

Capturing and Cultivating *Chosenia*

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In the fall of 1997 I visited Changbai Shan in northeast China with colleagues from four other botanical gardens, all members of the North American-Chinese Plant Exploration Consortium (NACPEC), as well as botanists from the Shenyang Institute of Applied Ecology and the Nanjing Botanical Garden.* We were there to collect a wide variety of woody plants but were open to anything we came across that was producing mature seed.

Changbai Shan is interesting for a number of reasons. From the geological perspective, the mountain is an active volcano that has erupted four times since the fifteenth century, in 1413, 1597, 1668, and, most recently, in 1702. Botanically speaking, the mountain is famous for the diversity of its vegetation and the size of its forest trees, which have never been heavily logged. Recognizing this, the Chinese established the Changbai Mountain Reserve in 1960 and, in 1979, expanded it to cover 190,000 hectares (475,000 acres) when it became part of UNESCO's "Man and the Biosphere" program.

The mountain is located in the southern portion of Jilin Province and stretches along the border between China and North Korea. *Changbai* translates literally as "eternally white mountain" and refers not to its snow-capped summit but to the layer of light-colored pumice that shrouded it after its most recent eruption. Today, this layer of pumice is covered by vegetation.

The entire Changbai Shan range covers an area of about 8,000 square kilometers (742 square miles) with altitudes that vary between 500 and 2,691 meters (1,640 and 8,825 feet). The highest

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Changbai Shan, counterclockwise from above: A distant view of the surrounding countryside from the summit; the lake in Baitou Shan's crater; the lake's outlet.



peak, Baitou Shan, is a volcano rising from a lava plateau. Inside the crater is a large lake, Tian Chi—the “Heavenly Lake”—between 200 and 350 meters (655 and 1,150 feet) deep. The border between China and North Korea runs straight through the middle of this spectacular lake, the outlet of which forms a 68-meter- (225-foot-) high waterfall. Both the lake and its waterfall are famous scenic spots in China and popular with tourists from all over Asia, especially those from South Korea, who consider the mountain to be the epicenter of their ancestral homeland.

The South Koreans, who make the pilgrimage to Changbai Shan by coming up from the Chinese side of the mountain, stay in fancy new hotels and shop at the flourishing herbal markets that sell every imaginable herb or animal product—with real or imagined medicinal properties—that are collected or cultivated on the mountain. The most popular medicinal product is the ginseng root, which is considered the best in all Asia. While the cultivation of this plant on Changbai Shan goes back many hundreds of years, its extent has increased dramatically in recent years, resulting in the clearing of large tracts of land on the lower slopes of the mountain. Such practices are ecologically destructive, given that they involve the removal of all existing vegetation, including the stumps, followed by a thorough plowing of the land.

Because of disease organisms, only two five-year crop cycles of ginseng can be grown on a typical site before it has to be abandoned for other purposes. Since the land is usually not replanted with trees, this pattern of use has led to serious erosion problems throughout the area.

The NACPEC group selected Changbai Shan as a target for collecting because of the richness and hardiness of its vegetation, and we were not disappointed. Our sampling strategy was fairly simple: to more or less follow the course of the Yalu River, which separates China from North Korea, stopping wherever the vegetation looked promising. On our very first day of collecting, just outside the county seat of Changbai Xian, we spotted a tree growing along the Yalu that roused everyone’s curiosity. It was early in the morning and the sun was rising up over the hills. The light was such that it was reflecting off hundreds of tiny seeds blowing in the breeze. Against the shady black background, the seeds stood out like tiny silver fireflies. “Stop the van,” we all shouted, “there’s a willow shedding its seed.” And out we piled to examine this tree that none of us could quite identify. Clearly it was a willow, but one with a tall, straight trunk and a strong conical growth habit. It also had a distinctive bark that was flaking off in long, thin plates. We collected as many seeds as we could find, along with some stem cuttings, hoping they



Above, clearing the land in preparation for planting a new crop of ginseng. Right, Panax ginseng being cultivated under polyethylene tents on Changbai Shan.



A view of the Yalu River looking into North Korea from the Chinese side. The river forms the boundary between the two countries.

would root once we got them home. After all, it was a willow and everyone knows how easily they grow from cuttings.

We continued to see the mystery willow throughout our trip, its distinctive conical shape always along the river, which is around 700 meters (2,300 feet) in altitude. The largest specimen we encountered had a ramrod-straight trunk with a diameter at breast height of 1.1 meters (3 1/2 feet). But none of the assembled collectors, including our Chinese hosts, could say for sure what species it was, and we never found another tree in seed after that first day.

The scientific identity of the mystery willow remained unknown until I got back to the Arboretum with my seeds and cuttings. In talking with the greenhouse staff about my collections I described the plant, at which point Irina Kadis, a native Russian who has worked in the far eastern part of that country, said matter-of-factly, "Oh, that's *Chosenia*. I saw it a lot when I was doing ecological work in Russia." A quick check of the descriptions in various reference books showed that Irina had nailed the identification in an instant.

Unfortunately, none of the cuttings we brought back rooted and none of the seed germinated, having spent too long in transit. Now at least I knew what the plant was even though I failed to bring it back alive. But my imagination had been fired up by the encounter, and I decided to learn

more about the plant that, along with *Salix* and *Populus*, is the only other genus in the willow family, Salicaceae. The plant is distinguished from the willows and the poplars by the structure of its flowers, which bloom in early spring. It typically sheds its tiny, plumed seeds anywhere from late spring to midsummer depending upon latitude, a time when few plant collectors are out and about. And finally, it doesn't seem to root from cuttings, another trait that clearly distinguishes it from the willows and poplars.

To my utter amazement, I also discovered that the plant did not appear to be presently in cultivation in either North America or western Europe. The Arnold Arboretum once had a plant labeled as *Chosenia bracteosa* that we got from the Morton Arboretum in Lisle, Illinois, in 1952 (#805-52-A). However, subsequent research in 1985 by George Argus of the National Museum of Canada, Ottawa, showed that the plant was not *Chosenia* at all, but *Salix daphnoides*, a shrubby European species.

Here was a plant—a magnificent tree—that had somehow fallen through a rather large horticultural crack. Not one to shy away from a challenge, I determined to bring the plant into cultivation. So I wrote to our Chinese collaborator at Changbai, Sun Long Xing, and asked him to collect seed when they were likely to reach full maturity in early summer. Later that spring, while doing a literature search on *Chosenia*,

Propagation from Cuttings

While *Chosenia* is notoriously difficult to root from cuttings of a mature plant, I experimented with taking cuttings from the plants when they were only three years old, on March 29, 2001. The results of the experiment, evaluated on June 17, 2001, indicated that cuttings taken from young plants are relatively easy to root.

Treatment	# cuttings	Results	% rooting
control	24	1	4.2
HRB (powder)	75	15	20.0
2500 ppm KIBA (quick dip)	50	13	26.0
5000 ppm KIBA (quick dip)	24	6	25.0

I came across an article published in 1994 by a Japanese scientist, Shingo Ishikawa, who described a series of experiments he had performed with *Chosenia* that he had raised from seed collected from an isolated population growing in the Azusa River floodplain in Nagano Prefecture in central Honshu. I wrote to Professor Ishikawa and asked whether it might be possible to send me seeds for my introduction project. Fortuitously, he wrote back in the affirmative, and seeds from the Nagano population arrived by DHL express a month later.

The seeds—which were assigned the accession number 176-98—were collected on June 15 and arrived at the Dana Greenhouses eight days later, June 23. I immediately sowed them in a coarse, sandy mix and placed them under the intermittent mist system we use for rooting softwood cuttings. Within three days, the cotyledons shot up above the soil surface and I had seedlings growing as thick as dog's hair. Not having much experience growing willows from seed, I was amazed at this incredible burst of germination energy.

About two weeks after the seeds arrived from Professor Ishikawa, a second package of seed arrived from Professor Sun (AA #184-98). Unfortunately, these had spent more time in transit than Professor Ishikawa's. Consequently they arrived desiccated and failed to germinate. But at least I had *Chosenia*, albeit from a wild Japanese population.

The seedlings grew extremely fast throughout the summer, and when they were several inches tall, I carefully transplanted them into individual pots. Based on her experience, Irina had warned me that *Chosenia* produces a long taproot that, when damaged, usually results in death, so I treated them with kid gloves.

The seedlings were big enough to be planted outside in the nursery a year later, during the spring of 1999, and they were moved to their permanent locations on the grounds in the spring of 2001. From what I could see, *Chosenia* was a plant that was programmed to grow like crazy. In the spring of 2004, the seedlings—

now six years old and between eight and twelve feet tall—produced their first flowers, which opened on April 21. Nine plants had been set out and eight of them produced flowers in 2004; three were females and five were males. To my delight, the female plants set mature seed, which I collected on June 9, 2004. After letting the seed air-dry for a few days, I sowed them as I had sown their parent's seed, under intermittent mist in the greenhouses. And again, the result was dog-hair germination within a few days. So the cycle is complete with the production of the second generation of seedlings in the Arboretum and with the promise of many more generations to come.

The Arnold Arboretum is pleased to offer to our Friends plants of *Chosenia arbutifolia*. The plants were raised from seed produced by Arboretum plants and are between 2 and 8 inches tall. A donation of \$40 per plant or three for \$100 will cover the cultivation, handling, and postage. Shipment will be in the spring of 2005. Send orders ASAP to:

Chosenia Distribution
Dana Greenhouses
The Arnold Arboretum
125 Arborway
Jamaica Plain, MA 02130



Chosenia seeds carried by the wind.



Chosenia seedlings growing like "dog's hair" in the Dana Greenhouses.



Two seedlings of Chosenia arbutifolia (AA# 176-98) growing side by side at the Arnold Arboretum. They were sown from seed in 1998 and photographed in February 2004.

Trees of Changbai Shan

The climate of Changbai Shan is continental and dominated by monsoons, which means cold, dry winters and warm, moist summers. Its vegetation includes 1,500 species of vascular plants and 500 species of cryptograms. It is also famous for the imposing stature of its trees, particularly the Korean pine (*Pinus koraiensis*). Moving up the north side of the mountain, botanists have identified four distinct vegetation belts. At the lowest elevations, starting around 550 meters (1,800 feet) and extending to 1,150 meters (3,770 feet), is the mixed forest of broad-leaved deciduous trees and conifers dominated by magnificent specimens of *Pinus koraiensis* along with *Acer mono*, *Tilia amurensis*, *Fraxinus mandshurica*, *Quercus mongolica*, *Betula platyphylla*, and *Ulmus japonica* with *Acer pseudosieboldianum* and *A. triflorum* in the understory.



Pinus koraiensis and on the right, *P. sylvestrifomis*.



Betula platyphylla.

Next comes the conifer forest, from 1,150 to 1,700 meters (3,770 to 5,575 feet), where large trees of *Abies nephrolepis*, *Picea jezoensis*, *Pinus koraiensis*, and the rare *Pinus sylvestrifomis* dominate, with *Betula costata* and various maples in the understory. The subalpine birch forest, between 1,700 and 2,000 meters (5,575 to 6,560 feet), is dominated by pure stands of windblown *Betula ermanii* with *Rhododendron dauricum* in the understory and *R. aureum* growing in open, exposed sites. At the highest levels of the mountain, from 2,000 meters to 2,300 meters (6,560 to 7,545 feet), is an alpine tundra covered with herbaceous plants and dwarf shrubs, including *Vaccinium vitis-idaea*, *Phyllodoce coerulea*, and *Rhododendron redowskianum*.



The author harvesting cones from Abies nephrolepis.



Windswept specimens of Betula ermanii below the summit of Changbai Shan.

	740 meters	1250 meters	1900 meters
Annual Mean Temperature	3.1 ^o C	- 0.2 ^o C	- 3.6 ^o C
Monthly Mean Temperature: July	18.5 ^o C	15.5 ^o C	12.7
Monthly Mean Temperature: Jan	- 14.5 ^o C	—	—
Maximum Temperature	31.5 ^o C	24.5 ^o C	21.7
Minimum Temperature	- 32 ^o C	- 33.6 ^o C	- 36.5
Number of Days w/ Temps > 10 ^o C	130	90	54
Annual Mean Precipitation	723 mm	840 mm	1057 mm

Temperature records for Changbai Shan between 1980 and 1983 (from Öberg and Bäck 1996).



Vaccinium uliginosum under *Larix olgensis*.

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