

New England Botanical Club – Minutes of the 1038th Meeting November 7th, 2008

Karen Searcy, Recording Secretary *pro tempore*

The 812th meeting of the New England Botanical Club, being the 1039th since its original organization, was held in the lecture hall of the Fairchild Biochemistry building at Harvard University on Friday, November 7th, 2008, with 31 members and guests in attendance. Upcoming meetings and the field trip to Michigan were announced.

Dr. Benjamin van Ee, a Mercer Fellow from the Arnold Arboretum, Harvard University, introduced the audience to the “charismatic” genus *Rafflesia* in a talk titled “Phylogenetics of the Philippine species of *Rafflesia* (Rafflesiaceae s.s.)”. The genus, found in parts of Southeast Asia, including peninsular Malaysia, Thailand, Java, Sumatra, Borneo, and the Philippines, was named in honor of Sir Stamford Raffles, founder of modern Singapore. All species are holoparasites with large, brightly colored flowers. *Rafflesia arnoldii* from Indonesia, which has flowers that can be up to 1.5 m in diameter, is considered to have the world’s largest flower. The host for this genus is *Tetrastigma* (Vitaceae), which is a large vine or liana found throughout the region and about which very little is known. The body of the *Rafflesia* plant is not well-documented and is hypothesized to consist only of strands of tissue running through the host. Depending on the species, flowers emerge from buds produced along the stem or roots of the vine. Van Ee speculated that the large vessels characteristic of lianas might facilitate infection. *Rafflesia* has unisexual flowers, and their morphology is distinctive. The flower is supported by a cupule-like structure that Van Ee thought was likely host tissue. Flowers have five outer lobes, called a perigone, which may be sepals, and an inner diaphragm-like structure possibly representing fused petals. These surround a sunken area that has the male or female parts. The pollen is liquid, and the plants are pollinated by flies.

Rafflesiaceae consists of three genera: *Rafflesia*, *Rhizanthus*, and *Sapria*. *Rafflesia* is the largest genus. The relationships of the family have been hard to determine by both traditional morphology-based methods and molecular methods. This is, in part, because *Rafflesia* flowers don’t look like anything else, and because it lacks a chloroplast genome. Genes from the chloroplast genome are the most widely used in constructing molecular phylogenies. Other difficulties include high rates of molecular evolution, creating long branches that can make phylogenetic relationships difficult to interpret. Rafflesiaceae was first placed in the order Malpighiales, and the most recent work places it sister to, or embedded within, Euphorbiaceae. Van Ee pointed out that this placement is interesting, because Euphorbiaceae are characterized by very small flowers, and the very large flowers of *Rafflesia* would need to be the result of a large increase in size, possibly over a brief period of evolutionary time.

A recent study of the molecular relationships within the genus using Bayesian analyses suggested that the closest relationships are among species of the same geographic areas, rather than among species with similar flower sizes. The pattern that emerged was that several large-flowered species were sister to small-flowered ones.

The rest of the talk concentrated on *Rafflesia* in the Philippines where the speaker spent four weeks collecting floral material for a molecular analysis. Van Ee pointed out that in the Philippines there has been an explosion of interest in *Rafflesia* among the general public and in the scientific community. Until 2002, only two species of *Rafflesia* were known from the Philippines, but since then, six additional species have been described and several more may be added soon.

Van Ee and colleagues, Daniel Nickrent from Southern Illinois University-Carbondale, and Julie Barcelona of the Philippine National Museum, traveled extensively in the Philippines and visited Northern Luzon, Panay, and Mindanao. Travel was by air, bus, and boat and was sometimes accompanied by armed guards. Species sampled included *Rafflesia schadenbergiana* from Mindanao, which is reported to have the second largest flowers in the genus and was thought to be extinct until 2007. They also collected *R. lobata* and *R. speciosa* from Panay. Altogether they were able to locate five of the Philippine species, including multiple samples of *R. manillana* from Luzon.

Van Ee showed images of the Philippine species of *Rafflesia* and discussed some of the relationships within this group. Preliminary molecular analysis indicates that, like the other sampled members of the genus, the Philippine species are characterized by considerable morphological variation, but little molecular differentiation. In fact, out of 3000 molecular characters, Van Ee and colleagues were only able to find 16 informative ones. Nevertheless, their results using nuclear and mitochondrial DNA support a single origin for the Philippine species. Within the Philippines, Luzon appears to be the center of diversity. They also found that species in the same geographic region of the Philippines were more closely related to each other than to those from farther away. This resulted in a pattern similar to that previously found where species with large flowers were often more closely related to species with small flowers within the same region than to species from other regions with large flowers.

Finally, Van Ee pointed out some of the difficulties in studying the group by traditional herbarium work, because the flowers do not preserve well. He also pointed out many gaps in our knowledge of this fascinating group of plants, which has no visible plant body and a very limited flowering time.