New England Botanical Club – Minutes of the 1026th Meeting
6 April 2007

Patricia Swain, Recording Secretary *pro tempore*

The 799th meeting of the New England Botanical Club, being the 1026th since its original organization, was held on Friday, April 6, 2007, in the lecture hall of the Fairchild Biochemistry Building at Harvard University, Divinity Avenue, Cambridge, MA. There were 54 members and guests in attendance. President Karen Searcy opened the meeting and announced two new/returning members and welcomed guests. Elizabeth Kneiper invited members and guests to a Farlow Walk co-sponsored by the Friends of the Assabet. George Newman will head a committee planning a field trip to the New Jersey Pine Barrens, probably in 2008.

Vice President Kanchi Gandhi then introduced the year's Distinguished Speaker, Dr. George W. Argus, who spoke on "Why is the taxonomy of *Salix* so difficult?" Professor Argus is Curator Emeritus, Canadian Museum of Nature, Ottawa, Canada. He received a B.S. (1952) in Geology and Biology from the University of Alaska, an M.S. (1957) in Botany from the University of Wyoming, and a Ph.D. (1961) in Biology from Harvard University. He taught at the University of Saskatchewan and then was curator and research scientist at the Canadian Museum of Nature until his retirement in 1995. He has contributed treatments of *Salix* to many floras, including *The Flora of North America North of Mexico*. He has a long-standing interest in the taxonomy of *Salix* and in the use of computerized interactive identification. This was not Dr. Argus' first talk to the club; he spoke to the November 4, 1960, meeting about his dissertation work at Harvard - about *Salix*. At that meeting he was ahead of his time, suggesting that opening the Club to women would be a good way to bolster membership. He was glad to note that the suggestion had been taken - years later.

From the time of Linnaeus (1753) willows have been considered a difficult group taxonomically. While not solving the taxonomic difficulties of the group, George Argus' talk went a long way toward clarifying the ecology, life history, and sources of variation that contribute to its reputation. Ecologically, willows tend to occupy moist, early successional habitats. These include the familiar riparian and wet marshes, as well as moist inter-dune depressions, such as those found in the Athabasca sand dunes, which support 5 endemic willows, and other recently deglaciated areas. In alpine tundra, soil creep, avalanches, and animal disturbances, allow the establishment of *Salix* species. Outside of disturbed areas, willows rarely reproduce from seed, and as succession progresses willows become increasingly uncommon. As a result, willows are typically short-lived. For example, while 30-year old individuals of *S. interior* have been found, average age is closer to 12 years. *S. alaxensis* declines quickly after reaching 9 years. The oldest reported age is for *Salix arctica* (236 years).

Willows reproduce both sexually and asexually. Because they are dioecious, hence obligate outcrossers, sexual reproduction can lead to greater variability than found in species that are able to self-pollinate. Vegetative reproduction can take place by sprouting from the base, shoot fragmentation, layering, rhizomes, and root shoots. Sometimes large clonal mats are produced in this group of pioneer species. Pollination is both by insect pollinators and by the wind. Argus pointed out that airborne pollen makes cross-breeding experiments very difficult and care must be taken to ensure that airborne pollen does not contaminate artificially made crosses. Sexual reproduction can begin very early, as early as 1 to 2 years in cultivation. A single plant might produce thousands of seeds each year but seed production is quite variable among species. Seeds are dispersed by wind, water, and theoretically, even by animals, but relatively few seeds arrive at a site suitable for germination and survival.

A major source of difficulty in understanding willows is their intraspecific variability. Other sources of variation, particularly in appearance, are due to environmental influences. For example, species vary phenotypically in response to moisture, nutrients, shade, and wind. Shade plants of *Salix* typically show thinner leaves lacking hairs or glaucescence. Perhaps more important, willows also show a great deal of developmental or seasonal variability. For example, there are developmental differences among juvenile, proximal, early and late (or apex) leaves. Stipules are more common and well developed in late leaves. In some willow plants, the leaf margins have more prominent teeth often resembling stipule-like outgrowths. In addition, flowering branchlets, stipes, and ovaries usually elongate in age. An additional complication is that secondary shoots can develop from buds of the year, which have not gone through dormancy. This is called syllepsis. As a result, characters that may be useful in identification may not be present at all stages of development.

Another source of variation in willows is hybridization. However, Argus indicated that hybridization in this group may be overestimated and suggested actually making crosses between putative parents to test hybridization hypotheses. Many taxonomic manuals have included large numbers of putative hybrids, including 52 in the *Flora of North America*, a section to which Dr. Argus contributed and edited. Sixteen of those are common, 26 confirmed, and six rare. Chromosome numbers also suggest past hybridization in willows. Counts have been done on 69% of 107 *Salix* species in North America. Of the 73 counted, about 60% were diploid, and about 40% polyploid, including *S. arctica* which is a hexaploid. The polyploids are assumed, but not proven, to be alloploids and, if so, are the result of hybridization.

In addition to individual variation within a population, geographic variation can be marked. The taxonomic treatment of this variation is handled differently in different floras, and Argus gave a number of examples in which variation was given infraspecific rank and others in which it was treated as distinct species.

Finally Argus asked, what are the solutions to understanding the variation in willows? He pointed out that it is important to appreciate the ways in which willows can vary and allow for that when circumscribing a species. A major recommendation is to tag plants and to collect specimens during the growing season so that developmental variation can be understood. The collection of population samples can help understand intrapopulation variation. A useful exercise is to attempt to put a name on every plant in a population. He also cautioned that, because of the high variability in *Salix*, dichotomous keys can only be expected to work for a small number of specimens. The use of interactive keys is a more effective identification tool, such as one he has made available for free at http://aknhp.uaa.alaska.edu/willow/. As Dr. Argus summarized, one should maintain a skeptical attitude toward willow identifications and assiduously apply the multiple working hypothesis to taxonomic problems.