Magnolia Chromosomes

by Walter S. Flory

Willis' "A Dictionary of the Flowering Plants and Ferns" (Airy-Shaw, 1966) states that in the Magnolia Family (Magnoliaceae) there are 230 species distributed among 12 genera occurring in temperate and tropical East Asia and America. It also states that the type genus, *Magnolia*, is made up of 80 species scattered from the Himalayas to Japan, Borneo and Java, and from eastern North America to the West Indies and Venezuela. Many of these species, and some of the hybrids involving them, are well known to lovers of flowering shrubs and trees. But it seems evident that a much larger number are unknown or poorly known by most of us, and that the possibilities are good additional species will be found of considerable use and interest. And although a number of *Magnolia* hybrids, including many with beautiful and exotic flowers, are now in cultivation, the possibilities here have hardly been scratched.

Indications in some of the Round Robin letters are that AMS members are becoming ever more interested in hybridizing different species and taxa of *Magnolia*. The same interest is evidenced by articles in other journals, by the entries in nursery catalogues, by reports from horticulturists, and by other reports.

Several years ago Philip G. Seitner prepared an especially interesting and helpful summary article in the AMS Newsletter (July 1968) concerning the intrageneric relationships in *Magnolia* and citing chromosome numbers for many cultivated species.

Whenever hybridizations are carried out with any group of organisms a knowledge of species relationships, chromosome numbers (and types, if possible), and potential parental species is useful in selecting the taxa to be crossed and in suggesting the combinations most likely to be successful. This article attempts to summarize the published information on chromosome numbers in *Magnolia*.

For the chromosome numbers chart (Table 1) the available plant chromosome lists have been consulted. These have included especially the very complete Russian summary "Chromosome Numbers of Flowering Plants" (Bolkhovskikh, Grif, Matvejeva and Zakharyeva, 1969), and Moore's "Chromosome Numbers 1967-71" (1973). In addition, the "Chromosome Number Reports" regularly summarized and reported in *Taxon* by A. Löve have been checked from 1966 through the second issue of 1977. The original references reporting the chromosome numbers listed in

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Table 1. Chromosome numbers reported for Magnolia *species and hybrids.*

Species (and Hybrids)	2n	Reported by (see "References")
acuminata L.	76	TWW, JA
ashei Weath.	38	JA
campbellii Hook. & Thom.	114	JA
cordata Michaux	76	JA
cylindrica Wilson (?)	38‡	FSS66b
dawsoniana Rehd. & Wils.	114	JA
delavayi Franch.	38	JA
denudata Desrouss.	114	KY, JA, FSS70a
foetida Sarg.	114?	Y
fraseri Walt.	38	TWW, JA
globosa Hook. & Thom.	38	JA
grandiflora L.	112-114	TM
	114	JA
griffithii	38	JA
guatemalensis Donn. Smith	38	FSS66b
hamori	38	JA
× highdownensis (M. sinensis × M. wilsonii)	38	JA
kobus DC	38	JA
liliflora Desrouss.	76	TWW, KY, JA
liliflora Desr. ex Lam. 'Darkest Purple'	76	FSS70a
liliflora Desr. ex Lam. 'Nigra'	76	FSS70a
liliflora × stellata	57	FSS69
× loebneri Kache	(38)*	FSS70b
× loebneri (M. stellata × M. kobus)	38	JA
macrophylla Michaux	38	JA
mollicomata	114	JA
nitida	38	JA
obovata Thunb.	38	JA
officinalis Rehd. & Wils.	38	JA
parviflora Sieb. & Zucc.	38	Y
praecocissima	38	KY
× proctoriana Rehd. (M. salicifolia × M. stellata)	(38)	FSS70b
pterocarpa	38	JA
purpurascens	95	KY
pyramidata Bartr.	38	FSS66b
× raffilli (M. Campbellii × M. molli.)	114	JA
rostrata	38	JA
salicifolia (S. & G.) Maxim.	38	JA
sargentiana Rehd. & Wils.	114	JA
schiedeana	114	JA
sieboldii Koch	38	JA
sinensis (Rehd. & Wils.) Stapf	38	JA
× soulangiana Soul. (M. denudata × M. liliflora)	76	TWW, PCN, JA
× soulangiana Soul. 'Alba'	95	FSS70a
'Alexandrina'	95	FSS70a
'Grace McDade'	133	FSS70a
'Lennei'	133	FSS70a
'Lombardy Rose'	123	FSS70a
'Rustica'	152	FSS70a
'Superba Rosea'	95	FSS70a
'Verbanica'	95	FSS70a
sprengeri Pampan.	114	JA
stellata (S. & G.) Maxim.	38	JA
stellata rubra (M. stellata × M. liliflora)	57	JA
× thompsoniana (M. tripetala × M. virginiana)	38	JA
× thompsoniana (Loud) Sarg.	(38)	FSS66a
tripetala L.	38	TWW, JA
tsarogensis Sm. & Forrest	38	JA
× veitchii Bean	(114)	FSS70b
× veitchii (M. denudata × M. campbellii)	114	JA
virginiana L.	38	WEM, TWW, JA
virginiana L. × grandiflora L.	76	FSS69
virginiana L. × obovata Thunb.	38	FSS69
× watsonii Hook (M. obovata × M. sieboldii)	38	JA
wilsonii (F. & G.) Rehd.	38	JA
yulan Crantz	ca. 80	LG

* Chromosome numbers in brackets were actually reported as n numbers, which have here been doubled to indicate the somatic (2n) number.

‡ Questions have been raised about the true identity of the plant now cultivated as *M. cylindrica* and Dr. Santamour also has expressed reservations about the authenticity of the plant material from which his chromosome count was derived (see Vol. X No. 1, spring-summer 1974).

NOTE: Species and hybrid names in above table presumably were those in use when the various reports were made and do not reflect nomenclatural or taxonomical changes made by others since then. It is possible, and even likely, that some species or cultivars may be listed more than once under different names. A few name errors are suspected but no attempt will be made here to guess the correct names.

Table 2. Somatic chromosome numbers reported for Magnolia *taxa.*

2n	Ploidy	Number of Species	Number of Hybrids
38	diploid	32	5
57	triploid	–	1
76	tetraploid	6	1
95	pentaploid	1	4
114	hexaploid	14	1
123		–	1
122	septaploid	–	2
152	octoploid	–	1

Table I are being carried in this article. Where available, the original articles have been checked for corroboration.

The basic (x), or smallest gametic number of chromosomes (found in eggs or sperm of Magnolias) is quite obviously 19, since the smallest number of somatic chromosomes reported for *Magnolia* species is 38. But as the numbers in Table 1 indicate, in addition to diploids with 38 chromosomes there are also *Magnolia* species tetraploids with 76, pentaploids with 95, and hexaploids with 114 chromosomes.

The number of chromosomes in the egg or sperm is often referred to as the number of chromosomes (which may or may not be the same as the x or base number). Since the body cells of a plant develop from a zygote formed by the union of an n number of chromosomes from both the male *and* female parents, it follows that the body or somatic cells of a plant developing from that zygote possess the 2n number of chromosomes. With some redundancy it can then be said that *Magnolia* species are known in which the 2n chromosome numbers are 38, 76, 95 and 114. *Magnolia* species in which 2n = 38 are called diploids (2x) and possess 2 sets of 19 chromosomes; when 2n = 57 the plants are triploids with 3 sets of 19 chromosomes; where 2n = 76 we have 4x (or tetraploid) forms with 4 sets of 19 chromosomes present; and where 2n = 114, the plants are said to be hexaploid, or 6x, since 6 sets of 19 chromosomes occur.

In hybrids the additional chromosome numbers of 2n = 57, 2n = 123, 2n = 133, and 2n = 152 have been encountered. There appear to be comparatively simple explanations for the origins of three of these numbers. The first, 2n = 57, is the expected intermediate or triploid number between the tetraploid *M. liliflora* (2n = 76) and the diploid parent, *M. stellata* (2n = 38). Hybrid plants with 133 chromosomes can be explained by assuming that an unreduced gamete of *M. liliflora* (2n = 76) fertilized a reduced egg of *M. denudata* (n = 57). Further, the 152 chromosomed hybrids may have resulted from the fertilization of an unreduced egg of *M. denudata* (2 n = 114) by a reduced gamete from *M. liliflora* (n = 38).

The 2n = 123 chromosome number for *Magnolia* × *soulangiana* 'Lombardy Rose' is a little more difficult to explain. Dr. Frank S. Santamour, Jr., research geneticist with the U.S. National Arboretum and authority for the 123 count, has furnished copies of his original papers (see under 'References'), and has also sent additional information concerning the situation in "Lombardy Rose' and its relatives. As pointed out elsewhere the parents of *M.* × *soulangiana* are *M. liliflora* (a tetraploid in which 2n = 76) and *M. denudata* (a hexaploid, 2n = 114). The exact intermediate number expected and found in some but not all the hybrids of these parents is 2n = 95.

'Lombardy Rose' and probably some of the other × *soulangiana* varieties are apparently second generation hybrids. Santamour (1970a) found that "failure of the second division, a common occurrence in these hybrids, could lead to the production of pollen grains with about 76 to 114 chromosomes: with modal numbers near 84, 95 and 106." Further, Dr. Santamour writes (letter of November 18, 1977) that the 2n = 123 number "is likely (from) the union of a ± 42 male or female gamete with a ± 84 male or female gamete. I know this adds up to 126, but a little loss is expected and can be tolerated." This would be especially true with polyploids (anything above the diploid level).

Table 2 is somewhat of a summary of Table 1, since it indicates the number of species, and also the number of hybrids, reported and having the several chromosome numbers already mentioned. It is obvious that, of the species on which chromosome reports have been made, the 32 diploids with 38 chromosomes, and the 14 hexaploids with 114 chromosomes predominate. It is also apparent, as might be expected, that triploids, pentaploids, septaploids, as well as an occasional aneuploid - all of which are rare or absent among true species - are more prevalent among hybrids.

It might be anticipated, based solely on chromosome number, that species with the same number would cross more easily than those with different numbers. Of the hybrids listed in Table 2, six have 38 somatic chromosomes, with all parents also being 2n = 38; and two have 114 somatic chromosomes, again with all parents being 2n = 114. However, *M. stellata rubra* (2n = 57) is intermediate in number be-