New England Botanical Club – Minutes of the 948th Meeting

7 May 1999 Prepared by Dr. Paul Somers, Recording Secretary

The 721st meeting of the New England Botanical Club, being the 948th since its original organization, met on Friday, May 7, 1999, in the main lecture hall at Harvard University's Biological Laboratories with an unrecorded number of members and guests present.

President Dave Conant chaired the meeting. Business included announcement of the two graduate student awards being granted by the Club, each for $1000. The awards were made to **Joel Gerwein**, University of Massachusetts at Boston, for a proposal entitled "Long-term effects of forest fragmentation on genetic diversity of red oak (*Quercus rubra* L.): A comparison of old growth and secondary forests," and **Julie Ellis** of Brown University for her proposal entitled, "The role of nesting seabirds in structuring New England coastal plant communities." Nine new members were introduced to the Club. Among a number of announcements that followed was the sad news that New England botanist, Cyrus McQueen of Johnson State College, had recently passed away. The evening's speaker was then introduced by Vice President, Lisa Standley.

Peter J. Walker addressed the Club on the topic "Biogeography and speciation in *Ammophila*," his Master's thesis research at the University of Vermont, which was supported in part by one of the Club's past graduate student awards. An impetus for the study was to determine whether or not the Lake Champlain populations of beachgrass known as *Ammophila champlainensis* Seymour, are distinct from populations of the much more widespread, but mainly coastal, American beachgrass, *Ammophila breviligulata* Fernald. A second objective of the research was to determine the origin of the four small populations at Lake Champlain. His approach was to examine genetic, morphological and phenological characteristics of 18 selected populations across the range of North American *Ammophila* and interpret this in light of known biogeographic history since the Pleistocene glaciation.

The genetic component of the research involved a study of DNA sequence variation in the internal transcribed spacer region of nuclear ribosomal DNA (ITS), a chromosomal region commonly employed in systematics. From the 18 North American populations, Walker sampled 48 individuals. As an outgroup for comparison, he used a few samples of *Ammophila arenaria* (L.) Link, the most closely related species, from a site in Scotland. The DNA sequencing revealed 18 unique ITS variants, i.e., any that differed from all others by at least one nucleotide base pair. Parsimony analysis of these 18 variants, containing a total of 46 parsimony informative nucleotides, was conducted and then further examined using bootstrap analysis to assess confidence levels of the inferred genetic tree. The North American populations separated into four distinct lineages or clades: 1) the Champlain Valley/St. Lawrence, 2) Great Lakes, 3) North Atlantic Coast, and 4) South Atlantic Coast. To assess the confidence levels for each branch of the inferred gene tree, Walker and colleagues performed bootstrap analysis with 500 branch and bound replicates. They also conducted a maximum likelihood analysis examining different arrangements of the clades. Another estimate of the genetic diversity within lineages was achieved by calculating statistics on the average number of nucleotide substitutions between two ITS variants and compiling them by geographic region.

Conclusions from the genetic analyses were that the four clades are well supported, and that the Lake Champlain Valley and Great Lakes clades are closely aligned and can be treated as one "Inland" clade. Unfortunately, however, the bottom of the tree separating the North Atlantic and South Atlantic clades was not fully resolved (supported by only 54% of the bootstrap replicates), and thus firm conclusions about the relationships among clades could not be made. Nucleotide diversity was highest, though, within the North Atlantic clade, thus supporting the hypothesis that a Pleistocene refugium for beachgrass may have existed in this region and that the other clades were derived from it following the retreat of the Laurentide ice sheet. In support of this hypothesis, Walker reminded us that there was much exposed land in the North Atlantic at the last glacial maximum. With sea-levels 120 meters lower during the Wisconsin glaciation, the Georges Bank would have been exposed providing considerable habitat for *Ammophila* in the vicinity of present day Newfoundland, Sable Island, and elsewhere. Another important finding of the study was the existence of substantial variation below the species level in the ITS region, in contrast to most instances where concerted evolution is thought to act on nucleotide substitutions by homogenizing rDNA within species. An explanation suggested for this is the prevalence of vegetative reproduction in *Ammophila*, which would maintain somatic mutations.

How unique are the Lake Champlain populations? Genetically Walker detected two nucleotide substitutions in the Champlain populations, but this he stated was no more significant that the two observed separating New Jersey and Delaware plants. Results from morphological and phenological comparisons of the four clades showed that Lake Champlain plants possess significantly shorter glumes and flower significantly earlier than *Ammophila* plants from the other geographic regions. So what did Peter Walker decide about the taxonomic status of the Lake Champlain populations? He compromised, recommending subspecies status and conservation of a taxon that has helped reveal the history of Lake Champlain.