

Seed Imaging: Ongoing Work at the Arnold Arboretum and Beyond[©]

Julie Shapiro

Arnold Arboretum, 125 Arborway, Jamaica Plain, Massachusetts 02130 U.S.A.

Email: julie_shapiro@harvard.edu

In keeping with the core of the Arnold Arboretum's mission — “to increase knowledge of the evolution and biology of woody plants, along with a commitment to acquire, grow, and document all recognized species,” the Seed Herbarium Image Project (SHIP) being part of this mission, is over 5 years old.

The SHIP is an initiative to create a web-based storage of high-resolution digital images documenting the morphology of woody plant seeds and selected fruit structures. Headquartered at the Dana Greenhouse in Boston, Massachusetts, SHIP supports the work of educators and professionals in horticulture and the botanical sciences, particularly in conservation research and management of rare and endangered species. These digitized images of seeds offer an important new aid for teaching seed identification and serve as a resource for nurserymen, horticulturists, botanical curators, taxonomists, ecologists, and the public.

However, one could say SHIP really began with Al Fordham, propagator at the Arnold Arboretum, and his development of the seed herbarium at the Dana Greenhouse close to 50 years ago. This collection includes newly acquired seed, rare and endangered seed as well as historic seed collections of woody plants and shrubs.

Today we've not only advanced the specimen count, but due to technological applications and generous grant funding from the Stanley Smith Horticultural Trust, Cabot Family Charitable Trust, and J. Frank Schmidt Family Charitable Foundation, we now have an online visual seed database for public use.

In March of this year, the SHIP initiative was introduced and launched, creating a new internet-accessible tool for the online community, with a web-based navigation and database system, making seed images searchable. Our website address for the SHIP database is <http://www.arboretum.harvard.edu/plants/herbarium.html>.

Subsequently, in concert with our Curation, Plant Records, and Information Technology staff we introduced a website where one can now browse a gallery of closely allied species, along with making the site visible and consumable to the search engine tools such as Google[®], Dogpile[®], Yahoo[®], and visual search engines such as Grokker[®].

Some of us have our own seed herbariums, but having digital images of these collections the striking differences and similarities between species can be appreciated.

The dedicated equipment used within this digital lab serves three purposes: capturing, editing, and storing. The capture of seed images is done with a choice of four image stages: micro, macro, and full-scale table, including a stereomicroscope with a choice of three image stages.

There are four storage systems: a main tape drive, an External 500 GB HD, DVDs for off-site safety, and two large-screen desktop PC's imaging software, not to mention a printer, ladders, stepstools, digital calipers, and micro and electrostatic tools electrostatic tools from the radio equipment industry, to help with statically-charged seed.

Along with the equipment, naming and editing protocols had to be designed. Monthly meetings with the Arboretum Greenhouse personnel were held to discuss

exactly how to display and design these images. It took many months and several variations later to come up with a viable system. How could the seed be viewed as accurately as possible? This was done using a metric ruler. Placing the seed specimen vertically and horizontally in the photo quickly determines its size. A neutral background was then added. Single and group images were taken to show the range of size, shape, and color in each accession. Each of the seeds shown is the average of that group. When possible, the seed set begins with at least 20 seeds to show variation and then the average, largest, and smallest seed were assembled for an image, as well as both sides of the propagule.

This has now become the working SHIP standard.

To date, seed of 300 taxa in over 37 genera have been digitally captured, with a total of close to 900 images in the seed herbarium of 2100 samples of which 662 are from accessioned plants, many wild-collected. By the end of this year SHIP should top out at close to 1000 digital seed images.

This past July, the editing and uploading of seed from our six NAPCC genera was completed — some of the digital images shown were:

Acer griseum

Acer pensylvanicum

Syringa reticulata subsp. *pekinensis*

Syringa reticulata var. *amurensis* (syn. var. *mandshurica*)

Syringa yunnanensis

Syringa vulgaris

Carya glabra

Carya aquatica

Fagus grandifolia

Fagus orientalis

Fagus crenata

Stewartia rostrata

Stewartia pseudocamellia

Stewartia ovata var. *grandiflora*

Tsuga heterophylla

Tsuga canadensis

Over 200 incoming seed accessions a year arrive at the greenhouse. Sometimes we acquire wild-collected seed from foreign countries, some with unknown origin. In some cases these digital photographs aid us in identification.

Over the past year, scientists and institutions have expressed considerable interest in our SHIP and there seems to be endless educational and scientific potential in a project such as this.

With SHIP as a diagnostic tool, we are not only showing the genetic integrity of the Arnold Arboretum's collection and its key importance, but with visual identification, we can give a greater range of application to the botanical and horticultural communities.