The Upright White Pine

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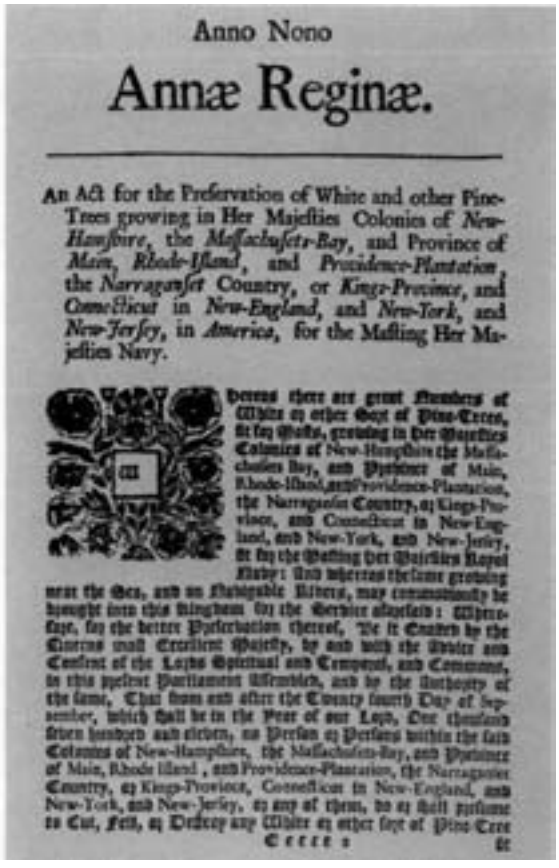
What's in a name? In the case of *Pinus strobus* 'Fastigiata', the fate of an excellent tree. All too often the acceptance or rejection of a plant lies not in its physical attributes but in the aptness of its common name. The so-called fastigiate white pine deserves a new one.

The white pine (*Pinus strobus*) was once the most important timber tree in North America. Its tall, straight trunk and lightweight wood were perfectly suited for all types of building projects. So valuable were large pines for ship masts that in 1711 Queen Anne of England, through an act of Parliament, took possession of all the white pines in her colonies that were larger than twenty-four inches in diameter and were not the property of any private person. She justified her action on grounds of national security, the trees being needed "for the Masting of her Majesties Navy." This peremptory seizure outraged entrepreneurial New England lumbermen, who considered the trees their private property even though they held no legal title to the land on which the trees were growing. Their outrage found an eventual outlet, some sixty years later, in the American Revolution.

In the period following the Civil War, New England white pines became less important as the white pine forests of the Great Lakes states and the extensive softwood forests of the Far West began to be cut. Around 1890, however, there was a reawakening of interest in white pine, when the New England farmland that had been abandoned during the Civil War started producing a marketable crop of white pine lumber. As this crop was being cut, the newly founded forestry departments of several universities as well as the United States Bureau of Forestry initiated programs of scientific silviculture directed at cultivating white pine on a commercial scale. However, the unpredictability of weather, the wide variation in soil types, and the competition from fast-growing deciduous trees frustrated most of these efforts.

In the few white pine plantations that were successfully established, the young trees still had to face the infamous white pine weevil (*Pinnodes strobi*). This native insect destroys the leading shoots of vigorous young white pines. Unfortunately for the forester, once the leader is destroyed, the basic shape of the tree is damaged and its utility diminished. At its worst, what was intended to be a straight-growing, single-stemmed tree is reduced by the weevil to a multistemmed bush. When weeviled trees reach harvestable size, many are either too crooked or too branched to be used for lumber. In addition to the white pine weevil, early foresters had to contend with the white pine blister rust, a fungus disease that was inadvertently imported from Europe around the turn of the century.

These two pests also adversely affected the use of white pines in landscape design. In the 1880s, the white pine was a widely planted



Anno Nono

Annæ Reginæ.

An Act for the Preservation of White and other Pine-Trees growing in Her Majesties Colonies of *New-Hampshire*, the *Massachusets-Bay*, and Province of *Main*, *Rhode-Island*, and *Providence-Plantation*, the *Narraganset* Country, or *Kings-Province*, and *Connecticut* in *New-England*, and *New-York*, and *New-Jersey*, in *America*, for the Masting Her Majesties Navy.

An Act for the Preservation of White and other Pine Trees in Her Majesties Colonies of New Hampshire, Massachusets-Bay . . . . for the Masting of Her Majesties Navy. A facsimile of the 1711 decree of appropriation of all white pines greater than twenty-four inches in diameter.

ornamental, grown both in groups and as single specimen trees. Writing in 1841 in *The Theory and Practice of Landscape Gardening*, Andrew Jackson Downing summarized the position that the tree occupied in landscape gardening:

> This species—the White Pine—seldom becomes flattened or rounded on the summit in old age, like many other sorts, but preserves its graceful and tapering form entire. From its pleasing growth and color, we consider it by far the most desirable kind for planting in the proximity of buildings, and its growth, for an evergreen, is also quite rapid.

But the weevil epidemic of the early 1900s and the introduction of the blister rust changed all this. A single tree planted in a lawn could not be counted on to produce the desired effect. More often than not, the tapering form never materialized. In its place, a bushy "cabbage" pine arose. True enough, many old pines that have been weeviled develop a certain picturesque appearance, but this is the result of many years of searching for a leader. Many modern landscapers suggest that the white pine be used in group plantings, where competition from neighboring trees will force it to grow straight in spite of repeated leader loss.

A Matter of Branch Angles

Happily, nature has provided gardeners with a way out of this unfortunate situation in the form of the so-called fastigiate (or, as I prefer, upright) white pine, *Pinus strobus* 'Fastigiata', which is distinguished from the normal white pine by the more vertical angle at which the lateral branches are carried. In order to appreciate the implications of this seemingly trivial difference, it is necessary to understand how a normal white pine grows. In the spring, when the terminal cluster of buds breaks, the laterals and the terminal all begin growing vertically. As the season progresses, however, the laterals slowly move downward, away from the terminal, under the influence of hormones produced by the terminal. This process continues through the year until, by the following spring, they are at angles of between fifty and seventy degrees to the main stem. By the end of the second year, the laterals are at angles of about seventy to ninety degrees to the main stem. By the end of the third year, almost all of the laterals are at right angles to the trunk. This is the normal, genetically controlled pattern of growth for undamaged white pines.

In the upright pine, the laterals and the terminal start out the way they do in the normal pine, but for some reason the laterals fail to move down into the horizontal position. The downward migration stops prematurely at an angle of about thirty degrees to the main stem.

The weevıled crown of a white pine.

It is only with increasing age (after ten years) that the laterals begin to sag down to angles greater than thirty degrees. When they do, it is the result of the weight of the limbs rather than of a predetermined genetic pattern, as it is in the normal pine. In other words, in the upright white pine the branches stay in a position alongside the main axis for a good ten years, while in the normal pine the laterals are alongside the leader for less than a year before moving down into a horizontal position.

This discussion of branch angles has implications that go beyond mere academic interest. Because its branches remain alongside the main axis for a longer time, the upright white pine is better able to replace a dead leader than the normal pine is. When the leader of a young tree is destroyed by either the white pine weevil or the blister rust fungus, there is already a lateral branch in position to replace it immediately. In the same season that the attack occurs, the most vigorous lateral assumes dominance and becomes the newly anointed leader. By virtue of this rapid leader replacement, the upright white pine will maintain its shape in spite of repeated losses of its leader. In contrast, when the leader of a normal white pine is killed, there are no ready replacements, and the re-erection of horizontal branches results in several laterals competing with one another, ultimately producing a multileadered specimen that looks more like a bush than a tree.

As well as preadapting the tree for rapid leader replacement, the ascending branches of the upright white pine give it a greater ability to shed snow; hence, it suffers less winter damage than does the normal pine with its horizontal branches. In addition, because the lower branches grow upward and not outward there is less of a tendency for them to be shaded out by the upper branches. Both of these factors contribute to the creation of a tree that, if given full sun, is green from top to bottom for many, many years. At maturity the tree has an imposing presence—a broad column of green that seems to reach out directly at the viewer to create a unique ascending appearance.

A Proposed Change of Name

You might ask why, if this tree is so superior for landscaping, its use has not been suggested before. One part of the answer is simple: the tree is not very well known. From time to time people have tried to popularize it but generally to no avail. In 1920, for example, when yards were big and landscaping grand, E. H. Wilson predicted that the upright white pine was "destined to be of great importance." Unfortunately, the tree planters of the day ignored this prophecy. This excellent tree has been planted here and there, but not nearly in the abundance it deserves.

A second part of the answer is that the plant does not live up to its common name. Certainly a change in the tree's common name from fastigiate white pine to upright white pine would not only be more accurate but

Compression Wood

In the white pine, as in most conifers, the production of a specialized type of wood known as compression wood plays an integral part in the development of a tree's shape. A cross section of the lateral branch of a white pine reveals the compression wood as a crescent-shaped, red blotch on the lower side of the branch. This "red wood," as it is called, is most conspicuously formed when the leader of a straight-growing conifer is destroyed and a lateral branch grows upward to become the new leader. Large amounts of compression wood are formed along the underside of the branch, forcing it upward. In an undamaged conifer the situation is more complicated. The innate tendency of the laterals to erect themselves is countered by hormones produced by the leader, which are aimed at pushing them down. The balance between these two opposing forces results in a specific amount of compression wood being laid down, which in turn results in branches being carried at angles that are specific for each species. In the white pine, this angle is nearly ninety degrees, or horizontal, to the main stem. This process was first described by the great German tree physiologist Ernst Münch, who called it "delayed epinasty." In a classic article, "Investigations on the Harmony of Tree Shape" (1938), he makes an analogy comparing "the terminal shoot with a tyrant who suppresses his subjects and prevents them from development. As soon as the tyrant is removed or weakened, the vassals fight for the leadership until one of them has reached the top and in his turn suppresses the others."

Compression wood in Abies balsamea, *the balsam fir, produced along the underside of a leaning trunk, pushing it up into a vertical position. Note the eccentric radial growth caused by the production of darkly stained compression wood on the lower portion of the cross section. Photo by T. E. Timell.*

would probably stimulate a greater appreciation of this distinctive cultivar.

While this may seem a trivial distinction, the fact of the matter is that people expect a plant to live up to its name, and when it doesn't they blame the plant and not the name. When I first saw the tree, I thought it was a perfect example of another useless horticultural selection. True, it was narrower than a normal white pine, but fastigiate? Never. When I first became interested in the plant in the early 1980s, I asked knowledgeable people about the plant and found that there is general agreement that the tree, although fastigiate when young, should be cut down when it fills out. When I started looking more closely at some of the old

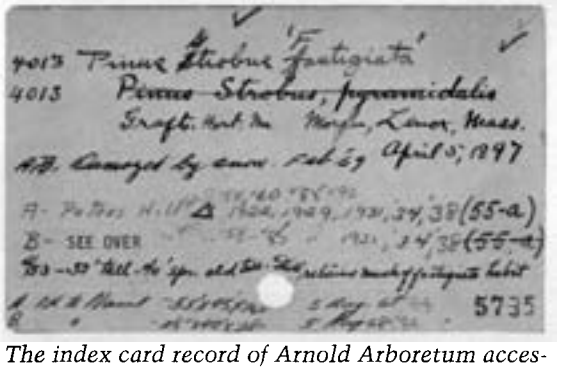
Pinus strobus, *the normal white pine, growing along Route 2 in Acton, Massachusetts.*

The upright white pine, **Pinus strobus** *'Fastigiata', at the Arnold* **Arboretum.**

trees in the Arnold Arboretum, however, I realized that they were indeed quite different from the normal white pine and that they were beautiful in their own right. Indeed, like many other plants, the upright white pine seemed to be condemned to oblivion more for what it is not than for what it is.

The Origin of the Upright White Pine

The history of *Pinus strobus* 'Fastigiata', while not quite as revolutionary as that of the normal white pine, is an interesting one. According to E. H. Wilson, in *Aristocrats of Trees*, "the original tree was discovered about 1895 in a garden at Lenox, Massachusetts, and the trees now growing at the Arnold Arboretum are grafts from this." Arboretum records reveal that, indeed, *Pinus strobus pyramidalis* (the



The index card record of Arnold Arboretum accession #4013, Pinus strobus *'Fastigiata', originally* Pinus Strobus pyramidalis, *a scion of Mr. Morgan's original tree.*

name was later changed to 'Fastigiata') scions were received from a Mr. Morgan of Lenox on April 5, 1897, and that two of these original propagations are still alive. On a hunch I called the Lenox town assessor and discovered that, yes, J. P. Morgan's brother, George H. Morgan, once lived in the town and was a great lover of trees. And yes, his old estate, Ventfort Hall Villa, is still standing. I went out to Lenox as soon as I could to try to locate the original upright white pine from which the Arnold

At center is the original Pinus strobus *'Fastigiata' photographed by the author in Lenox, Massachusetts, in 1980.*

Arboretum scions had come. After much searching, which involved climbing onto the roof of the old mansion, I finally spotted the tree's distinctively pointed crown.

The tree was about a hundred and twenty feet tall and at four feet from the ground was twenty-seven inches in diameter, a perfect ship-mast pine. The spread from branch tip to branch tip was about thirty-two feet. There was no sign of any graft union near the base, and the straight trunk (devoid of branches for its first fifty feet) showed no evidence of weevil or blister-rust damage. The fact that the tree was growing close to other, equally large, normal pines suggests that several trees were planted as a group before Morgan recognized that one of them was different. Fortunately, he

had the good judgment to send scions to the Arnold Arboretum, whence the tree eventually made its way into the nursery trade.

The upright white pine is easily propagated by grafting and is available from several nurseries, particularly those specializing in conifers. It grows best in the natural range of the normal white pine: Newfoundland to Manitoba, south to Georgia (in the higher elevations), and west to Minnesota. It grows as quickly and as tall as the normal white pine (one hundred to one hundred and fifty feet after a century), so it needs lots of room. It does best when planted in a sandy loam with good drainage, but it is tolerant of thin, stony soil as well. If grown in full sun, the upright white pine will keep its lower branches for as long as it lives. This tendency, together with its narrow growth habit, makes the tree a perfect choice for a tall hedge or a screen. As a specimen plant, the upright white pine presents a fuller, neater appearance than the normal white pine. It is striking enough to be used in a position of prominence, either close to a house or at the edge of a deciduous wood.

References

Albion, R. G. 1926. *Forests and sea power. the timber problem of the royal navy, 1652-1862.* Cambridge, Mass: Harvard University Press.

Del Tredici, P. 1982. Resurrecting the white pine. *Horticulture* 55 (5): 17-20.

Downing, A. J. [1841] 1977. *A treatise on the theory and practice of landscape gardening.* Reprint. Little Compton, Rhode Island: Theophrastus Books.

Malone, J. J. 1964. *Pine Trees and Politics.* Seattle: University of Washington Press.

McKinnon, F. S., G. R. Hyde, and A. C. Cline. 1935. *Cut-over old field pine lands in central New England* Harvard Forest Bulletin No. 18.

Munch, E. 1938. *Untersuchungen uber die Harmonie der Baumgestalt. Jahrbucher fur Wissenschaftliche Botanik* 86: 581-673 (English translation available from Translation Center, John Crerar Library, 35 West 33rd St., Chicago, IL 60616).

Sinnott, E. W. 1952. Reaction wood and the regulation of tree form. *American Journal of Botany* 39: 69-78.

Timell, T. E. 1986. *Compression Wood in Gymnosperms,* 3 vols. New York: Springer-Verlag.

Wilson, E. H. [1930] 1974. *Aristocrats of the trees.* Reprint. New York: Dover Books.

Zimmerman, M. H., and C. L. Brown. 1974. *Trees. structure and function.* New York: Springer-Verlag.

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