and thousands of pages of text! Her primary effort has been to record how FNA treats each plant they cite as occurring in Oregon. She takes note of whether the FNA accepted name is the same as the Oregon Flora Project's accepted name, or if they consider it a synonym. She also compares spelling, authorities, and common names. Of particular interest to OFP are those taxa that FNA reports from Oregon for which we have no record of occurrence. Charlene notes all such inconsistencies in our Microsoft Access database.

How does a volunteer manage a task of this magnitude? Oregon Flora Project database manager Katie Mitchell designed an input form to receive the information gathered by Charlene. Charlene's home computer is equipped with the Access software and the Checklist database, and new data are transferred via CDs or email. She notes that an essential component of her work is the table of OFP acronyms. These taxon-specific codes are necessary for tracking plant names through all the OFP files. Since 2003, Charlene has reviewed 12 published volumes of FNA. Five volumes covering the Asteraceae (sunflower family) and the Poaceae (grass family) have been published in the past two years, and, as we know, these families have significant representation in Oregon. Charlene's timely review of these volumes has more than kept pace with the approaching completion of our Oregon Checklist.

Charlene's OFP research is in addition to her part-time employment at the University of Oregon Office of Student Financial Aid and Scholarships. She reports that she loves the Flora Project volunteer work because she learns so much. She has not only deepened her knowledge of the plants of Oregon, but also has gained an insider's knowledge about the Oregon Flora Project's process in developing our soon-to-be-published, large-scale, synonymized checklist.

Editor's Note: To order a copy of *Vascular Plants of Lane County Oregon* by Simpson *et al.* send $15 per copy to Lane Checklist, Emerald Chapter NPSO, PO Box 902, Eugene, OR 97440-0902.

Photo by Rhoda Love

Charlene at the 2004 Glide Wildflower Show.

Serviceberries, *continued from page 9*

well-known form found west of the Cascades.

Dr. Campbell has made the argument to me that Hitchcock's variety *A. alnifolia* var. *cusickii*, with the largest flowers of all our Oregon serviceberries, should be recognized as a separate species *A. cusickii* because according to his research, it has a different blooming time than varieties of *A. alnifolia* and thus does not exchange genes with that species. However, the overlap of key morphological traits between *A. cusickii* and *A. alnifolia* probably means that, for certain plants in eastern Oregon, it will be arbitrary which species name one chooses to use. For now, until molecular work can be done on our Oregon serviceberries, we will recognize three species in our state. These are *Amelanchier utahensis*, *A. cusickii*, and *A. alnifolia*, with three varieties of the latter: var. *alnifolia*, var. *pumila*, and var. *semiintegrifolia*. Some perplexity certainly remains, and *A. cusickii* probably needs closer study, but hopefully Campbell and his co-workers may one day be able to extend their work to the Northwest, and spend some time amid our handsome Oregon serviceberries.

Author's note: *I thank Kenton Chambers for reading earlier drafts of this article and offering very helpful suggestions.*

Project News: Legislative Support for OFP?

The state of Oregon's tax revenues for the 2005-2007 biennium exceeded its budget projections, meaning that taxpayers will receive a refund under the state's "kicker" law. Flora Project supporters might view this as an opportunity for individuals to determine exactly where their tax dollars are spent. If you receive a refund from the state this December, please consider donating this money to the Oregon Flora Project. OFP staff will keep track of these donations and report to our legislators the number of Oregonians who wish to see state support for creating a state flora—and we will urge them to appropriate funds for this much-needed resource. Your personal letters to legislators on this topic would be very helpful as well.

Our website, *www.oregonflora.org*, has been redesigned, and hopefully many of you have logged on and noticed the changes. Student employee Kit Hoffman has done an excellent job of making the pages more attractive and easy to navigate. We will continue to add features, such as search capabilities for all newsletters, as well as more data, most notably images from the Photo Gallery, as our resources allow.

Input from botanists throughout the region is key to the development of the resources of the Oregon Flora Project. This has been evident as we prepare the Checklist for review by our eighteen Checklist committee members. Thea Cook, one of our database managers, has expertly incorporated the contributions of the many Checklist manuscript authors, researching and resolving the many issues that required clarification. Our reviewers will soon receive the draft Checklist, and once their comments are incorporated this important component of the Flora Project will be available to the public early next year.

In late August, an article about the Oregon Flora Project was published in several Oregon newspapers. Our thanks to Eugene *Register-Guard* reporter Andrea Damewood for her story that informed a wide audience of the work we are doing!

Would you prefer to receive this newsletter electronically?

Beginning with the next issue (October 2007) of the *Oregon Flora Newsletter*, we will offer readers the option of receiving an email notification with a link to the latest OFN issue on our website. This gives you instant access to our publication—with color photographs—as a pdf file. Should you choose to subscribe to our newsletter exclusively online, it will keep more paper out of your mailbox, as well as reduce our printing and mailing expenses.

For those whose email address we have on file will receive a message by September 30th. Simply reply if you would like us to **stop** sending you a paper copy of the *Newsletter* and instead receive only an email notice of each new issue. If you do not hear from us by this date, send us a message at *ofpflora@oregonflora.org* with "Newsletter" in the subject line. To continue receiving a paper copy, no action is necessary

You can view all issues, past and present, of the Oregon Flora Newsletter at our website, *www.oregonflora.org/newsletter.php*

Thanks

We thank the following for their generous financial support of the Oregon Flora Project:

(names deleted for internet privacy)

Gifts were given in memory of Mary Carlson and of Bonnie Hall.

How can I contribute?

Donations to the Oregon Flora Project are a critical part of our operating budget. Your contributions help pay the salaries of our staff and students, as well as all newsletter expenses.

There are two ways to donate to the Oregon Flora Project:

(1) With a check payable to the Oregon State University Foundation, ATTN: Oregon Flora Project.

(2) Through the Friends of the Oregon Flora Project, with a check payable to the Native Plant Society of Oregon, ATTN: OFP.

Mail your check to:
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With your contribution, please let us know if you do *not* wish your name listed in our "Thanks" column, and if you would like to be added to our *Oregon Flora Newsletter* mailing list.

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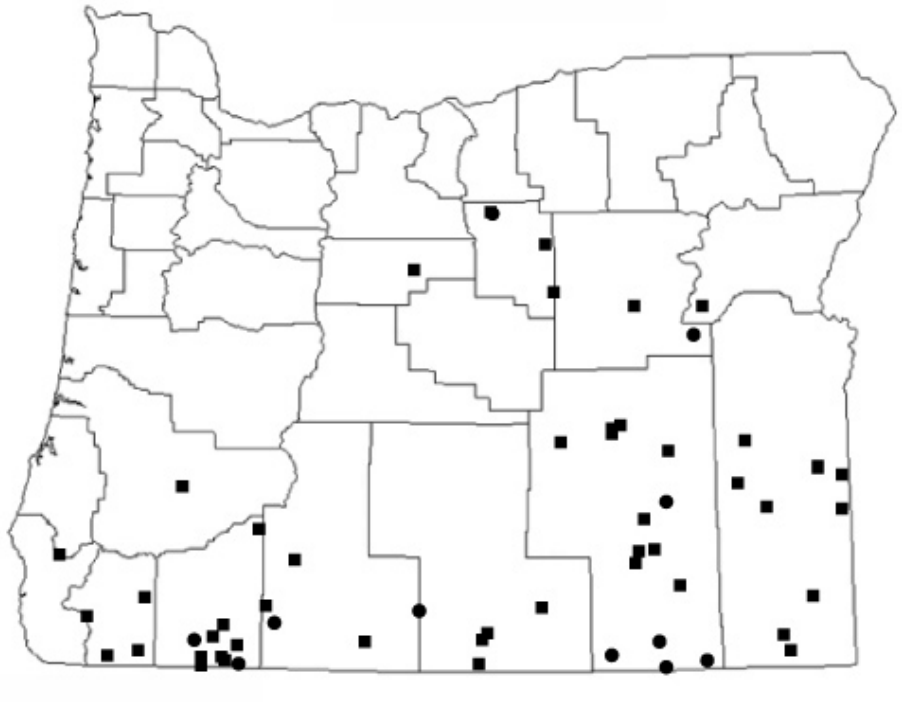
TIME DATED MAIL

Did you know?

• Campbell, Dibble, Frye, and Burgess, in their 2007 draft treatment of *Amelanchier* for *Flora of North America*, recognize approximately 20 species of serviceberry for our continent north of Mexico. The earlier accepted treatment by G. N. Jones (1946) recognized 18 species; while Hitchcock *et al.* in *Vascular Plants of the Pacific Northwest* (1961) suggested the number was closer to 12.

• Hitchcock stated that the genus *Amelanchier* ". . .is well known for the degree of intergradation between taxa." Campbell addresses a similar problem for the taxonomist, writing, " . . . many species have not diverged much from one another genetically…"

• Utah serviceberry, *Amelanchier utahensis* (see map), has long been considered genetically distinct from other North American serviceberries. Campbell et al. state that no hybrids between *A. utahensis* and other species are known. Nonetheless, *A. utahensis* is so variable throughout its range in the mountains and deserts of the western U.S. that taxonomists have described and redescribed it under more than two dozen specific and varietal names (Jones 1946).



Known distribution of Utah serviceberry, *Amelanchier utahensis*, in Oregon. The plants are described as low shrubs with tomentose young branches, and leaves that are permanently hairy. The fruit is frequently pubescent, and the flower petals are usually less than 10 mm. in length. Oregon plant distribution maps and collection data can be studied at *www.oregonflora.org*