MALUS

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FROM THE EDITOR'S DESK

This issue is the last issue for me as editor for IOCS. It has been a great experience, one I think everyone should have, at least once in their lifetime. I have learned a lot, both about crabapples and about desktop publishing. IOCS has been fortunate in having a dependable printing company, Modernistic Printers, Cullman, Alabama, as their printers. Modernistic Printers has been very reliable, punctual, and consistently good in the quality of their printing.

The proof readers have been unquestionably helpful in reviewing the material before it went to the printers. In the beginning they were Dr. Thomas L. Green, John Sabuco, and Floyd Swink. Later, others helped, such as John Pair, and Dave Allen. Still others helped on occasion. Next were all the authors. Without their articles, there could not have been anything issued. Some of you helped by finding articles that could be used. The two most prominent helpers were Mike Yanny and Dr. Edward Hasselkus.

For the most part I was able to mail issues of MALUS on a timely basis because of this help. This year, 1997, I was not able to do this. Perhaps, with David Guthery taking over as your editor, he will be able to get the help he needs to maintain a dependable schedule. I hope you will be able to give him the same help you have given to me the last 5 ½ years.

For myself, I intend to remain active with the society, and help in every way that I can, short of being your editor. I look forward to the continued progress of the Society.

FORTY YEARS WITH CRABAPPLES

Philip E.Keenan
Dover, N.H.

I have several passions in life - family first, of course - and one of them has been crabapples. In the decade of the sixties I planted more than 40 crabapples representing more than 20 different kinds, on two acres, in Dover, New Hampshire. In addition, I spent ten years observing and taking notes at all seasons of the year in the Arnold Arboretum crab collection in Jamaica Plain, Massachusetts. Bloom season in May and fruit display in October and November were the two primary seasons, obviously. I have also observed and taken notes of crabapples in the National Arboretum, Washington, D.C. and other gardens around the northeast. I have been a member of the International Ornamental Crabapple Society for several years. I almost wrote a book on the subject, but then another passion overtook the crabs - the wonderful world of wild orchids, which did result in a book (due in 1998 with Timber Press). In view of the editor's dire need for articles then, it may be appropriate to present a summary of a layman's opinion on the subject.

I am very much a believer in and supporter of annual bloom cultivars. Over the years, however, it has been difficult to pin down in the literature which cultivars are annual and which are alternate. These designations have been sadly neglected by many authors. Alan Michael's Fall 1997 article on Pennsylvania crabs points up another difficulty. After emphasizing the value of the many new and improved cultivars (1980's and 1990's), his list of "favorites" includes only three of them, *M.* 'Molten Lava', *M.* ';Golden Raindrops' and *M* 'Adirondack'. My comments also will be confined to older cultivars because of lack of experience with most of the newer cultivars. So with this caveat, let us proceed.

During the sixties in the Arnold Arboretum, many of my favorites unfortunately turned out to be alternate bloomers. One such, *Malus toringoides*, was always outstanding in fruit color, an unusual bi-color combination of red and yellow, with a pear shape yet, considered by E. H Wilson, the Arboretum's great plant explorer and collector of the plant, the best of all *Malus* species for fruit color, to which I heartily agree. Interesting cut leaves and good health are other virtues, but the white flowers are disappointing. A newer and superior cultivar of the species apparently is *M.* 'Bristol'. Other excellent red fruits belong to *M.* 'Mary Potter', named in honor of Charles Sargent's daughter, *M. zumi calocarpa* and *M. sargentii*, all unfortunately alternate

bloomers, but all with excellent white flower shows in the spring. *M.* 'Golden Hornet' was always the best yellow-fruited cultivar in the Arnold Arboretum and in my yard, but it is another alternate bloomer with health problems.

An interesting category among the crabapples involves those with essentially no fruit display. Ordinarily, since good fruiting is arguably the most important virtue of all crabs, one would reject those without this feature. Two exceptions are *Malus halliana parkmanii* and *M. tschonoskii*, the former with pretty, pendulous , semi-double rose-pink flowers with annual bloom, but the least hardy of all crabs in the Arnold Arboretum and in my yard, probably. The latter is wonderful for its distinctive foliage, silvery-gray and tomentose in spring and summer, and spectacular pink-orange, and crimson-purple in the autumn. Upright and relatively narrowly pyramidal in shape (mine is perfectly symmetrical), it does very well here, consistently colorful each fall and healthy. I can imagine a street or driveway border of this, but have never seen or heard of one.

As Michael points out in his article mentioned above, the variety of shapes and growth habits is often overlooked when considering crab choices but shouldn't be. One of the few good weepers - until several recent improvements - was always *Malus* 'Red Jade' a chance seedling introduced in 1953. But again, an alternate blooming habit makes it a little less appealing, but the outstanding symmetrical weeping form warrants continued use. Fiala thinks it not suitable for smaller home gardens, with which I disagree. Two very new weeping cultlivars, *M.* 'Molten Lava' and *M.*'Red Swan', sound as if they will supersede *M.* 'Red Jade' once they get national distribution. Both are healthy and annual bloomers. And speaking of the difference between regions, this crabapple (Red Jade) - like most others as a matter of fact - is apparently afflicted with disease in a few areas, but not all areas. And most people can live with some disease. Only a few cultivars are almost universally condemned on grounds of their disease susceptibility, for examples, Almey, Hopa, Strathmore, and Eleyi.

The Tea Crab, *Malus hupehensis*, also collected by E. H. Wilson for the Arnold Arboretum, from China in 1908, has several things going for it, including attractive vase-shaped structure, thick, leathery, long-lasting leaves that turn yellow-bronze-purple in the late autumn, and small, mostly yellow fruit (in our yard) that attracts more birds than any other crabapple in my collection - during winter - particularly the waxwings, both cedar and Bohemian. Absolutely no disease problems, and fragrant bloom that is annual here but with heavier production every other year, round out the attributes of this fine specimen tree, four of which border our driveway. The waxwings literally live off these trees for a good part of the winter, creating a mess on our parked cars, which to the non-bird enthusiast would be intolerable. Second to the Tea Crab for winter food value is Bob White Crab. The small yellow fruit is the longest lasting of any crabapple that I am familiar with in terms of retaining good color. Most crabs

will lose their color with the first hard frost, hanging on as soft brown fruit all winter. *M.* 'Bob White' retains good yellow color down to at least twenty degrees above zero. The least hardy of our crabapples is the charmingly pretty *M. halliana parkmanii*. Although it has survived for more than thirty years with us in a protected corner of the house, It is an annual semi-double, pendulous bloomer, with few, practically unnoticeable purple fruit and small leaves. Fine as a no-care, small tree if fruit is not important to you. Another structurally interesting crab, a semi-dwarf shrub-tree twice as wide as high, is another species, *M. sargentii*. Several trunks branch from the base of the plant in all directions, producing one of the best of all white flower displays late in the season when almost every other crab is finished. Prolific red fruit is relished by the birds in October, which strip it in a matter of a few weeks time. The only major drawback - you guessed it - is that bane of so many crabapples, alternate habit, in this case completely barren in the off year. In some so-called alternate kinds, there is often partial bloom, but not so with the Sargent. And I mustn't forget one of the most picturesque of all crabapples, noted for its multiple trunks as well as beautifully contrasting red buds and pinkish-white flowers, an exquisite combination seldom equaled in the entire plant world. I am speaking of *M.* x *atrosanguinea*. It was an annual bloomer, too, but tends to be a bit tender and died out eventually with us. There are several other crabs with this delightful contrast in bud color, some new like *M.* 'Luwik', and some old as in *M. floribunda*. A recent Robert Simpson introduction, *M.* 'Ralph Shay', has this combination as well as gorgeous dark, but bright red, medium-large fruits whose color persists as long as any other crab - except *M.* 'Bob White'. The fruits are larger than most ornamental crabs. Alas, this broader than high, horizontally branched small tree is alternate.

Malus 'Donald Wyman' borders on alternate habit but usually makes at least a fifty percent effort year after year. It is a broad tree that needs some room, a relatively slow grower with good white bloom and heavy bright red fruit production that hangs on all winter. Fiala does not rate it highly, but Dirr includes it among his top ten favorites, as I do. The best older deep red-flowered crab is probably *M.* x *purpurea* 'Lemoinei', unequaled for mass display, apparently the most popular of all our red-flowering crabs, of which we have too few, in my opinion. Fiala's newer *M.* 'Orange Crush' is said to be even better. Other old reliables year after year include the cultivars *M. floribunda*, *M.* 'Blanche Ames' (white with yellow fruit), *M.* 'Adams', *M.* 'Dorothea' (healthy here), and the wonderfully fragrant *M. ioensis* 'Prince Georges', all of them annual bloomers.

Disappointments include *M.* 'Royalty', *M.* 'American Beauty', *M.* 'Barbara Ann', *M.* 'Radiant', and many others, for the usual negative reasons.

A word about the literature on crabapples may be appropriate here. My favorite for many years was Donald Wyman's "Trees for American Gardens" (1st edition in 1951 and the 2nd revised edition in 1965), and his smaller paperback devoted entirely to crabs: "Crab Apples for America" published in 1955 by the American Association of Botanical Gardens and Arboretums. Michael Dirr's fine soft cover "Manual of Woody Landscape Plants" included several dozen *Malus* cultivars, but with only black and white drawings. Incidentally, Dirr has a new volume just published - by Timber Press - in color. The editor's father, Arie F. den Boer, authored perhaps the grand-daddy of all crabapple books, titled "Ornamental Crabapples" and published in 1959 by the American Association of Nurserymen. It was my bible throughout the sixties, until the revised edition of Wyman's came along. Long out of print, it suffered in not having color (actually three kinds were presented in color, each of them poorly: *M.* 'Irene', 'Patricia' and *M* x *micromalus*). I was on the mailing list of the late Robert Simpson, longtime owner of the Simpson Orchard Co. in Vincennes, Indiana, who prepared a great little paperback descriptive list or pamphlet on "The Flowering Crabapples" which included some of his introductions, and a recommended list. Today, of course, we have the excellent and definitive "Flowering Crabapples", by the late Father John Fiala, also published by Timber Press in 1995 with copious color, most of which is reasonably good.

THE TAXONOMY OF THE GENUS MALUS

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(Translated by Mr. A. de Boer)

Note: This article is based on the text of a talk presented at the Dendrologendag of October 5, 1978, in the Netherlands, supplemented with literature which had become available since that time.

1. Introduction

Ornamental apples and apples for the retail market have been cultivated for a very long time. Many problems of identification and classification concern old and new cultivated forms. Also when we discuss the taxonomy of the wild *Malus* species, we will see that the picture is obfuscated by old cultivars that run wild and their hybrids with wild plants.

2. Subfamily Maloideae

2.1

Within the family *Rosaceae* we distinguish the subfamily *Maloideae*, which is characterized by a special kind of fruit, the pome. In this case the actual fruit (core), the fully developed ovary that contains the seeds, is either entirely or in part encapsulated in the receptacle. The classification of the *Maloideae* into genera is a controversial issue, which has to be addressed here in order to arrive at a circumscription of *Malus*, if such a thing is at all possible. Some modern American floras contain no other genus than *Pyrus*, which comprises not only *Pyrus*, but also *Malus*, *Sorbus*, and *Aronia*. This is not surprising, as there are hybrids of *Pyrus* and *Malus*, *Sorbus* and *Pyrus*, and *Sorbus* and *Aronia*. This argument is not decisive, as many genera with the *Maloideae* are mutually crossable. See Figure 1. Linnaeus united apples and pears in *Pyrus*. Philip Miller wrote in his Gardener's Dictionary (1768) that he took the liberty to disagree with the learned Linnaeus and that he had the common sense of a market gardener who knows that an apple and a pear cannot be grafted upon each other. If Miller had left the rootstock some leaves and if Rehder had not been convinced by Miller's partly incorrect argument, it might very well be that, in practice, we would speak of *Pyrus* rather than *Malus*. Not only because it would be somewhat unsatisfactory to discontinue this story in the absence of a subject, I would like to defend a distinct genus *Malus* and to distinguish the relevant genera in *Pyrus* sensu lato from *Malus* as follows.

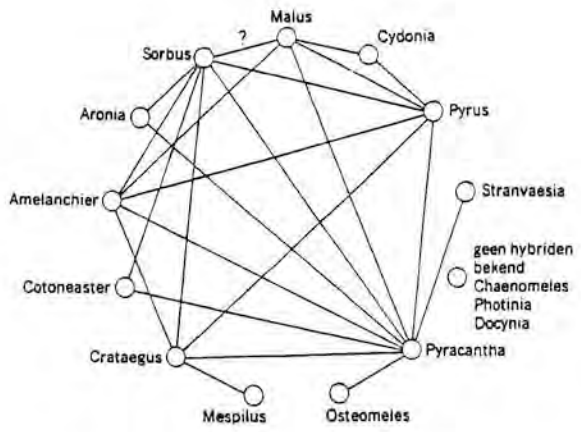

Fig. 1: Genus-mongrels in the *Maloideae*. A connecting line points to the existence of mongrels.

2.2

	Inflorescence	Style	Anthers	Pulp
Sorbus	composite			
Aronia	composite			
Pyrus	simple	free	red, ripening centripetally	with stone cells
Malus	simple	connated	Yellow, ripening centrifugally	without stone cells

Docynia, as *Malus*, but wintergreen and more than two ovaries per ovarian cell.

Thus circumscribed, we can describe *Malus* as follows:

Deciduous shrubs or trees, which are seldom thorny. Simple leaves, sometimes lobed. Flowers in simple umbels. Calyx with claws, light pink or red. Stamens 15-50; anthers centrifugally ripening, yellow. Carpel connated, 3-5, cartilagineous, 2 seeds per ovarian cell. The fruit a pome, no stone cells, roughly circular. Styles 3-5, grown together at the base.

Type: *Malus sylvestris* Miller.

As often, this is a very broad description, and there are many exceptions. *Malus florentina* and cultivars of pears for the retail market sometimes have composite umbels. In case of *M. baccata jackii*, the styles are not grown together. In the *Yunnanensis* series and the section *Docyniopsis*, the fruit contains stone cells, whereas *Pyrus fauriei* has no stone cells. The anthers ripen centripetally in the case of *M. trilobata*, and only one seed per ovarian cell ripens, and *M.* 'Redflesh' has pear-shaped fruits. In order to find a characteristic that applies without exception until now, we need to resort to phytochemistry, see 5.

3. The classification of *Malus*

3.1

Leaf characteristics play an important part above the species level, either lobed or not, folded in the bud or rolled up.

3.2

Species characteristics are often found in the anatomy of the flower (Huckins 1968): number of styles, relative length-ratio of stamen and styles, the form of calyx and corolla, and the color of the flower.

3.3

Fruit characteristics play an important part at species and cultivation level. For section classification the following items are important: whether or not the calyx falls off, and the form of the core and whether or not the core is completely enclosed within the false fruit (see Fig. 5).

3.4

Rehder, Van Eseltine and Henning ground their classification first and foremost on the venation of the leaf, section *Malus* with rolled-in leaves, and the other sections with folded leaves. Further classification rests on the falling off of the calyx, leaf indentation, the lie of the core, and the presence of stone cells in the pulp.

Koidzumi bases the main classification on the falling off of the calyx. He also places a number of sections outside *Malus* in the genera *Docyniopsis*, *Eriolobus*, *Sinomalus*, and *Macromeles*. In this respect, he is followed by, among others, Browicz and Likhonos, who end up with only eight kinds in *Malus*. Langenfeld presents an extremely fine-grained classification, founded on his rather speculative ideas concerning the evolution of *Malus*. The most recent taxonomic work has been done by Huckins, whose work I, regretfully, only know in summary. He especially concentrates on phytochemical and karyological data. I will follow his classification here. See table 2 and the area maps, Fig. 2, Fig. 3, and Fig. 4.

4. Reproduction and karyology

4.1

There are many known hybrids of *Malus* cultivars. Only with *M. trilobata*, which flowers after all other species, no hybridization has ever succeeded. All other cultivars that have been tested hybridize. This means that all plants from hybrid seeds are hybrids. Schmidt has discovered that with *M. hupehensis*, *M sieboldii*, and *M. sargentii* there is apomictic seed formation. Apomixis is a hereditary characteristic with *Malus*. Parts of the seeds will consist of hybrid seed, other parts of apomictically formed seed. With *Malus*, apomixis results from apospory: The embryo sac is not formed after meiosis, but out of a diploid without fertilization. One of the cells of the diploid embryo sac develops into an embryo. So we get a clone out of a seed: the offspring is genetically identical to the mother plant. This explains why *M. hupehensis*, in spite of conscious efforts towards hybridization through cross-pollination with pollen of another species, may return apparently unchanged. This refutes the argument that *M. sargentii* is a good species, because it may return unchanged from the seed.

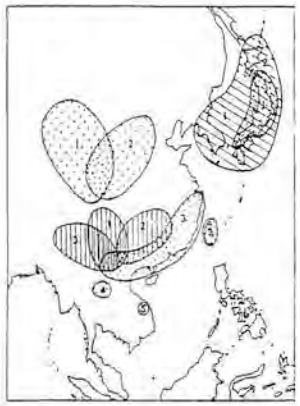

Fig. 2 Areas of the section *Docyniopsis* and the sub-section *Kansuenses* and *Sieboldianae*

Docyniopsis
1. M. tschonoskii (Maxim.) Schneid.
2. *M. formosana* Kawak. & Koidz.
3. *M. melliana* (Hand.-Mazz.) Rehd.
4. *M. laosensis* Chev.
5. *M. doumeri* (Bois) Chev.

Sieboldiana
1. *M. sieboldii* (Reg.) Rehd.
2. *M. sargentii* (Rehd.) Bean

Kansuenses
1. *M. honanensis* Rehd.
2. *M. toringoides* (Rehd.) Hughes
M. kansuensis (Batal.) Schneid.
M. transitoria (Batal.) Schneid.

Yunnaenses
1. *M. yunnanensis* (Franch.) Schneid.
2. *M. prattii* (Hemsl.) Schneid.
3. *M. ombrophiola* Hand.-Mazz.

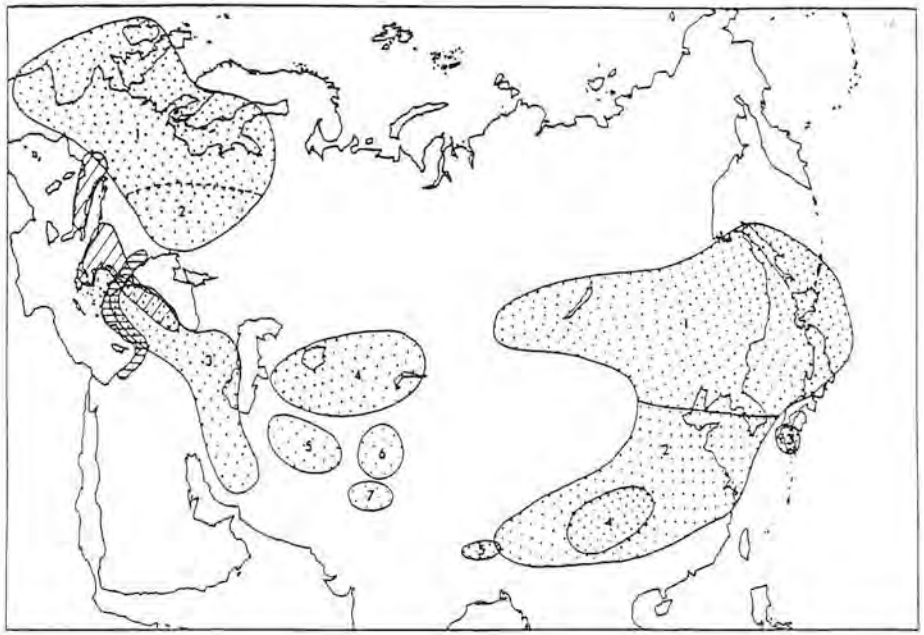

Fig. 3. Areas of the sections *Eriolobus* and *Sorbomalus* and of the sub-section *Malus*.

Baccata
1. *M. baccata* (L) Borkh.
2. *M. baccata* + *M. hupehensis* Borkh.(Pampan.) Rehd
3. *M. spontanea* Mak.
4. *M. rockii* Rehd.
5. *M. sikkimensis* (Wenzig) Koehne

Pumila
1. *M. sylvestris* Mill.
2. *M. praecox* (Pall.)
3. *M. orientalis* Uglitz.
4. *M. sieversii* (Ledeb.) Roem.
5. *M. turkmenorum* Juz. & Pop.
6. *M. kirghisorum* Al. & Theod.
7. *M. chitralensis* Vassilcz.

Eriolobus
M. trilobata (Poit.) Schneid.

Sorbomalus
M. florentina (Zuccagni) Schneid.

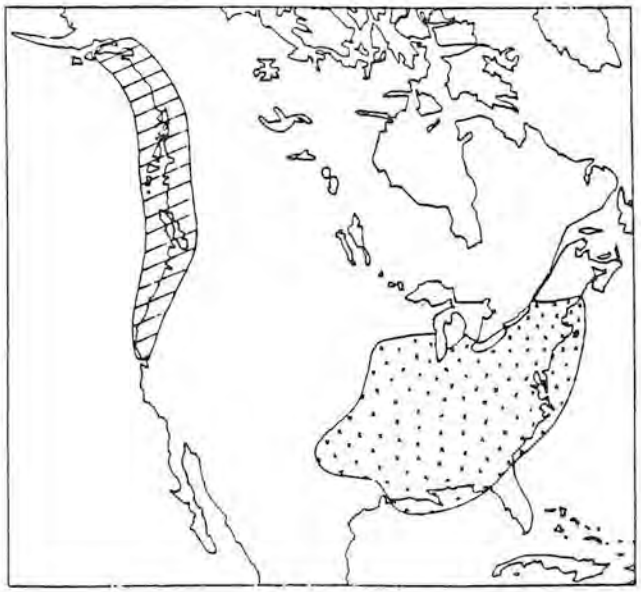

Fig. 4. Areas of the section *Chloromeles*.

M. fusca (Raf.) Schneid.

M. angustifolia (Ait.) Michx.
M. bracteata Rehd.
M. coronaria (L.) Mill.
M. glaucescens Rehd.
M. ioensis (Wood) Britt.
M. lancifolia Rehd.

4.2

The occurrence of relative differences in length of style and stamen (see 3.2) might point to a preference for cross-pollination, as with *Primula* and *Lythrum*, but there is no evidence for this. The open form of the flower does not point in that direction either. "Repeated pollination of apple blossoms with the corollas removed showed that double pollination doubled the seed-formation and that the second pollen is twice as active as the first, which apparently plays the role of 'pioneer pollen'," (Jaarerslag IVT 1978).

The basic chromosome number of the *Maloideae* is x = 17. Most *Malus* species are diploid, so 2n = 34. There is a concentration of tetraploids in the section *Chloromeles*: *M. coronaria*, *M. angustifolia*, *M. glabrata*, and *M. glaucescens* contain tetraploid plants often in addition to diploids. There are also triploids in this group (2n = 51): *M. bracteata*, *M. lancifolia*. Among the *Baccata*, *M. rockii* and *M. sikkimensis* are

tetraploids, with there also being triploids of *M. rockii* and pentaploids (2n = 85) of *M. sikkimensis*. The partly apomictic *M. hupehensis* discussed earlier is triploid. *M. sieboldii* has a very broad spectrum: diploid, triploid, tetraploid (partly apomictic), and pentaploid. Of the *Kansuensis*, *M. toringoides* is tri- and tetraploid. The apple cultivars for the retail market are either diploid or triploid.

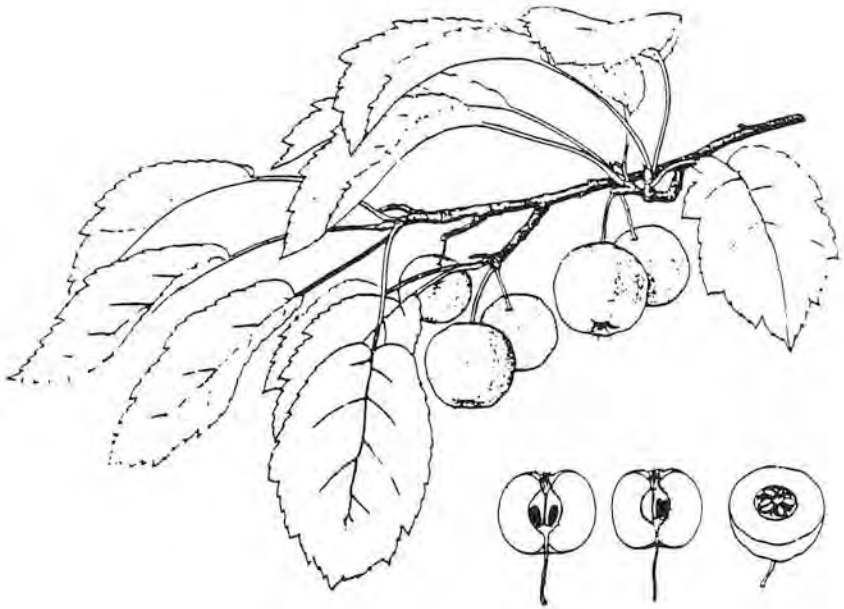

Fig. 5. Malus coronaria (L.) Mill. (Reduced)

5. Phytochemistry

The fruits of *Malus*, and the seed, too, contain prussic acid; they may even emit prussic acid spontaneously. *Pyrus* does not contain prussic acid.

A typical compound for *Malus* is phenol phloridzin. *Sieboldiana* and *Eriolobus* contain closely related compounds. It is thought that the concentration of this chemical is related to scab resistance. Apart from *Malus*, phloridzin has only been found in x *Sorbopyrus malifolia*, which suggests that this is a *Malus* x *Pyrus* cross.

Pyrus contains the phenol arbutin. This chemical may have something to do with resistance against fire blight.

6. Cultivated species.
A number of familiar names is missing from the overview of the wild *Malus species* (see area charts): *M. floribunda* Sieb., *M. halliana* Koehne, *M. spectabilis* (Ait.) Borkh. and *M. prunifolia* (Willd.) Borkh. There are no known wild populations of those varieties. *M. floribunda* and *M. spectabilis* are very old Japanese and Chinese ornamental shrubs; *M. prunifolia* has been used as a fruit tree. There is mention of a wild variety of *M. halliana*, *M. halliana* var. *spontanea*, but Ohwi classifies *M. spontanea* as an independent species.

Likhonos views all cultivars as cultivated plants, and therefore adds them as subspecies of our cultivated apple, *M. domestica*, a proposal we can add as a curiosity to the history of nomenclature.

7. Hybrids
A large number of wild species have has been crossed with cultivated apples, see Table 1.

Table 1. Hybrids of the cultivated apple and *Malus*-varieties

M. x *adstringens* Zab.	*M. baccata* x cultivated apple
M. x *astracanica* Dum.-Cours.	*M. prunifolia* x cultivated apple
M. x *soulardii* (Bailey) Britt.	*M. ioensis* x cultivated apple
M. x *heterophylla* Spach	*M. coronaria* x cultivated apple
M. x *magdeburgensis* Schoch.	*M. spectabilis* x cultivated apple
M. x *dawsoniana* Rehd.	*M. fusca* x cultivated apple

Nothing is known about hybrids of central and southern Chinese varieties. As species like *M. formosana* and *M. toringoides* tend to be used as rootstocks for cultivated apples according to Yü Te-tsun and Yen Chen-lung, I think that hybrids exist. The 'Golden Delicious' is an example of an extremely successful hybrid of a cultivated apple and a wild American variety, presumably *M. ioensis*.

Ornamental apples
The hundreds of ornamental apples that together form the *Malus*-selection originate from a surprisingly low number of species.
M. baccata x *sieboldii* = *M.* x *zumi* (Matsum.) Rehd.
M. baccata x *prunifolia* = *M.* x *robusta* (Carr.) Rehd.
M. baccata x *spectabilis* = *M.* x *micromalus* Makino
M. baccata x *floribunda* = *M.* x *arnoldiana* (Rehd.) , Sarg.
M. sieboldii x *halliana* = *M.* x *atrosanguinea* (Sieb.) Schneid.
M. x *atrosanguinea* x *M.* x *sieversii* 'Niedzwetzkyana' = *M.* x *purpurea* (Barbier) Rehd.
M. x *purpurea* x *ioensis* = *M.* x *denboerii* Krussm.
M. spectabilis x *sieversii* 'Niedzwetzkyana' = *M.* x *eleyi* (Bean) Hesse
M. floribunda x *prunifolia* = *M.* x *scheideckeri* Späth ex Zab.
M. prunifolia x *sieboldii* = *M.* x *sublobata* (Dipp.) Rehd.

But there is one hybrid with two wild varieties as parents:
M. x *zumi*, also occurring in natural conditions. All the other mongrels contain cultivated elements. *M.* x *micromalus* occurs in natural conditions in Korea; it is not clear whether this tree has anything to do with the cultivated "micromalus".

9. A few remarks on some species and cultivars
9.1
The cultivated apple is often referred to as *Malus pumila* Mill. This name, however, refers to the paradise apple or Doucin, a small shrub not higher than two meters, with sweet fruits measuring 3-5 centimeters. *M. pumila* is closely related to *M. dasyphylla* Borkh., a species from the Danube basin and the northern parts of the Balkans. I group the *M. dasyphylla* under the most variable *M. sylvestris* Mill. In my opinion, the proper name for the cultivated apple is *M. domestica* Borkh. *M. sylvestris* (including *M. dasyphylla* and *M. praecox*) and *M. orientalis* have certainly contributed to the origins of the cultivated apple.

9.2
M. x *moerlandsii* J. Doorenbos is the general term for hybrids of *M.* x purpurea and *M. sieboldii*. 'Liset' and 'Profusion' belong to those. Because *M.* x *purpurea* contains sieboldii 'blood' through its parent *M.* x *atrosanguinea*, I consider 'Liset' and 'Profusion' back crosses of a hybrid and one of it parents. According to article H3 of the Code, such back crosses bear the name of the hybrid. This means that the name *M.* x *moerlandsii* is superfluous and a synonym of *M.* x *purpurea*.

9.3
The easternmost representatives of the *Pumila* have been subdivided into four species here. They are, however, closely related, and could perhaps all be grouped under *M. sieversii*. I classify *Malus* 'Niedzwetzkyana' under *M. sieversii*. The red color is spread among the populations. The 'Niedzwetzkyana' has been of prime importance for the origin of many ornamental apples, for example those of the Rosybloom group.

9.4
The *Baccata* are rather variable. There is no downright definition of *M. hupehensis*. America and Europe grow something quite different under the same name. In my opinion, the original material of the Kew herbarium is identical to the European *hupehensis*. In the northern part of its area, *M. baccata* is often called *M. mandshurica, M. sachalinensis* and *M. pallasiana*. It is not quite clear to me what all those names signify, which is why I group then all under *M. baccata*. Likhonos classifies the western American *M. fusca* under *M. baccata*. I see no reason for this. The *M. baccata* with pink flower buds and fruits measuring 2-3 centimeters is not *M. baccata* but *M.* x *robusta*.

9.5
The sub section *Sieboldiana* contains only one most variable species: *M. sieboldii*. This species displays many ploid levels and also apomixis (See 4.1 and 4.3), so that there are a number of more or less fixed standard forms being cultivated. *M. sargentii*, a small shrub with red fruits, is one of those. Ohwi adds *M. sargentii* to the synonymy of *M. sieboldii*, and I follow him in this.

The sharply thorned shrub which passes for *M. toringoides* in nurseries, is a kind of *M. sieboldii*. The real *M. toringoides* can be observed at Belmonte.

9.6.
The *Chloromeles* section only occurs in cultivated form. The flowering time of those American cultivars is weeks after that of the surasiatic ones. Moreover, the flowers smell like violets. *M. ioensis* 'Plena', *M. ioensis* 'Fimbriata', *and M. coronaria* 'Charlottae' are more or less familiar. *M.* 'Kola' is a less well-known cultivar which is certainly worth while. At Belmonte we are specially struck by *M.* 'Okanagan'.

9.7
M. 'Katherine' is a *halliana* seedling with filled flowers, deep pink in the bud and white blossoming. What has been distributed in the Netherlands under the name *M.* 'Katherine' from the wrongly named specimen at Belmonte does not belong to this cultivar.

9.8
M. x *heterophylla* Spach and *M.* x *platycarpa* Rehd. tend to be viewed as hybrids of the cultivated apple and *M. coronaria*. If one considers both plants hybrids of those varieties, the proper name for both would be *M.* x *heterophylla* Spach.

10. Concluding remark
The center of genus *Malus* lies in southern China. This area is closed to us. The last general revision dates back to 1947 (Henning). The hundreds of ornamental apples that are being cultivated are to a large degree derived from older cultivars from northeastern Asia. None of the southern Chinese cultivars have become popular, and they have not been used for improvement either. The late and fragrant blossoms of the American cultivars are hardly encountered in hybrids either.

VON SIEBOLD'S APPLE

A nomenclatory supplement to the taxonomy of the genus *Malus*

In my overview of *Malus*, I used the name *Malus sieboldii* (Regel) Rehd., although I realized that this familiar name rests on a somewhat shaky foundation. Recently the Japanese botanist Hara tripped up this name, so that I can no longer get around the correct name, *Malus toringo* (Sieb.) Sieb. ex De Vriese. The history runs as follows.

In 1848 the Jaarboek van de Koninklijke Maatschappij ter aanmoediging van den Tuinbouw appeared. This book contained Extrait du catalogue et du prix-courant des plantes du Japon et des Indes-Orietales et Occidentales Néerlandais, cultivées dans l'etablissméent de van Siebold & Comp. à Leyde. On page 47 there is an offer of 6 grafted plants for 500 francs each of a recently imported Japanese plant; *Sorbus Toringo* Sieb. There is a description in a footnote: "Arbust nain à feuille florales elliptiques et rameales trilobees. Couvert au premier printemps de fleurs blanches et rosées moins grandes que celles de notre *Pyrus spectabilis*; il est d'un aspect delicieux, en automne il porta des baies jaunes comestibles et tres recherchées par les merles et d'autres oiseaux."*

In 1856 Dr. De Vriese publishes the combination *Malus Toringo* (Sieb.) De Vriese in Tuinbouwflora (the article is unsigned, but authorship is attributed to De Vriese because he was the editor of the magazine).

* Translation: A small shrub, elliptical leaves on the blossoming branches, trilobate leaves, vegetative branches. It is covered with white and pink petals in early spring, which are smaller than those of our *Pyrus spectabilis*. In autumn it carries yellow edible fruit which is highly popular among blackbirds and other birds.

In the 1859 seed list of the Hortus Botanicus in St. Petersburg, Regel publishes the name *Pyrus sieboldii*. Rehder groups this plant under *Malus* in the description of Wilson's Chinese collections: Plantae Wilsonianae (1915). Von Siebold's ornamental apple is now usually known as *Malus sieboldii* (Regel) Rehd. Hiroshi Hara recently brought this to light (Journ. Jap. Bot. 53 (8):233-234, 1978). He also argues that *M. sargentii* Rehd. is a variety of *M. toringo*, something with which I quite agree. I am not convinced by his notion that *M. zumi* (Matsum.) ex Koidz. is a variety of *M. toringo*.

All in all it is obvious now that *Sorbus toringo* Sieb. has validly been published by Von Siebold in 1848. This name has priority over *Pyrus sieboldii* Regel. This means that *Malus toringo* (Sieb.) ex De Vriese is the right name for this ornamental apple. For the sake of brevity the authors can also be cited as (Sieb.) De Vriese.

Formally summarized:
Malus toringo (Sieb.) Sieb. ex De Vriese Tuinbouw-Flora 3: 368. 1856.
Sorbus toringo Sieb. Jaarb. Kon Ned. Maatsch. Aanmoediging v.d. Tuinbouw p. 47. 1848
Sorbus toringo K. Koch Ann. Mus. Lugd.-Bat. 3.41. 1864
Malus toringo (K. Koch) Sieb. ex Carriere Rev.Hort. 1879-71:451.t, 63.
Pyrus sieboldii Regel Ind. Sem. Hort. Petrop. 1858: 51. 1859
Malus sieboldii (Regel) Rehd. Pl. Wilson. 2: 293. 1915

Malus toringo is a name which was formerly used for this species. In a way an old name is restored, In the past, however, this name has been cited as *M. toringo* (K. Koch) Sieb. ex Carr. By the "discovery" of the publications of Von Siebold (1848) and De Vriese (1856) instead of Koch (1864 as *Sorbus toringo*) and Carriere (1870-71) the priority of Regel's name has expired. Von Siebold's name, however, and with it the link with the Dutch nurseries, remains connected to this ornamental apple. The name "toringo" is a little unfortunate in that it is used in Japan for *Malus prunifolia* var. *rinkii*.

IDENTIFYING CRABAPPLE TREES RESULTS AND CONCLUSIONS

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The article "Identifying Crabapple Trees" appeared in the Fall 1996 edition of MALUS {10(2):3}, in which I described my research project to identify crabapple cultivars on the campus of Illinois State University. This project involved following 36 unknown and 10 known cultivars through one growing season (Spring 1996-Fall 1996) by recording various characteristics for each tree. After collecting the data, the identification of each cultivar relied on the use of the IOCS Crabapple Encyclopedia computer program created by John H. den Boer.

The data collected for each tree were as follows:

Qualitative characters:

Flowers:

- bud color
- balloon color
- flower color
- petal apex shape
- petal base shape
- petal position
- calyx pubsecence inside/outside
- calyx color
- hypanthium pubescence
- style color
- filament color
- anther color before anthesis
- anther color after anthesis
- pedicel color
- pedicel pubescence
- fragrance

Qualitative characters: Cont.

Fruit:

- immature fruit color
- ripe fruit color - shaded side
- ripe fruit color - sunny side
- fruit shape - longitudinal
- fruit shape - transverse
- luster of fruit
- wax on fruit?
- pedicel stiffness
- calyx persistence
- fruit persistence
- lenticel intensity/quantity
- lenticel size/distribution
- lenticel color

Leaves:

- color of young leaves
- color of mature leaves
- pubescence of young leaves (top & bottom)
- pubescence of mature leaves (top & bottom)
- leaf shape
- leaf apex shape
- leaf base shape

Tree:

- young tree form (mainly for knowns, planted in Fall 1994)
- mature tree form
- cambium color
- thorn-like spurs?
- branching texture
- branching habit
- mature tree height (estimated)

Quantitative characters:

- leaf blade length and width
- ratio of leaf blade length/width
- petiole
- flower diameter
- petal length and width
- number of flower petals
- inflorescence number
- fruit diameter and length
- ratio of fruit diameter/length
- pedicel length of fruit

The characters were selected, based on what could be determined readily, i.e., my own ability to evaluate the trees. The qualitative characters were more subjective than the quantitative characters; my confidence in taking measurements was greater than my observational judgments considering my limited experience with crabapple cultivars.

The problems encountered in the data entry were numerous. When I began to enter the data into the computer, the program did not have the capability to save files. To make entering the data easier, Den Boer later added this functionality which allowed data to be stored and not erased once the program was exited. I entered all of the data for each cultivar at once and then saved it under the number it had been assigned. In order to see whether the program would identify the trees correctly, I attempted to evaluate my data only from the known cultivars. From this initial test, none of the known trees had a match with the data within the program. Unfortunately, entering all of the data at once later proved to be a waste of time according to the way the program runs. According to Den Boer, the best way to enter the data was by elimination: "Take those characteristics that are the least subject to judgment, such as type of flower, color of fruit, calyx depression, calyx persistence, and then run those data against the database. Keep adding a little at a time until you get the number of names down to about three or less. Then you can add other descriptions you wish until you have it down to one name..." (22 Jan. 1997 electronic mail). Due to time constraints which prevented me from re-entering the data for each tree according to Den Boer's instructions, I attempted to enter the data selectively as suggested by Den Boer for a few of the known cultivars, and still did not get a correct match. I was unsure whether I had entered the data incorrectly or whether there was a problem with my data, so I sent Den Boer a copy of my data for all of the unknown and known trees and asked him to evaluate my data for the knowns. The results of his evaluation appear below, along with the actual names (names correct according to the nursery labeling); Den Boer did not have the correct cultivar names during his evaluation.

Den Boer's Evaluation	Actual name
41: A real mixed bag. Certain characteristics of this crab are unique to Radiant and other characteristics are unique to Kibele	41: Red Barron
42: Another mixed bag. Could be either Guinevere or Royal Scepter	42: Centurion
43: Might be Ormiston Roy, Jewelberry, or Winter Gold	43: Zumi
44: Adirondack or Excalibur	44: David (data were limited)
45: Liset	45: Adams
46: Pinkbud Sargent	46: Floribunda
47: Halliana Spontanea	47: Red Jade
48: Thunderchild	48: Profusion
49: Toringo	49: Sargent
50: If the leaves are often lobed, it is Redbud, else it is Snowdrift	50: Mary Potter

From the analysis made by Den Boer, the problems encountered are most likely due to my data not matching up with data for the trees in the database which were based on Den Boer's observations and various literature. I made my evaluations based on my knowledge of the terminology of plant morphology, and many of the characteristics I chose, unfortunately, were not effective in discrimination between the cultivars. I did not evaluate lobing, leaf margin, flesh color of fruit, or calyx depression, important characteristics which Den Boer pointed out after I had collected the data (19 March 1997 electronic mail). A scoring of the characteristics (e.g., 3 for most important, 2 for somewhat important, and 1 for least important) would have been helpful.

Due to the problems encountered in the evaluation, I was unable to identify any of the unknown crabapple cultivars, the main goal of my research project. I was, however, able to test the effectiveness of the computer program. The differences in my data and Den Boer's data in the program could be, in part, due to environmental influences or different interpretations of some of the characteristics. The goal of the computer program is for novices to be able to identify the cultivars without the aid of an expert, which is difficult when comparison of interpretations cannot be made. The program seemed to be unforgiving for certain characteristics, in that some were either an all or nothing situation, which might not be the case if environmental influences are involved.

I believe that the best way to evaluate the data is to enter all of the data at once, which eliminates the need for the user to know which characteristics are more powerful than others for elimination and would be more forgiving if an error in interpretation were made. The program could then do a 100% match (if one existed), a 90% match, and 80% match, and so on. The closest match would be the most likely candidate. From my understanding, Den Boer has been working on a revised version of the program in which he uses scoring to determine the cultivar similar to the % match concept. I have not used this version but it appears to be working, and he has been able to identify all of the knowns from my data, with the exception of #44 (comes up with both David and White Angel)(2 July electronic mail).

I am unsure whether the problem of crabapple cultivar determination can be solved with a computer program. It seems easier and more efficient to have experts in the field evaluate the cultivars because disagreement of a characteristic determination can easily arise, as well as environmental variations; as stated before, there was little variation allotted in the version of the Crabapple Encyclopedia that I used. The program seems to be unnecessary for experts to use since they have experience in determining the cultivars by physical examination, but if the revised program is effective, it may be of benefit to some crabapple novices in the nursery industry or at arboretums. Having enough time to collect the data over a growing season and then

evaluating the data is an issue; the user must have enough time to do both. At this point, I believe that the easiest solution for identifying crabapple cultivars in the future would be to leave the tags on the trees as soon as they are cloned, perhaps using special tags that are both attractive enough to leave on the tree and that do not hinder its growth. This would not eliminate error that could occur in labeling, but right now it seems to be an easier way for a novice to identify a crabapple cultivar without a human expert.

Acknowledgments

I would like to thank Donald Schmidt, my project adviser, for his guidance throughout the growing season and beyond, and John H. den Boer, for without his help and the Crabapple Encyclopedia, my project would not have been possible.

Editor's Comments:
I wish to thank Ms. Kopetz for all the work she did in evaluating that part of the Crabapple Encyclopedia that was designed to identify crabapple trees. The program design was based on the premise that each crabapple has one or more sets of unique characteristics that will distinguish it from all other crabapples. This turns out to be unworkable. That version has been replaced with one that has several steps in it to arrive at a solution. It does require very complete description of the unknown. The first step identifies the 20 or more crabapples in the database that have the greatest number of characteristics that match the unknown. The second step eliminates those crabapples in the list obtained from Step 1 on the basis of characteristics that would obviously exclude that crabapple from being the unknown., such as one crabapple having white flowers, and the other having red to purple flowers. The third step involves work by the user to make comparison, with the help of the computer program, pair by pair of all the crabapples in the remaining list with the unknown, the user determining which of each pair most nearly matches the unknown. Final scoring is made on the basis of the comparative number of matches each crabapple has when compared with all other crabapples in the list. The crabapple with the highest score is presumed to be the identity of the unknown. The final step is to compare the descriptive information available in the database with that of the unknown to be sure that there is not some characteristic that is so different that the choice is suspect.
Ed.

OHIO'S URBAN FORESTERS WILL NEED 20,000 TREES FOR THE YEAR 2000

T. Davis Sydnor
Daniel K. Struve

Summary:

There continues to be a real need for increased diversity in urban tree populations to counter the threat of massive losses of overplanted species, such as occurred when Dutch elm disease struck the American elm. Insect and disease sprays are rarely an option for most urban foresters in today's political climate. Reasons for the limited numbers of species are identified.

A survey of 27 urban foresters in Ohio was conducted to identify potential demand for nursery stock for planting in the year 2000 and beyond. Survey results were shared with the nursery industry by publishing the results in the August 1996 Educational Update in *The Buckeye*. Results of the survey are being shared with urban foresters so that they might know which plants are being requested and might be available for inclusion on a bid list.

We hope to assist nursery production planning by identifying which of the 127 species and cultivars on the survey form are likely to be requested by urban foresters. Plants likely to be in less demand have been identified as well. Some trees that have been requested are ones that producers might not be growing. The needs identified in the survey might encourage producers to grow some new plants and enable urban foresters to increase biological diversity in the urbanscape.

Introduction:

A survey was conducted to identify the needs of Ohio's cities and towns for the year 2000 and to enhance the diversity of species being planted along Ohio's streets and highways. Akron's recent street tree inventory identified 58% of the treelawn trees as *Acer*, while University Heights had 45% *Acer*. Both cities felt the need to diversify but expressed concern over the difficulty in obtaining less commonly grown trees needed to accomplish the task. We feel that these two comments are representative of the feeling of urban foresters in Ohio's cities and towns.

Common guidelines used to foster biological diversity are:

1. No more than 5% of the trees should be in the same species.
Or:

2. No more than 10% of the trees should be in the same species, no more than 20% in the same genus, and no more than 30% in the same family (10-20-30 Rule).

We endorse the 10-20-30 rule as a benchmark against which to measure the diversity on the urban forest. Based on Akron and University Heights inventories, it is easy to conclude that there is a real need to diversify.

The difficulty in obtaining "unusual" species is easy to confirm and exists for a variety of reasons. For the nursery manager, a common statement is: "No one ever asked for that before." This statement is often used to rationalize the fact that nursery producers feel that they cannot produce a tree for which they do not have an established market. We can all agree that just growing a tree is a risk. There has to be a market for the product. Hopefully, this paper will help the nursery industry to identify potential markets for uncommon trees which they may not be growing at the present time.

Materials and Methods:

Urban foresters were given a paper describing 31 less commonly grown trees. These were trees that had either been raised through the Ohio Production System, or trees that the authors felt had strong potential for use in urban areas. These 31 trees are listed in Table 1 with their common name in bold type. The survey also included more commonly grown trees.

Urban foresters were asked to provide the following information:

* Name and address.
* The size of plant you would normally purchase and an estimate of the total number of trees you expect to plant in the year 2000.
* An estimate of the number of plants of each type you might wish to purchase in the year 2000 for planting in your community.

Forms were then returned to Dr. T. Davis Sydnor, Ohio State University, 210 Kottman Hall, 2021 Coffey Road, Columbus, OH 43210-1085 for tabulation.

Results and Discussion:

The cities of Akron, Bellefontaine, Bexley, Cincinnati, Cleveland, Cleveland Heights, Columbus,. Dayton, Dublin, Elyria, Garfield Heights,Grove City, Lakewood, Maple Heights, Medina, Mount Vernon, Sandusky, Springfield, Toledo, University Heights, Upper Arlington, Westlake, and Worthington as well as the villages of Granville, Leetonia, Mount Gilead, and Terrace Park responded to the survey. A total of 19,700 trees were requested and expected to be planted in the year 2000. Table 1 lists all 127 species and cultivars on the survey form and how many plants were requested of each. Trees with few or no requests were also included. Knowing which species had low demand is as important to a producer as knowing which were in high demand.

There were 31 frequently requested species in 23 different genera. Of the species with 200 or more requests, only the *Acer*, *Fraxinus*, and *Quercus* genera included more than one species (Table 1). Of the eight species and hyhbrids of *Acer* that were heavily requested, four (x *freemanii*, *platanoides*, *rubrum*, and *saccharum*) have been commonly grown in Ohio, while four (*buergerianum*, *campestre*, *ginnala*, and *griseum*) are less commonly grown. *Fraxinus* contained two commonly and one less commonly grown species in the commonly requested species list. *Quercus* contained two species, both of which are grown by Ohio growers.

Other heavily requested species included *Amelanchier* x *grandiflora*, *Carpinus betulus*, *Celtis reticulata*, *Corylus colurna*, *Eucommia ulmoides*, *Ginkgo biloba*, *Gleditsia trianthos*, *Halesia carolina*, *Koelreuteria paniculata*, *Malus* x cultivars, *Ostrya virginiana*, *Platanus* x *acerifolia*, *Pyrus calleryana*, *Syringa reticulata*, *Tilia cordata*, *Ulmus parvifolia*, and *Zelkova serrata*. Only *Celtis reticulata* is not listed in the Ohio Nursery Stock Survey as published by the Ohio Nursery and Landscape Association. The netted hackberry has a particular appeal for urban foresters since it is alkaline soil tolerant and has a mature height of less than 30 feet, which allows it to be grown under power lines for 30 years without pruning for line clearance. Both characteristics are desirable for urban sites.

An interesting result of the survey was the popularity of various genera (summarized in Table 2). There were 3,363 requests for maples of various types, which made *Acer* the most requested genus. This is consistent with maple's current popularity and not unexpected. *Fraxinus* was requested 1,488 times, *Amelanchier* and *Tilia* were requested 1,144 and 979 times, respectively. *Gleditsia*, *Pyrus*, and *Ulmus* were requested more than 700 times each. *Syringa* has been increasing in popularity in recent years and was requested almost 600 times.

The second most requested genus was Quercus, with 1,769 requests. This is surprising, since only two oak species appeared in the most requested species list. Eleven oak species were requested moderately (55-256 requests). Oaks have performed well in urban situations, since they have been long lived and relatively free of serious pests. It is interesting to speculate on the impact of gypsy moth feeding on oak performance in urban areas. Gypsy moth is now established in Ohio. Based on the experience of the eastern United States where the gypsy moth has not been established, oaks will not lose their popularity and will remain serviceable, if properly sited.

Nurseries often find that oaks are less desirable from their perspective, since they may require more time to produce salable plants and lack the marketing advantages of clones. Clones have not been as popular with urban foresters as they are with the general public. Urban foresters are more concerned with service life and maintenance costs than they are with aesthetic characteristics such as fall color and flower color, which are often the basis for clonal selection and marketing.

One thing to remember with oaks is that they are seedling grown. Seed source is important when a plant has a large geographic range. Also, in an urban environment, plants may be grown at the environmental equivalent of the northern or western edge of the species' range. Sawtooth, red, and Shumard oaks must be from northern seed sources to ensure that the seedlings are cold hardy. Pin oak must be from local seed sources to ensure tolerance to Ohio's neutral to alkaline soils. Seedlings from parent trees, which appear to have been native near McMinnville, Tennessee, have been prone to iron deficiency, while seedlings from native Ohio pin oaks have shown resistance to this problem. Ohio's best producers can use seed sources as a marketing tool if they maintain records.

Ulmus is another surprisingly popular genus, with 777 requests. When asked at a recent meeting to predict the most popular genera during the early part of the next century, Davis Sydnor predicted an increase in elm popularity. Perhaps people believe the prediction, but we hope that urban professionals remember that elms were a monoculture in the 1920's. Their extreme tolerance to the stresses associated with urban sites resulted in overplanting early in the century. Elms are no less urban tolerant today than they were 70 years ago. There are many sites where urban tolerance outweighs sensitivity to Dutch elm disease (DED).

The key in proper plant selection is to maximize assets while minimizing liabilities. A disease sensitive American elm would probably last for five years longer than green ash in a truly urban site. Thus the health of the urban forest would be improved, even if the trees eventually died from DED. Of course, DED-resistant American elms are now available and should receive preference for planting in the 1990's.

A number of trees were not requested by urban foresters. Boxelder, sugar maple seedlings, European bird cherry, Chinese chestnut, and Russian olive received no requests at all. Fewer than 30 requests were received for 11 species where specifying named cultivars was not an option. These included redbud, pagoda dogwood, flowering dogwood, Washington hawthorn, star magnolia, white mulberry, wild black cherry, black locust, European mountain ash, David elm, and Wilson's elm. The reasons for the lack of popularity of these plants were not specifically stated, but likely result from poor service life, overplanting, lack of familiarity with the species, or extreme site specificity.

The seedling versus clone debate has been an interesting one. While the survey was not designed to look at this issue directly, some information emerged and is worth noting. Freeman maple, red maple, silver maple, sugar maple, white ash, and green ash clones were heavily requested, while seedlings have less than 30 requests. This might be expected, since the clones of these plants are among the most heavily promoted, and the aesthetic advantages are obviously of interest to urban foresters. Surprisingly, seedlings were requested more than clones for sweetgum, American linden, and littleleaf linden. Aesthetic differences between seedlings and clones are less pronounced for these plants and may account for the result.

One omission in the survey was Osage orange. The survey should have noted thornless male selections rather than the seedlings which appeared. Perhaps clones would have been requested more, as fruit and thorns are real problems for the seedlings in urban areas. Thornless male clones such as 'White Sword' and 'Wichita' will allow us to take advantage of the environmental tolerance and moderate size of Osage orange while avoiding its liabilities.

Cities are not the only customers for production nurseries. Urban foresters may be more discriminating and more concerned with serviceability than the general public. Still, nurseries may want to consider the overall popularity or lack of popularity for these plants when deciding on future production planning for these plants.

Another concern of producers is that they prefer plants that are easy to produce profitably. The Ohio State University is concerned about this, as are commercial producers. Current research programs focus on alternative production techniques for less commonly grown trees.

American Electric Power's (AEP) Smart Tree program is funding Dr. Struve's investigation on production techniques and performance of uncommon trees for urban use. AEP is particularly interested in trees that could be used under power lines with reduced pruning and thus reduced line-clearing costs. Still, AEP understands that growers must know how to grow a tree profitably in order for that tree to be produced

for sale and planted in the urban landscape. Thus, AEP has funded production research.

Trees with scientific names appearing in bold type in Table 1 have been tried in the Ohio Production System (OPS). Results to date have been variable. Most plants respond with vigorous growth, shaving years from traditional production cycles, while other plants perform no better in the OPS system than under standard field production techniques.

This paper has dealt with a variety of issues that have been shared with us over the years. Neither urban foresters nor nursery producers are aware of some of the unusual species that could be grown. Ohio's urban foresters believe that they must increase species diversity. Less common species are difficult to find and purchase. Nurseries need to reduce production risks by growing trees that are in demand. A special need exists for trees that can be grown beneath power lines for 30 or more years without heavy pruning.

Urban foresters, nursery producers, landscape architects, landscape contractors, and utility companies must all understand the need for increased diversity and remain committed to the task. The real truth is that all of us want an improved quality of life; this is especially important for 80% of Ohio's population, as these people live and work in towns and cities of more than 30,000 people.

Table 1. The Numbers of Plants Requested by 27 Urban Foresters for Planting in the Year 2000

The trees are listed alphabetically by species and cultivar. The total number of requested trees is 19,700. Plants whose scientific name is in bold type have been grown in the Ohio Production System. Plants whose common name is in bold type were discussed in the diversity paper given to the urban foresters before they filled in the form.

Expected Need	Scientific Name	Common Name	Family
360	***Acer buergerianum***	trident maple	Maple
603	*Acer campestre*	hedge maple	Maple
0	*Acer* x *freemanii* (seedlings)	**Freeman maple**	Maple
254	*Acer* x *freemanii* CULTIVARS	Freeman maple selection	Maple
268	***Acer ginnala***	Amur maple	Maple
343	*Acer griseum*	**paperbark maple**	Maple
0	*Acer negundo*	boxelder	Maple
72	*Acer palmatum*	Japanese maple	Maple
10	*Acer platanoides*	Norway maple (seedling)	Maple
426	*Acer platanoides* CULTIVARS	Norway maple selections	Maple
95	***Acer rubrum***	red maple	Maple
456	***Acer rubrum*** CULTIVARS	red maple selections	Maple
20	***Acer saccharinum***	silver maple	Maple
59	*Acer saccharinum* CULTIVARS	silver maple selections	Maple

Table 1 Continued The Numbers of Plants Requested by 27 Urban Foresters for Plantng in the Year 2000

Expected Need	Scientific Name	Common Name	Family
0	*Acer saccharum*	sugar maple	Maple
272	*Acer saccharum* CULTIVARS	sugar maple selections	Maple
125	*Acer saccharum nigrum*	black maple	Maple
38	***Aesculus glabra***	Ohio buckeye	Horsechestnut
125	***Aesculus octandra***	yellow buckeye	Horsechestnut
100	*Alnus cordata*	Italian alder	Birch
120	***Alnus glutinosa***	European alder	Birch
1144	*Amelanchier x grandiflora*	**serviceberry**	Rose
41	***Asimina triloba***	**pawpaw**	Custard Apple
70	*Betula nigra*	river birch	Birch
94	*Betula nigra* CULTIVARS	river birch selections	Birch
210	***Carpinus betulus***	European hornbeam	Birch
276	*Carpinus betulus* CULTLIVARS	European hornbeam selections	Birch
62	***Carya cordiformis***	**bitternut hickory**	Walnut
0	***Castanea mollissima***	Chinese chestnut	Beech
55	*Celtis laevigata*	sugar hackberry	Elm
82	*Celtis occidentalis*	American hackberry	Elm
258	***Celtis reticulata***	**netted hackberry**	Elm
180	*Cercidiphyllum japonicum*	Japanese katsura tree	Katsura
27	***Cercis canadensis***	Eastern redbud	Pea
172	*Chionanthus retusus*	**Oriental fringetree**	Olive
25	*Cornus controversa*	pagoda dogwood	Dogwood
60	***Cornus drummondi***	**Drummond gray dogwood**	Dogwood
9	*Cornus florida*	Flowering dogwood (Northern seed source)	Dogwood
105	*Cornus kousa*	kousa dogwood (Northern seed source)	Dogwood
138	***Cornus mas***	Corneliancherry dogwood	Dogwood
318	***Corylus colurna***	Turkish filbert	Birch
10	*Crataegus phaenopyrum*	Washington hawthorn	Rose
232	*Crataegus crus-galli* 'Inermis'	thornless cockspur hawthorn	Rose
90	*Crataegus punctata* 'Ohio Pioneer'	Ohio Pioneer dotted hawthorn	Rose
112	*Crataegus viridis* 'Winter King'	**Winter King green hawthorn**	Rose
30	*Diospyros virginiana*	common persimmon	Ebony
0	*Elaeagnus angustifolia*	Russian olive	Oleaster
194	*Eucommia ulmoides*	**hardy rubber tree**	Eucommia
180	*Evodia daniellii*	**Korean evodia**	Rue
80	*Fagus sylvatica*	European beech	Beech
55	*Fraxinus americana*	white ash	Olive
462	*Fraxinus americana* CULTIVARS	white ash selections	Olive
80	*Fraxinus excelsior*	European ash	Olive
25	*Fraxinus pennsylvanica*	green ash	Olive
549	*Fraxinus pennsylvanica* CULTIVARS	green ash selections	Olive
317	*Fraxinus quadrangulata*	**blue ash**	Olive
344	*Ginkgo biloba*	**ginkgo**	Ginkgo
145	*Gleditsia triacanthos*	honeylocust	Pea
623	*Gleditsia triacanthos* CULTIVARS	thornless honeylocust selections	Pea
140	*Gymnocladus dioicus*	Kentucky coffeetree	Pea
245	*Halesia carolina*	Carolina silverbell	Storax
383	*Koelreuteria paniculata*	**golden raintree** (cold hardy source)	Soapberry
161	*Liquidambar styraciflua*	sweetgum (cold hardy source)	Witch hazel
26	*Liquidambar styraciflua* CULTIVARS	sweetgum (hardy selections)	Witch hazel
40	*Liriodendron tulipifera*	tulip poplar	Magnolia
30	*Maclura pomifera*	Osage orange (thornless males)	Mulberry
92	*Magnolia acuminata subcordata*	**yellow cucumbertree magnolia**	Magnolia

Table 1 Continued The Numbers of Plants Requested by 27 Urban Foresters for Plantng in the Year 2000

Expected Need	Scientific Name	Common Name	Family
47	*Magnolia x loebneri*	Loebner magnolia	Magnolia
40	*Magnolia x soulangiana*	saucer magnolia	Magnolia
5	*Magnolia stellata*	star magnolia	Magnolia
70	*Malus* species	**crabapples**	Rose
604	*Malus* x CULTIVARS	disease resistant crabapples	Rose
88	*Metasequoia glyptostroboides*	Dawn redwood	Redwood
5	*Morus alba*	white mulberry	Mulberry
224	*Nyssa sylvatica*	blackgum	Tupelo
378	*Ostrya virginiana*	American hophornbeam	Birch
120	*Phellodendron amurense*	Amur corktree	Rue
251	*Platanus x acerifolia*	London planetree	Sycamore
50	*Platanus occidentalis*	sycamore	Sycamore
0	*Prunus padus*	European bird cherry	Rose
210	*Prunus sargentii*	Sargent cherry	Rose
15	*Prunus serotina*	wild black cherry	Rose
150	*Prunus serrulata*	Oriental cherry	Rose
59	*Ptelea trifoliata*	**waferash**	Rue
35	*Pterocarya fraxinifolia*	**Caucasian wingnut**	Walnut
30	*Pteroceltis tatarinowii*	**Tartar winged celtis**	Elm
80	*Pyrus calleryana*	Callery pear (seedling)	Rose
620	*Pyrus calleryana* CULTIVARS	Callery pear selections	Rose
175	*Quercus acutissima*	**sawtooth oak** (cold hardy seed source)	Beech
156	*Quercus alba*	white oak	Beech
188	*Quercus bicolor*	**swamp white oak**	Beech
208	*Quercus coccinea*	scarlet oak	Beech
256	*Quescus imbricaria*	shingle oak	Beech
86	*Quercus macrocarpa*	bur oak	Beech
155	*Quercus muhlenbergii*	**chinquapin oak**	Beech
64	*Quercus palustris*	pin oak (local seed source)	Beech
160	*Quercus robur*	English oak	Beech
55	*Quercus robur* 'Fastigiata'	upright English oak	Beech
111	*Quercus rubra*	red oak (cold hardy seed source)	Beech
150	*Quercus shumardii*	Shumard oak (cold hardy seed source)	Beech
10	*Robinia pseudoacacia*	black locust	Pea
125	*Sassafras albidum*	**sassafras**	Laurel
98	*Sophora japonica*	**Japanese pagodatree** (cold hardy source)	Pea
5	*Sorbus aucuparia*	European mountainash	Rose
597	*Syringa reticulata*	Japanese tree lilac	Olive
143	*Taxodium distichum*	baldcypress	Redwood
80	*Tilia americana*	basswood	Linden
115	*Tilia americana* CULTIVARS	American linden selections	Linden
388	*Tilia cordata*	littleleaf linden	Linden
140	*Tilia cordata* CULTIVARS	littleleaf linden selections	Linden
30	*Tilia mongolica*	**Mongolian linden**	Linden
85	*Tilia tomentosa*	**silver linden**	Linden
161	*Tilia tomentosa* CULTIVARS	silver linden selection	Linden
120	*Ulmus* x CULTIVARS	hybrid elm selections	Elm
159	*Ulmus americana* CULTIVARS	disease resistant American elm	Elm
15	*Ulmus davidiana*	**David elm**	Elm
443	*Ulmus parvifolia*	lacebark elm	Elm
20	*Ulmus wilsoniana*	**Wilson elm**	Elm
142	*Viburnum lentago*	**nannyberry**	Honeysuckle
67	*Zelkova serrata*	Japanese zelkova	Elm
220	*Zelkova serrata* CULTIVARS	Japanese zelkova selections	Elm

Table 2. Requests by Genera Where More Than One Taxa is Listed in Table 1 or Where the Genus Comprises 1% or More of the 19,700 Total Requests

Genera	Common Name	Number	Percentage
Acer	maple	3363	17.1
Aesculus	buckeye	163	0.8
Alnus	alder	220	1.1
Amelanchier	serviceberry	1144	5.8
Betula	birch	164	0.8
Carpinus	hornbeam	486	2.5
Celtis	hackberry	395	2.0
Cornus	dogwood	337	1.7
Corylus	hazelnut	318	1.6
Crataegus	hawthorn	444	2.3
Eucommia	hardy rubber tree	194	1.0
Fraxinus	ash	1488	7.6
Ginkgo	ginkgo	344	1.7
Gleditsia	honeylocust	768	3.9
Halesia	silverbell	245	1.2
Koelreuteria	golden rain tree	383	1.9
Liquidambar	sweetgum	182	0.9
Magnolia	magnolia	179	0.9
Malus	crabapple	674	3.4
Nyssa	blackgum	224	1.1
Ostrya	hophornbeam	328	1.7
Platanus	plane tree	301	1.5
Prunus	cherry	375	1.9
Pyrus	pear	700	3.6
Quercus	oak	1769	9.0
Syringa	lilac	597	3.0
Tilia	linden	999	5.1
Ulmus	elm	777	3.9
Zelkova	zelkova	287	1.5
Total of Frequently Requested Trees		17,848	90.6

IOCS DIRECTORS

Front Cover Photo: *Malus parkmanii*
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