Inter-subgeneric Hybridization Between Magnolia Grandiflora and M. Acuminata

by Frank S. Santamour, Jr.

Interspecific hybridization in *Magnolia*, both natural and artificial, has been extensive. Differences in chromosome number or sectional classification of the species have not proved insurmountable barriers to hybridization. However, up to the present time, there have been no reports of successful hybridization between species belonging to different subgenera.

Among magnolias suited to cultivation in the temperate zones of the United States, *M. grandiflora* L. of subgenus Magnolia is the only reliable and fairly hardy evergreen species. All species of the subgenus Magnolia have essentially white tepals. Tepal pigmentation is, however, widely distributed among species of subgenus Yulania. Anthocyanin (reddish) pigments are present in the tepals of many species and the yellow carotenoids are found in significant amounts in *M. acuminata* L. and its variety *subcordata* (Spach) Dandy (Santamour, 1965; Demuth and Santamour, 1978; Santamour and Demuth, 1978). Thus, if breeders are going to develop evergreen magnolias with pigmented tepals, the inter-subgeneric barrier must be overcome.

This paper is a report on successful inter-subgeneric hybridization between *M. grandiflora* and *M. acuminata* var. *subcordata* (*M. cordata* Sargent). Although the hybridity of these plants was determined cytologically in the seedling stage, this report was deferred until flowering occurred and the horticultural potential of the plants could be determined.

Hybridization and Seedlings

The successful crosses were made in 1971, using two individuals of *M. grandiflora* as female parents and the National Arboretum's single specimen of the trade form of *M. "cordata"* (NA 3160) as the male

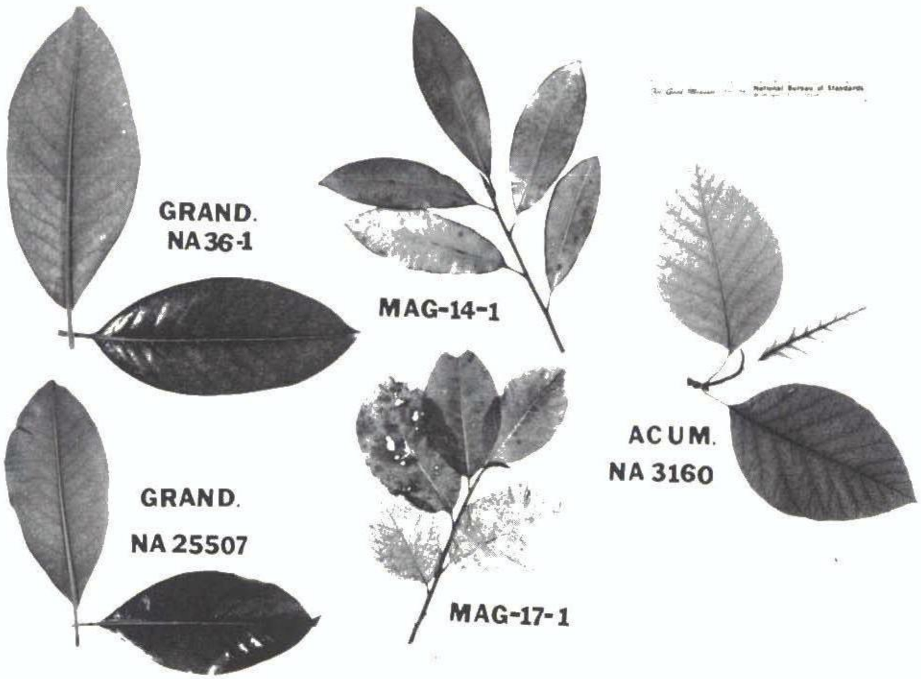

Photo 1. Leaves of parents (Magnolia grandiflora *and* M. acuminata *var.* subcordata) *and of inter-subgeneric hybrids. Scale rule at top right is 6 inches or 15 centimeters.*

Photo 2. Typical flowers of Magnolia grandiflora *NA 36-1 (left) and the hybrid MAG-14-1 (right) with* M. acuminata *var.* subcordata. *Scale rule is 20 centimeters.*

parent. Two flowers of *M. grandiflora* (NA 36-1) were pollinated and both produced mature fruit. Of the 14 seed from these fruit, nine were "sinkers" and appeared viable. However, only one seed of this cross germinated and the seedling was given the pedigree designation MAG-14-1. A single flower of *M. grandiflora* 'Praecox Fastigiata' (NA 25507) was also pollinated. Of the 20 seed produced in the single fruit, five appeared filled but only one seed germinated. This seedling was given the pedigree designation MAG-17-1. Seedlings from open pollination of the *M. grandiflora* parents were also grown for comparison. No seed had ever been produced on NA 3160, and the tree died in 1973.

It was obvious, even from the cotyledon stage, that MAG-17-1 was a true hybrid. Seedling MAG-14-1 did appear slightly different than the open-pollinated progeny of NA 36-1, but looked like it would remain evergreen. Cytological studies of mitosis in the root tips of these seedlings indicated that both were hybrids with 2n=95 chromosomes. Both seedlings were outplanted in the Magnolia test plots in the spring of 1974. The leaves on MAG-17-1 were tardily deciduous while those of MAG-14-1 were evergreen. MAG-17-1 was slow-growing and suffered repeated winter die-back, finally succumbing during the winter of 1977-78. MAG-14-1 has grown well, remained evergreen through our most severe winters, and has been propagated by rooted cuttings. Leaves of the hybrids and their parents are illustrated in Photo 1. The young leaves of MAG-14-1 are ferrugineous-pubescent beneath, but are often nearly glabrous at maturity.

Herbarium specimens of the parents and the hybrids have been deposited in the National Arboretum Herbarium.

Flowering and Meiosis

MAG-14-1 produced three flowers in 1977, its sixth growing season from seed. Five flowers were produced in 1978. Photo 2 shows a 1978 flower of MAG-14-1 compared to a typical flower of its maternal parent, *M. grandiflora* NA 36-1. Floral and meiotic characteristics of parents and the hybrid are given in Table 1. Because of the untimely death of the male parent, some of these data (as noted) were based on a hybrid between *M. acuminata* var. *acuminata* and *M. acuminata* var. *subcordata*. The tepals of the hybrid showed a slight but insignificant increase in carotenoid content and are more creamy-white than yellow.

Table 1

Floral characteristics of *Magnolia grandiflora*, *M. acuminata* var. *subcordata*, and the interspecific (intersubgeneric) hybrid between them.

	M. grandiflora NA 36-1	Hybrid MAG-14-1	*M. acuminata* var. *subcordata* NA 3160
No. tepals	9-12	11-12	6[1]
Tepal size (Largest)	13×10 cm.	10.5×6 cm.	7.5×3 cm[1]
No. Anthers	318	212	96[1]
No. Stigmas	72	44	38
Percent good pollen	96	20	95
Pollen size (microns)	72.9	65.7	48.5

[1]Data taken from a hybrid between typical *M. acuminata* and var. *subcordata*.

Counts of 2n=95 chromosomes made on root tips of seedlings and rooted cuttings were confirmed at meiosis. If autosyndetic pairing among the polyploid parent genomes were complete, there would have been 47 bivalents and 1 univalent at first metaphase. Instead, we found from 9 to 13 univalents. Distribution of chromosomes at anaphase I was roughly equal (45 to 50) but some lagging occurred. Loss of chromosomes was observed at both divisions and about one-third of the microspore tetrads contained "dwarf" microspores formed by one or two chromosomes. The oval pollen grains average 65.7 microns in diameter, but some grains up to 86-93 microns also were found, with the large grains most likely resulting from failure of the second meiotic division. Stainability of the pollen grains with acetocarmine averaged only 20 percent.

Conclusions

Inter-subgeneric hybrids between *M. grandiflora* of subgenus Magnolia and *M. acuminata* of subgenus Yulania are possible. The cross has been successful only when *M. grandiflora* has been used as the female parent. Reciprocal crosses have been attempted, but failed. Even when *M. grandiflora* is the female parent species, the degree of "evergreenness" in the foliage of the progeny may vary depending on the genotype of the specific parent tree. Because of possible "maternal" inheritance of carotenoid flower pigments, the development of yellow-flowered evergreen hybrids may be difficult, if not impossible, to achieve.

Two plants of MAG-14-1, rooted from cuttings in 1974, produced three flowers each in 1979. The capacity to flower at an early age is an extremely desirable horticultural characteristic in an evergreen magnolia, even though the flowers may not be as large as typical *M. grandiflora*. Also, there is a potential for MAG-14-1 to be more cold-hardy than most *M. grandiflora*. For these reasons, we will initiate a modest propagation-testing scheme for more extensive evaluation of this inter-subgeneric hybrid.

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Understock Compatibility

"Stocks, in my experience, don't make too much difference with most *Magnoliaceae*, providing they're hardy where planted. A possible exception is *M. macrophylla*, which I had a few years ago on a branch of *M. acuminata*. *Michelia* should grow on *Magnolia* stocks, either subgenus. Scions that tend to grow faster than stocks are *M. sprengeri* on *accuminata* or × *soulangiana* and *hypoleuca* on *tripetala*. *Stellata* is still doing well on *virginiana*. 'Woodsman' on *stellata*, *sieboldii* on both *virginiana* and *acuminata*, and *virginiana* on *acuminata* or × *soulangiana*. Many more are yet to be tried; there may be some incompatibles but nothing like what we have in *Acer*, *Prunus*, and *Quercus*." —J.C. McDaniel, in Robin No. 4.