

The Mexican White Pine

by JEANNE SMITH

The Arnold Arboretum has more than 40 species of pine growing on its grounds from throughout the geographic range of the genus. The Mexican White Pine, *Pinus ayacahuite*, is particularly intriguing because it is the Arboretum's southernmost representative of the genus as well as being one of the very few Mexican plants hardy here. The 24-year-old specimen, propagated from seed from the Royal Botanic Garden, Kew, England, is located in the conifer collection in Kent Field. Not only does it demonstrate the remarkable quality of being hardy in the Boston area, but it exhibits outstanding ornamental features as well. Branched to the ground, it is densely pyramidal, with slightly ascending branches in relatively regular whorls. The needles, arranged in groups of five, are about five inches long, glaucous-green and pendent. The tree has been compared to the Himalayan Pine, *P. griffithii*, because of its drooping foliage, but exhibits a somewhat denser habit. It rivals our native Eastern White Pine, *P. strobus*, with the handsome bluish cast of its stouter, longer needles.

Although an outstanding representative of the soft pines (subgenus *Haploxydon*), *Pinus ayacahuite* is virtually unknown to the American gardening public, found in only a small number of arbore-

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A branch from a *Pinus ayacahuite* at the Masonic Homes Arboretum in Elizabethtown, Pennsylvania. Taken during the summer, this photograph shows both the previous year's mature cones and cones that will reach maturity in the fall.

ta, and rarely available as plants or seeds from nurseries and seed companies. This scarcity is due to two factors. One is the uncertainty of the plant's hardiness outside of its native geographic range. The other is that *P. ayacahuite* is one of a number of pine species that have shown considerable variability, resulting in a confusing taxonomic and nomenclatural history. A discussion of the complexity of pine genetics and the diversity of environmental conditions existing within the native range of the species in Mexico will help to clarify the situation.

All pines possess the same number of chromosomes, $2n = 24$, and the chromosomes themselves are relatively uniform morphologically. The conventional definition of a species cannot always be easily applied to the pines because genetic barriers to crossing are often absent; even well-defined species cross to produce fertile hybrids. As a result of interspecific hybridization, complexes or clines with intermediate forms can often be found where two or more species overlap geographically.

Pinus ayacahuite appears to be the southern representative of a north-to-south pine complex or cline of apparently intergrading species. The cline begins with *P. flexilis* James, in the mountains of western North America from southern British Columbia and Alberta southward to New Mexico. Its range overlaps that of *P. strobiformis* Engelmann, which ranges from southern Colorado to San Luis Potosi in Mexico. The cline ends with *P. ayacahuite* Ehrenberg, which

reaches from Jalisco and Hidalgo in central Mexico southeastward to El Salvador and Honduras.

Pinus ayacahuite was first described in 1838 by Ehrenberg. In 1909 G. R. Shaw described two new varieties of *P. ayacahuite* distinct from the typical southern variety: *P. ayacahuite* var. *veitchii*, found in the central states of Mexico, and *P. ayacahuite* var. *brachyptera*, from the northern states. Since 1909 the nomenclature associated with the northern variety has resulted in a confusion of synonyms: *P. ayacahuite* var. *brachyptera*, *P. strobiformis*, *P. flexilis* var. *reflexa*, and *P. reflexa*. However, most authorities now consider this plant to be a distinct species, *P. strobiformis*.

Recent work by Andresen and Steinhoff clearly distinguishes *Pinus strobiformis* and *P. flexilis* and establishes the range of variation in critical characters, but further study is needed to determine the relationship between *P. strobiformis* and *P. ayacahuite*. As a result of this situation, an evaluation of the horticultural merits of plants labelled *P. ayacahuite* can be made only after one determines whether the plant is the true species, one from a range of intermediates between two species, or a hybrid of two species formerly dissociated geographically but brought together in cultivation.

As a geographic area, Mexico possesses a remarkably diverse range of environmental conditions: climates ranging from tropical to cold temperate, rainfalls from deficiency to abundance, and altitudes from sea level to snow-covered volcanic peaks over 4000 meters high. These factors may contribute to and explain the range of hardiness of *Pinus ayacahuite* specimens grown in American arboreta. For example, seed originally collected at sites with severe climatic conditions may yield plants exhibiting hardiness associated with such a climate. According to literature sources, *P. ayacahuite* grows high in mountain ravines with a warm- to cold-temperate climate in the southern Mexican states of Hidalgo, Puebla, Tlaxcala, and Vera Cruz, and southward to Guatemala.

A questionnaire was sent to U.S. arboreta indicating holdings of *Pinus ayacahuite* to obtain additional information on the hardiness, culture, and ornamental qualities of the species. Microfiche records from the Plant Sciences Data Center revealed specimens in nine arboreta. Of these, only five had specimens whose identity had been verified by a taxonomist: the Arnold Arboretum, Strybing Arboretum, University of Minnesota Arboretum, Westtown School Arboretum, and the Institute of Forest Genetics.

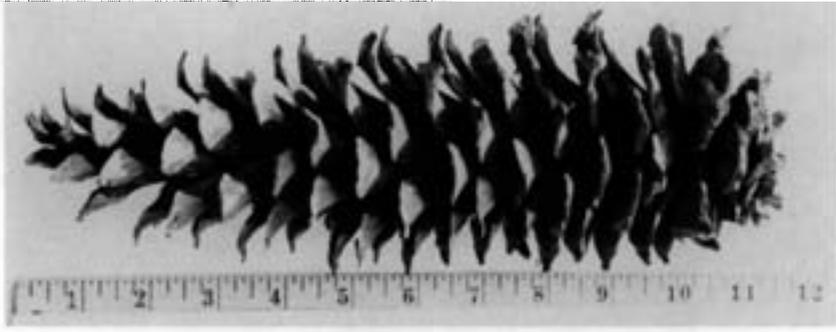
Positive identification of the specimens at the other arboreta is difficult because their trees mostly have not yet produced cones. Arboreta that have plants labelled but not conclusively identified as *P. ayacahuite* include Barnard's Inn Farm, Longwood Gardens, the University of Washington Arboretum, and the Masonic Homes Arboretum. Table 1 shows a list of arboreta, the source of their specimens, the year and form in which acquired, the identification number of the

TABLE 1. ARBORETA IN THE U.S. HAVING SPECIMENS LABELLED *Pinus ayacahuite*.

Arboretum	Verified by Taxonomist	Source of Specimen	Year Acquired	Form in Which Acquired	Arboretum I.D. Number	Minimum Winter Temperature
Arnold Arboretum, Jamaica Plain, MA	Yes	Royal Botanic Garden, Kew, England	1954	Seed	431-54-B	-9°F.
Barnard's Inn Farm, Vineyard Haven, MA	No	Westtown School Arboretum, Westtown, PA	1961	Seed	Conifer row 3, #3	0°-10°F.
Institute of Forest Genetics, Placerville, CA	Yes	Mexican National Institute of Forestry	1933	Seed	Ay-N4	Daily min. temp. for Jan. 33.9°F.
Longwood Gardens, Kennett Square, PA	No	Westtown School Arboretum, Westtown, PA	1960	Seed	602299	0°F.
Masonic Homes Arboretum, Elizabethtown, PA	No	Unknown	1936	Unknown	None	-10°F.
University of Minnesota Landscape Arboretum, Chaska, MN	Yes, vegetative*	Cabot Foundation, Harvard University	1961	Scion	60191	-25°F.
Strybing Arboretum, San Francisco, CA	Yes	Unknown	Unknown	Seed	xy-2439	22°F.
University of Washington Arboretum, Seattle, WA	No	Prof. Martinez, Mexico	1963	Seed	15-63	Av. daily temp. for Jan. 34.7°F.
Westtown School Arboretum, Westtown, PA	Yes	Moon's Nursery, Yardley, PA	1924	Plant	WS0523	0°F.

TABLE 2. DESCRIPTIONS OF SPECIMENS EXAMINED LABELLED *Pinus ayacahuite*.

SOURCE	<i>Arnold Arboretum</i>	<i>Masonic Homes Arboretum</i>	<i>Barnard's Inn Farm</i>
ACCESSION OR LOCATION	431-54-B	<i>South of Formal Garden</i>	<i>Conifer Row 3, #3</i>
AGE	24 years.	42 years.	17 years.
HEIGHT	6.5 m.	12.1 m.	4.2 m.
NEEDLES	12-14 cm. long, bluish green, all edges serrate, with 4-5 bands of stomata on inner surfaces.	13.5-15 cm. long, bluish green, all edges serrate, with 4-5 bands of stomata on inner surfaces.	11-15 cm. long, bluish green, all edges serrate, with 4-5 bands of stomata on inner surfaces.
CONES	Cylindric with tapered apex, 14-17 cm. long \times 3.2-3.5 cm. broad, pendent, deciduous, dull reddish brown, resinous at tips of scales, the peduncles 2.5 cm. long.	Cylindric with tapered apex, 20-23 cm. long \times 3.5 cm. broad, pendent, deciduous, dull reddish brown, resinous at tips of scales, the peduncles 2 cm. long.	Cylindric with short-tapered apex, 11-13 cm. long \times 5.5-6.0 cm. broad, pendent, deciduous, dull orange brown, resinous at tips of scales, the peduncles 1-1.5 cm. long.
SCALES	Margins not wavy, dark red-brown below umbo, 4.5 cm. long \times 2 cm. broad, reflexed on upper third of cone.	Margins thin and wavy, light red-brown below umbo, 5.3 cm. long \times 2.5 cm. broad, reflexed to varying degrees throughout.	Margins not wavy, dark red-brown below umbo, 3.5 cm. long \times 2 cm. broad, scales not reflexed.
SEEDS	Pale gray-brown with dark brown streaks, the nut 8 mm. long \times 5 mm. broad, the wing 19-22 mm. long \times 6-7 mm. broad.	Pale gray-brown with dark brown streaks, the nut 9 mm. long \times 6 mm. broad, the wing 27-33 mm. long \times 9 mm. broad.	—



A mature cone of the *Pinus ayacahuite* at the Masonic Homes Arboretum. The ruler is in inches.

arboretum, and its minimum winter temperature. Only two arboreta — the Institute of Forest Genetics and the University of Washington Arboretum — have specimens propagated from seed originating in Mexico. It seems unfortunate that propagation and distribution of this species have been primarily by seed collected in arboreta rather than from wild-collected material given the possibility of distributing interspecific hybrids rather than the true species.

Branches and cones from trees in the Arnold Arboretum, the Masonic Homes Arboretum, and Barnard's Inn Farm were studied to verify the authenticity of the specimens. The results of the examination appear in Table 2. From a review of needle and cone morphology, the trees at the Arnold Arboretum and the Masonic Homes Arboretum appear to correspond with the literature describing the typical species and with pine taxonomist G. R. Shaw's specimens of *Pinus ayacahuite* in the Arnold Arboretum herbarium. This opinion is based on a comparison of needle size, color, serration and stomatic bands; cone shape, color and dimensions; and seed nut and wing dimensions and color. The sample from Barnard's Inn Farm agrees in needle characteristics. But it differs in the color and the sparse pubescence on its branchlets and more noticeably in the small size of its cone and seed and in its lack of reflexed cone scales. This specimen perhaps is a hybrid, judging from the intermediate trend of various characteristics and the fact that it presumably was grown from seed from an isolated arboretum specimen among numbers of other pine species.

The author is aware of only one commercial seed source in the United States for *Pinus ayacahuite*. The seedsman is Frank T. Sessock, 6045 Foley Lane, Central Point, Oregon 97502. The seed he offers is custom collected from selected trees in Mexico and must be ordered in advance of the collection season. The Arnold Arboretum has recently received seed of *P. ayacahuite* var. *veitchii* from a private source in Mexico and if proven hardy, the plants will be distributed to interested nurserymen and arboreta. The seeds germinate readily without stratification within 21–28 days of sowing. Asexual propaga-



The 42-year-old Pinus ayacahuite at the Masonic Homes Arboretum. Pinus ayacahuite grows old with noteworthy dignity and beauty. It can be highly recommended for the large yard or as an informal hedge and can be used in public and industrial parks, on college campuses and for highway plantings.

tion is an alternative if seed is unavailable. Hopefully, nurserymen recognizing the ornamental qualities of the species will begin to propagate by grafting, using scion wood from trees of proven hardiness and beauty. As noted above, propagation from seed from cultivated sources may result in hybrid plants.

To insure optimum growth, trees should be planted in well-drained

sandy silt to clay loam, pH 5.5–7.0, and located where they will receive full sun the major part of the day. In severe climates damage has been reported due to ice, wind, and heavy snow, but in general trees in the Northeast have suffered no more damage than *Pinus strobus*. *Pinus ayacahuite* is susceptible to white pine blister rust, but no actual case was reported by respondents to the questionnaire. In its native habitat it matures to heights of 60 to 100 feet. Forty- to fifty-year-old trees observed in the Northeast have not exceeded 55 feet, and these tend to have multiple upswept side branches producing a broad, dense, rounded crown.

I would like to thank Gary Koller and Richard Weaver for their assistance with this project. In addition, I would like to acknowledge and thank those individuals at the botanic gardens and arboreta mentioned in this paper who took the time and interest to respond to my questionnaire. Their comments contributed greatly to the success of this endeavor.

References

- Andresen, J. W. & R. J. Steinhoff. 1971. Taxonomy of *Pinus flexilis* and *P. strobiformis*. *Phytologia* 22: 57–70.
- Bailey, L. H., ed. 1923. The cultivated evergreens. 434 pp. The Macmillan Co., New York.
- Bloom, A. 1972. Conifers for your garden. 146 pp. Charles Scribner's Sons, New York.
- Critchfield, W. B. & E. Little, Jr. 1965. Geographic distribution of the pines of the world. 99 pp. *USDA For. Serv. Misc. Publ.* 991.
- Dallimore, W. & A. B. Jackson. 1966. A handbook of Coniferae and Ginkgoaceae, ed. 4, rev. S. G. Harrison. 729 pp. Edward Arnold Ltd., London.
- Elwes, H. J. & A. Henry. 1910. *Pinus ayacahuite*, in *Trees of Great Britain and Ireland*, Vol. 5, pp. 1017–1022. Published privately.
- Kent, A. H. 1900. Veitch's manual of the Coniferae. 562 pp. H. M. Pollett & Co. Ltd., London.
- Martinez, M. 1948. *Los pinos mexicanos*, ed. 2. 361 pp. Ediciones Botas, Mexico.
- Menzies, A. 1969. *Pinus ayacahuite* and its varieties. *Jour. Cal. Hort. Soc.* 22: 113–114, 118.
- Mirov, N. T. 1967. The genus *Pinus*. 602 pp. Ronald Press Co., New York.
- Ouden, P. den & B. K. Boom. 1965. Manual of cultivated conifers hardy in the cold- and warm-temperate zone. 526 pp. Martinus Nijhoff, The Hague.
- Shaw, G. R. 1909. The pines of Mexico. 29 pp., 22 pl. *Publ. Arnold Arb.* #1. J. R. Ruiter & Co., Boston.
- . 1914. The genus *Pinus*. 95 pp., 39 pl. *Publ. Arnold Arb.* #5. Riverside Press, Cambridge.
- Steinhoff, R. J. & J. W. Andresen. 1971. Geographic variation in *Pinus flexilis* and *P. strobiformis* and its bearing on their taxonomic status. *Silvae Genetica* 20: 159–167.
- Webster, A. D. 1896. Hardy coniferous trees. 196 pp. Hutchinson & Co., London.
- Zobel, B. & F. Cech. 1957. Pines from Nuevo Leon, Mexico. *Madroño* 14: 133–144.