Magnolia virginiana in Massachusetts

by PETER DEL TREDICI

History

The sweet bay magnolia swamp in Gloucester, Massachusetts has been a botanical shrine since its discovery in 1806 Early New England naturalists and botanists of all types, from Henry David Thoreau to Asa Gray, made pilgrimages to the site of this northernmost colony of *Magnolia virginiana* L.* (fig. 1). The local residents of Gloucester were so impressed with a "southern" plant growing this far north that they changed the name of the Kettle Cove section of the town to Magnolia in the mid-1800s. It is probably no coincidence that this name change occurred at the same time the area was starting up its tourist trade.

In addition to its isolation, the Gloucester *Magnolia* population was remarkable for having escaped notice until 1806 in an area that was settled in 1623. This fact has led at least one author to speculate that the colony was not wild but escaped from a cultivated plant (Anonymous, 1889). However, the overwhelming consensus of earlier botanists is that the population is, in fact, native. Whatever its origin, the swamp remains today the unique and mysterious place it has been for almost 200 years.

Very little has been written about the magnolia swamp in recent years. The latest, and best, article about it was written by Dr George Kennedy, and appeared in 1916 in *Rhodora*, the journal of the New

* The next nearest population of *M. virginiana* is growing 150 miles to the south on the eastern shore of Long Island, New York (Little, 1971).

Figure 1 This drawing of Magnolia virginiana *appeared in 1849 in Asa Gray's* Genera Plantarum *(pl 23), with the caption " a branch in flower of the Northern variety, from Gloucester, Massachusetts, of the natural size "*

England Botanical Club. Dr. Kennedy summarized the history of the stand, and cleared up the confusion about who discovered it by publishing a letter he found, written by the Honorable Theophilus Parsons to the Reverend Manassah Cutler in 1806. The letter captures the emotion of the moment of discovery:

> Reverend and Dear Sir:
>
> In ridıng through the woods in Gloucester, that are between Kettle Cove and Fresh Water Cove I discovered a flower to me quite new and unexpected in our forests. This was last Tuesday week [July 22, 1806]. A shower approaching prevented my leaving the carriage for examination, but on my return, on Friday last, I collected several of the flowers, in different stages, with the branches and leaves, and on ınspection ıt ıs unquestionably the Magnolia glauca Mr. Epes Sargent has traversed these woods for flowers and not having discovered it, supposes it could not have been there many years. It was unknown to the people of Gloucester and Manchester untıl I showed it to them. I think you have traversed the same woods herborizing. Did you discover it? If not, how long has ıt been there? It grows in a swamp on the western or left side of the road as you go from Manchester to Gloucester, and before you come to a large hill over which the road formerly passed. It is so near the road as to be visible even to the careless eye of the traveler. Supposıng the knowledge of this flower, growing so far north, might gratify you, I have made this hasty communicatıon.
>
> Your humble servant,
> Theoph. Parsons

The existence of the magnolia swamp was first announced to the general publıc ın 1814 by Jacob Bigelow ın the first edition of his famous *Plants of Boston*:

> The only species of this superb genus, that has been found native ın our climate. It attains the height of a dozen feet, but is sometimes killed down to the roots by severe winters . . . The bark is highly aromatic, and possesses medicinal properties. It grows plentifully in a sheltered swamp at Gloucester, Cape Ann, twenty five miles from Boston, which is perhaps its most northern boundary. — June, July.

And on September 22, 1858, Henry David Thoreau vısited the swamp and wrote about it in his *Journal*:

> Sept 22. A clear cold day, wind northwest
> Leave Salem for the Cape on foot . . . We now kept the road to Gloucester, leaving the shore a mile or more to the right,

Figure 2 An unusually old, tall, multi-stemmed specimen of Magnolia virginiana *growing in the old C. S Sargent estate in Brookline, Massachusetts The tree is 10 meters tall Photograph by P Del Tredici.*

> wishing to see the magnolia swamp. This was perhaps about a mile and a half beyond Kettle Cove. After passing over a sort of height of land in the woods, we took a path to the left, which within a few rods became a corduroy road in the swamp. Within three or four rods on the west side of this, and perhaps ten or fifteen from the highroad, was the magnolia. It was two to seven or eight feet high, but distinguished by its large and still fresh green leaves, which had not begun to fall. I saw last year's shoots which had died down several feet, and probably this will be the fate of most which has grown this year. The swamp was an ordinary one, not so wet but we got about very well. The bushes of this swamp were not generally more than six feet high. There was another locality the other side of the road.

Clouds of doubt concerning the survival of the swamp started to gather in 1875, in *A Report on the Trees and Shrubs Growing Naturally in the Forests of Massachusetts* by George B. Emerson. He noted "scores" of trees broken down in a single season by people who sold the flowers in Boston and Salem. By 1889, the situation had deteriorated to the point that J. G. Jack, the dendrologist at the Arnold Arboretum wrote:

> So eagerly have the flowers been sought for by collectors, and especially by those who wished to make money out of the sale of both plants and flowers, that there has been some apprehension that the day would soon come when the Magnolia could only be classed in New England floras as one of the indigenous plants of the past.

But some good news also appeared in this article, for he goes on to say, "The hope is now entertained, however, that the owners of the woods where it occurs, appreciating its rarity and interest, will take care that its existence, in a wild state, may be perpetuated." And indeed it was, for in that same year, 1889, Mr. Samuel E. Sawyer, the owner of the swamp, set up a trust fund, to be administered by a board of trustees, to manage the land. He chose to call it "Ravenswood Park" and instructed that it be left open for and made accessible to the general public.

This great display of generosity, however, did not stem the tide of destruction. Dr. Kennedy in his *Rhodora* article quotes a letter from C. E. Faxon, the illustrator at the Arnold Arboretum, to a Mr. Walter Deane, which shows the condition of the swamp in the summer of 1913:

> April 17, 1916.
>
> Dear Mr. Deane:
>
> I have just found in Garden and Forest an interesting letter from Mr. Fuller giving a marginal note from Judge

> Davis's copy of Bigelow's Plants of Boston . . . When I first visited the swamp some 45 years ago there were plenty of good specimens all about, sometimes 15 feet tall or more. It was easy to find them, as the boys who sold the flowers on the Boston trains had made trails from one plant to another all over the swamp.
>
> When I visited the place with Dr Kennedy two years ago we found with the aid of the Tree Warden of the town, only two little plants a few feet high that had escaped the Magnolia hunters — such had been the destruction!
>
> Yours faithfully,
> C. E. Faxon

More recently the story has developed a more cheerful turn. When I visited the swamp during the winter of 1981, I estimated there to be somewhere between 40 and 50 multi-stemmed clumps of *Magnolia virginiana*. Most of the stems were 2 to 4 meters tall, but there was one 6 meters high. Stem diameters ranged from 2 to 10 centimeters in thickness. About 1970, the trustees of Ravenswood Park thinned out some of the larger trees that were shading the magnolias that grew in the back part of the swamp. The effect of this selective thinning has been a great increase in the vigor and fruitfulness of the plants — so much so that in the fall of 1980, I managed to collect 938 fertile seeds from about half a dozen plants. By no means was this the total seed production of the colony, only what I could collect without doing damage to the trees.

In Jack's 1889 article, he listed the common plants of the swamp, and it is clear that it contained a great degree of diversity. When I visited the swamp in 1981, I had Jack's list with me so I was able to make some comparisons As for the trees, not much has changed: hemlock (*Tsuga canadensis*), white pine (*Pinus strobus*) and red maple (*Acer rubrum*) still dominate the canopy. In the shrub layer, however, there are fewer kinds of plants now than there were in 1889. Presently, blueberries (*Vaccinium corymbosum*), sweet pepperbush (*Clethra alnifolia*), catbrier (*Smilax rotundifolia*) and tall *Osmunda* ferns are most abundant. Interestingly, the shade-tolerant evergreen inkberry (*Ilex glabra*), common in the swamp today, was not mentioned by Jack. Conversely, Jack reported that the sun-loving cranberry (*Vaccinium macrocarpum*) grew thickly in the swamp in 1889 but I couldn't find it anywhere. This absence of cranberry along with the decrease in the diversity of shrubs suggests that in 1889 the swamp was not as grown up with trees as it is presently. It also suggests that a periodic thinning of the canopy is the best way to maintain the swamp in a healthy condition.

In the spring of 1982, the Arnold Arboretum, in conjunction with the trustees of Ravenswood Park, plans to replant part of the swamp with seedlings grown from seed collected at the park in 1980. We will

Figure 3 An evergreen form of Magnolia virginiana *growing in the front yard of a private home in Milton, Massachusetts The tree is 9 meters tall The photograph was taken in February. Photograph by P Del Tredici*

Figure 4 The Milton magnolia, photographed from below, showing the thin, but evergreen, canopy. The photograph was taken in February. Photograph by P Del Tredici

concentrate our efforts on those parts of the swamp where the magnolia is not now growing but probably was originally. Our hope is that some day the swamp will contain as much magnolia as it did when it was discovered. Preparatory to the planting, the Board of Trustees plan to do some thinning of the now dense canopy to allow more light to reach the seedlings, thereby increasing the chances of their survival.

Other forms of *Magnolia virginiana*

In 1919, C. S. Sargent suggested that there may be two botanical varieties of *Magnolia virginiana*, a southern one, var. *australis*, and a northern one, var. *virginiana*. The southern form is evergreen, larger and more pubescent than the northern form. Subsequent authors have either contested or supported the validity of such a separation and to those articles the interested reader is referred (Ashe, 1931; McDaniel, 1966 and 1967; Spongberg, 1976). Suffice it to say that the situation is very complex and confused and that many different forms of *Magnolia virginiana* of uncertain origin can be found.

In the vicinity of the Arnold Arboretum, for example, there are two very striking, and very different specimens The first one is 10 meters tall, multi-stemmed, deciduous and very vigorous. It is growing on the old C. S. Sargent estate, Holm Lea, in Brookline, Massachusetts (fig.

2), and is probably part of Sargent's original planting. The second specimen is a smaller, younger tree, with a single stem, growing in the front yard of a private home in Milton, Massachusetts. The remarkable feature of this plant is its strongly upright habit and its evergreen foliage held through the most severe winters (fig. 3, 4.) I have not yet determined whether this plant corresponds to McDaniel's definition of variety *australis*, but I plan to do so during the summer when blooms are produced. Regardless of its botanical name, it is a fascinating tree, that suggests that a reliably evergreen magnolia for Massachusetts may not be just a fantasy. Unfortunately, nothing is known about the tree's history except that it was planted by the Blue View Nurseries of Canton, Massachusetts in the 1950s.

The existence of these two different forms of *Magnolia virginiana*, along with the smaller native form, suggests that the enterprising plant breeder has good material to work with when selecting for a hardy, evergreen magnolia. It is also possible that by crossing the Gloucester form with some of the hardiest clones of *Magnolia grandiflora*, that evergreen hybrids hardier than *Magnolia* 'Freeman' may be possible (McDaniel, 1966).

Seed Germination

On October 13, 1980, 938 sound seeds were collected from various plants of *Magnolia virginiana* growing at Ravenswood Park. On this day, the fruit aggregates were just beginning to crack open, revealing the bright scarlet seeds inside (see back cover). In processing the seeds, the first step was to clean them. This was done by allowing them to soften up in a plastic bag for a week, and then washing them in running water. Once the seeds were clean, I noticed that the hard bony layer on all of them was a creamy white (fig. 5). This is curious since all illustrations I could find show this layer to be black (Sargent, 1890; Schopmeyer, 1974; Wood, 1974). However, Professor J. C. McDaniel of the University of Illinois has told me that he has seen plants with white or mottled bony layers.

Once the fleshy layer was removed, the seeds were air dried overnight and placed in a moist stratification medium consisting of half peat moss and half sand. They were then put in a refrigerator kept at 2°C. Every two weeks, one hundred seeds were removed and sown in medium grade vermiculite and placed in a greenhouse kept at constant 18°C with supplementary light from 4 p.m. to midnight. The purpose of the experiment was to see exactly what the minimum chilling requirement of *M. virginiana* was, given that the standard recommended treatment is a rather broad recommendation of three to six months (Schopmeyer, 1974). The results of the experiment can be seen in Table 1. It should be noted that while unchilled seeds did give 12% germination, they did so only very slowly and irregularly in comparison to the chilled seeds.

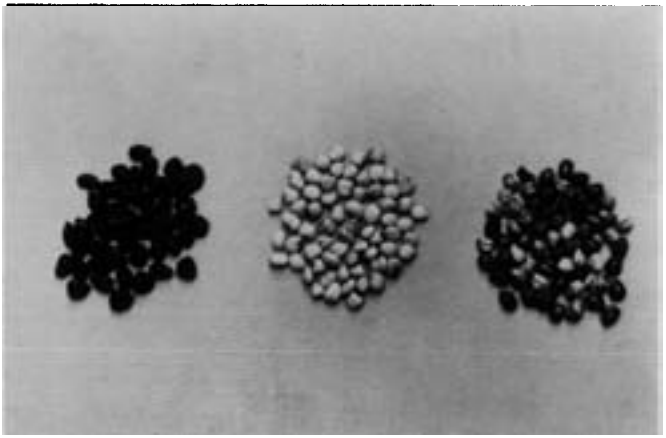

Figure 5 Cleaned seeds of Magnolia virginiana. *The black seeds on the left are from the tree at the C S Sargent estate (figure 2) The white seeds in the middle are from the Gloucester population, and the mottled seeds on the right are from the evergreen Milton tree (figure 3) Photograph by P Del Tredici*

Table 1 Germination behavior of cleaned seeds of *Magnolia virginiana.*

Cold Stratification Period (in Days)	Sow Date	Number of Days to Germination*	% Germination as of 10 Feb. 1981
0	21 Oct 80	60	12%
14	4 Nov 80	57	14%
27	17 Nov 80	42	80%
42	2 Dec 80	34	84%
58	18 Dec 80	33	93%

* Germination is defined as the emergence of the hypocotyl above the soil surface

When the seeds of *M. virginiana* are shed (and indeed, in all magnolias that I have observed or read about), the embryo is minute, being less than 20% of the length of the seed itself. When the seeds are taken from stratification, regardless of whether it is for one month or four months, the embryo shows little or no change in size. However, immediately upon sowing, the embryo starts to grow, so that after 14 days the embryo is about 50% as long as the seed and after 30 days, the cotyledons are almost as long as the seed and the radicle has broken through the seed coat. After 40 days, the germination is usu-

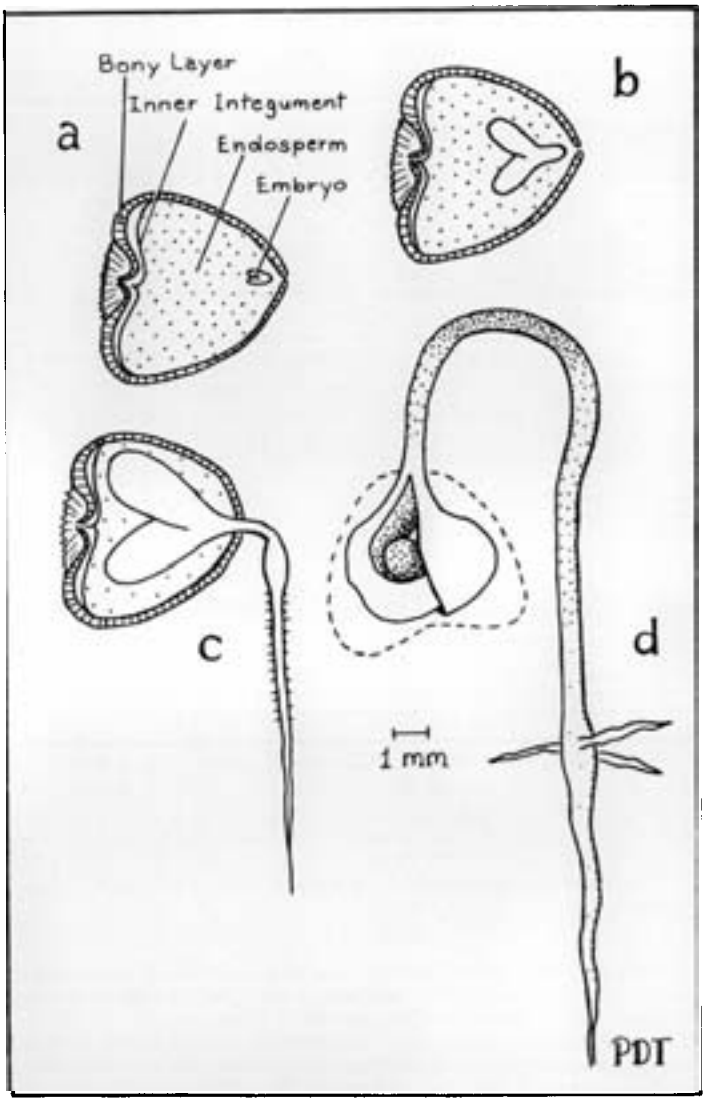

Figure 6 Seed germination sequence of Magnolia virginiana *after 90 days of cold stratification (a) the day the seeds were sown, (b) 14 days after sowing, (c) 32 days after sowing, (d) 40 days after sowing, germination nearly complete*

ally complete (Fig. 6). In contrast, the unchilled seed showed no uniformity. After 112 days, some embryos were still at the same developmental stage as they were when they were shed from the plant while others were fully germinated.

A germination process similar to that of *Magnolia virginiana*, where there is a chilling requirement in order to allow the embryo to complete its development, has been reported for *M. grandiflora* (Evans, 1933), and *M acuminata* (Afanasiev, 1937), and my own observations have shown that it holds true for *M. tripetala* and *M. macrophylla* as well. It is also true for another member of the Magnoliaceae, the tulip tree (*Liriodendron tulipifera*) (Wean and Guard, 1940). In effect, what is happening is that the underdeveloped embryo requires a chilling period in order to remove the block that keeps it from developing. However, the embryo will not grow until it is moved to a warm environment. Thus, *Magnolia* seeds require a cold period (of about two months) followed by a warm period (of about one month) before they will germinate. What looks like an ordinary chilling requirement is, in reality, a special type of double dormancy As far as I can tell, this dormancy type has never been recognized by seed dormancy specialists (Crocker and Barton, 1953; Stokes, 1965; Villiers, 1972; Mayer and Poljakoff-Mayber, 1975).

The situation in *Magnolia* contrasts with other dicotyledons that shed ripe seeds with underdeveloped embryos. In the case of *Panax ginseng* (Grushvitskij, 1956), and *Ilex opaca* (Ives, 1923), the tiny embryo grows to full size in warm temperatures but then will not germinate unless it receives a chilling period of 2 to 3 months. A variation of this type of dormancy is shown by *Viburnum acerifolium* (Giersbach, 1937) in which the radicle germinates during the warm period, but the epicotyl requires a chilling in order to grow. In the case of *Viburnum nudum*, on the other hand, both the radicle and the epicotyl grow to maturity and germinate without requiring any chilling. Finally, in the case of the herbaceous cow parsnip, *Heracleum sphondylium* (Stokes, 1952), the underdeveloped embryo actually grows to full size during the chilling process and will even germinate in the refrigerator, something *Magnolia* never does.

Thus, within the category of dicots which shed their seeds with underdeveloped embryos (which I shall arbitrarily define as having embryos less than 25% of the length of the mature seed), we have four basic germination behaviors: (1) plants which require only warm conditions; (2) plants which require a warm period and then a cold period; (3) plants which require only a cold period; and (4) plants which require a cold period followed by a warm period.

It should be kept in mind, of course, that the lack of a precise definition of germination complicates this otherwise neat situation. Villiers (1972) sums up the basic problem that one faces in discussing seeds with immature embryos, by noting that: "It is difficult to decide whether this embryo development is part of the final stage of seed development or the initial stage of the germination process." In spite

of this intrinsic difficulty, the type of dormancy shown by *Magnolia* and *Liriodendron* is distinct enough from those types already recognized to merit a classification of its own.

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