Intersubgeneric Hybrids Between M. Grandiflora and M. Liliflora

by Frank S. Santamour, Jr.

In an earlier paper (Santamour, 1979), I reported on the creation of the first verified intersubgeneric hybrids in Magnolia (*M. grandiflora* L. × *M. acuminata* L.). The flower tepals in this hybrid combination did not contain sufficient amounts of the yellow carotenoid pigments, normally present in *M. acuminata* (Santamour and Demuth, 1978), to alter the white color. This result might have been expected on the assumption that carotenoid pigments were associated with plastids and tended to be inherited maternally.

The present paper is a report on the successful production of additional intersubgeneric hybrids with *M. grandiflora*, in which the potential for other-than-white tepals seemed to be greater. The male parent in these new hybrids was *M. liliflora* Desrouss. (=*M. quinquepeta* (Buc'hoz) Dandy) 'Darkest Purple,' a deciduous shrub with deep purple flowers. The pigments responsible for the tepal color in this species are anthocyanins. Anthocyanins are found in the cell sap, and inheritance of these pigments is usually more predictable than carotenoids. In addition, even though the tepals of *M. grandiflora* are white, there are some anthocyanins produced in the filaments of the anthers (Santamour, 1965).

Hybridization and Seedlings. In June of 1969, a single flower each of *M. grandiflora* specimens NA 36-1 and NA 36-2 was pollinated with pollen from *M. liliflora* 'Darkest Purple' (NA 3162). A total of 10 flowers on two individuals of *M. grandiflora* 'Lanceolata' (NA 639-1, 639-2) were also pollinated with 'Darkest Purple' pollen. All of the developing fruit on 'Lanceolata' dropped from the trees before July 16, 1969, but fruit matured on the other two trees. Sixteen filled seed developed in the single fruit of NA 36-2 and 27 seed in the fruit of NA 36-1. These and seed from open pollination of the parent trees were sown on January 21, 1970.

Ten of the 16 seed from NA 36-2 and 22 of the 27 seed from NA 36-1 had germinated by March 23, 1970. Only one seedling showed any signs of posible hybridity in the early seedling stage, and even this plant simply "looked different" from *M. grandiflora* NA36-1 control seedlings. A root-tip chromosome count of 2n=95 confirmed the hybridity of this particular seedling. Thus, we were reassured that some of the progeny were true hybrids and we deferred any further cytological work until the plants were older and had, perhaps, begun to show hybrid morphological features.

The seedlings were kept in containers until outplanting in May, 1973. Planting was in a heavy clay soil at 8-foot spacing.

Chromosome Counts. Even when the plants were 3 years old, at the time of outplanting, there were no discernible "hybrid" characteristics that could be used to distinguish the one known hybrid, or other suspected hybrids, from the non-hybrid *M. grandiflora* seedlings. Therefore, we had to rely on root-tip chromosome counts for verification of hybridity. Some counts were made on root tips taken at the time of outplanting and other counts

were made on rooted cuttings of older trees.

Of the 10 seedlings raised from NA 36-2, none were hybrid and all seedlings had a chromosome count of 2n=114, the normal hexaploid number. We were only able to obtain counts on 20 of the 22 seedlings from NA 36-1, since two of the seedlings died after outplanting. Ten of these 20 seedlings were true hybrids with 2n=95 chromosomes, while the other 10 were non-hybrids. Apomictic seed production is well known in *M. grandiflora,* and this could account for the non-hybrid seedlings. The entire progeny of *M. grandiflora* NA 36-1 × *M. liliflora* 'Darkest Purple' NA 3162 was given the pedigree designation MAG-3, and the individual seedlings were also identified by number. Without cytological analyses, it is doubtful whether we could have identified any of these trees as hybrids.

Growth and Flowering. All of the hybrid plants, as well as the non-hybrids, have remained evergreen and cold hardy in Washington, D.C. Total height and trunk diameter at one foot above ground level were measured at the end of the growing season in 1979, when the trees were 10 years old from seed. The 10 verified hybrids of MAG-3 averaged 14.8 feet in height and 2.7 inches in diameter as compared to non-hybrids (also 10 trees) of the same progeny at 6.9 feet in height and 1.1 inches in diameter. Three other non-hybrid trees from open pollinated seed of NA 36-1 averaged 7.8 feet tall and 1.3 inches in diameter. These data suggest that the genetic combination of *M. grandiflora* and *M. liliflora* shows considerable hybrid vigor, and this may make the hybrids more adaptable to difficult growing conditions.

A single hybrid tree flowered in 1977, at 8 years old from seed. One more tree flowered in 1978, one more in 1979, and two more in 1980. Thus, five of the 10 hybrids have flowered already, although none of the non-hybrids have flowered yet. A comparison of the flower and pollen characteristics of those five hybrids and the parent trees is given in Table 1.

Unfortunately, all of the flower tepals have been white, and the breeder's dream of a red-(or pink-) flowered evergreen magnolia, at least in the first hybrid generation, has not been realized.

Advanced Generation Breeding. Would it be possible to eventually develop evergreen magnolias with yellow or reddish tepals? The varying degrees of pollen abortion observed in the hybrids thus far examined indicate that there may be a slight possibility. Backcrossing the hybrids to the deciduous parent might lead to plants with sufficient anthocyanin or carotenoid pigmentation in the tepals to be "colored." However, the potential

Table 1. Floral characteristics of *Magnolia grandiflora* NA 36-1, *M. liliflora* 'Darkest Purple' NA 3162, and five of their interspecific hybrids.

Tree No,.	No. Tepals	Largest Tepal cm	No. Anthers	No. Stigmas	Percent Good Pollen
NA 36-1	9-12	10×13	318	72	96
MAG-3-2	9-12	7.5×12	279	78	49
MAG-3-3	12	7.5×10.5	234	52	41
MAG-3-7	9-10	9.5×13.5	211	57	30
MAG-3-16	9	6×11	188	43	35
MAG-3-18	9	8.5×11	207	62	20
NA 3162	6-8	5×10	76	42	98

Magnolia 'Galaxy' was introduced by the National Arboretum last year.

loss of the evergreen character might be a problem. Backcrossing to *M. grandiflora* would be counter-productive. Perhaps the method with the highest potential would be intercrossing among the hybrids to develop variable second generation (F_2) populations. In 1979 and 1980, we attempted about 10 inter-hybrid crosses. None of these produced fruit. Some fruit was set, however, to open pollination of hybrid flowers, even though no viable seed was obtained. As the number of flowers available for pollination increases over the years, we will continue our attempts to secure backcross or F_2 progenies with colored tepals and evergreen leaves.

Vegetative Propagation. The female parent, *M. grandiflora* NA 36-1, may be unusual for the species, in that a high percentage of cuttings can be rooted, even from a 45-year-old tree. The hybrids appear to have inherited this desirable characteristic. All hybrids have rooted over 50 percent and a few have shown over 95 percent rooting.

Potential Cold Hardiness. It may be that the *M. grandiflora* × *M. liliflora* hybrids will exhibit greater cold hardiness than presently available clones of *M. grandiflora*. We distributed own-rooted plants of four of the most vigorous and early flowering selections to cooperators in 1981, and will monitor the performance of these plants over the next several years.

Frank S. Santamour, Jr. is Research Geneticist, U.S. National Arboretum, Science and Agricultural Administration, Agricultural Research, U.S. Department of Agriculture, Washington, D.C. 20002.

Literature Cited

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Santamour, Frank S., Jr. 1979, Intersubgeneric hybridization between *Magnolia grandiflora* and *M. acuminata*. Newsl. Amer. Magnol. Soc. 15 (2): 11-13.

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'Galaxy' Takes a Bow

The lovely Magnolia × 'Galaxy' about which you have seen mention from time to time in MAGNOLIA as a hybridization between *M. liliflora* 'Nigra' and *sprengeri* 'Diva,' but without the name, has been officially introduced by the U.S. National Arboretum. Details were published by Frank S. Santamour, Jr., of the National Arboretum in the periodical

HortScience vol. 15(6) December 1980 issue, page 832.

As members know who saw this selection during a tour of the National Arboretum grounds at the AMS meeting in 1977, M. 'Galaxy' is a strong, upright growing tree which resulted from a cross by William F. Kosar in 1963 and which first flowered in 1971.

Its large red-purple flowers are borne in profusion, Frank reports, and open sufficiently late to miss significant frost damage, an inheritance from *M. liliflora.*

The flowers have 11 or 12 tepals, those in the two outer whorls up to 12 cm long by 5.5 cm wide. It is partially sterile. 'Galaxy' has proved adaptable to a number of soil and cultural conditions, is perfectly hardy in Zone 5b and survives with some cold injury in Zone 4a. Cuttings root easily.

Plants were distributed to wholesale nurseries in 1980 and a distribution was planned in 1981 to cooperating arboretums and botanical gardens.

'Galaxy' is the first selection from this hybridization. A few siblings of this cross, planted out in the National Arboretum, seem eminently worthy of introduction, though some may not be perhaps as strongly tree-like as 'Galaxy.'

About 'Gere' and Others

A member wrote recently complaining that he is unable to buy trees of *M. denudata* 'Gere,' a clone that I mentioned previously in MAGNOLIA. Things do not work that fast, but I can report that scions have been sent to the Hetzers at Little Lake Nursery, who do their own grafting, and 'Gere' should appear in their catalog sometime in the future.

Large and smaller wholesalers are propagating some cultivars of interest that local retailers may be able to get now or soon. One of the largest wholesalers is Monrovia Nursery Co., Azusa, California, which usually has two pages of advertising in each issue of the *American Nurseryman.* According to the 1979 Proceedings of the International Plant Propagators Society, *M. grandiflora* 'Little Gem' is one of three *grandiflora* cultivars Monrovia propagates by grafting (along with its own patented 'Majestic Beauty' and the old 'Saint Mary'). *M. grandiflora* 'Samuel Sommer' was featured in a recent advertisement by another California wholesaler, Hines Wholesale Nurseries, Inc. P.O. Box 11208, Santa Ana.

On the east coast, two wholesalers who offer liners of my *M. loebneri* 'Ballerina' are A.M.S. member Peter Vermeulen of John Vermeulen & Son, Inc., Neshanic Station, New Jersey 08853, and Hoogendorn Nurseries, Inc., Turner Road, Newport, Rhode Island. While none of these sells directly to the planter, your retail nursery can order from them—J.C. McDaniel

. . . Short Takes

• In the Spring 1981 issue the name of the author of the root hardiness article on page 12 is Dr. John R. Havis, not Harris, as printed.