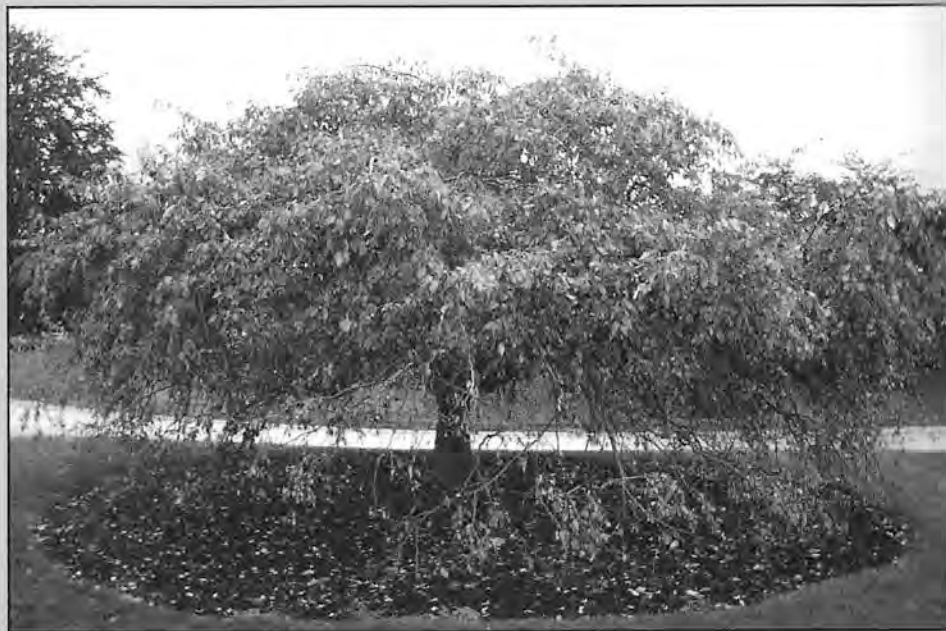


Malus

International Ornamental
Crabapple Society



The showy spring flower display of *Malus baccata* 'Jackii' at the Longenecker Horticultural Gardens, University of Wisconsin - Madison Arboretum. (Photo by Peter Bristol)



Malus 'Red Jade' at the Chicago Botanic Garden. (Photo by Peter Bristol)

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International Ornamental
Crabapple Society
c/o David Allen
The Holden Arboretum
9500 Sperry Road
Kirtland, OH 44094

www.malus.net

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International Ornamental
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c/o David Guthery, Editor
Johnson's Nursery, Inc.
W180 N6275 Marcy Road
Menomonee Falls, WI 53051

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Front Cover Photo: A close-up of *Malus* Royal Raindrops™ dynamic cutleaf, purple foliage. (Photo by David Guthery)

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(Top left) The 1/4" reddish-maroon fruits persist on Royal Raindrops™ crabapple through the end of the year.

(Top right) Royal Raindrops™ crabapple under production at J. Frank Schmidt and Sons Co.

(Bottom) The numerous shapes and colors of leaves and fruit from different crabapple taxa examined in a study by Andrea Tietmeyer and Peter Bristol of the Chicago Botanic Garden. (Photo by Peter Bristol)

President's Corner

On a personal note, the season of 2002 was a great year for crabapple peregrinations as fellow board member Erik Draper and I visited National Crabapple Evaluation Program plots in Minnesota, Illinois, and Pennsylvania. We did a review of the plot at the Minnesota Landscape Arboretum with Mary Rose of the Arboretum and Jim Stolzenburg of Bailey Nurseries and a review of the Penn State University plot with curator Alan Michaels of PSU. Erik and I also visited Princeton Nurseries in New Jersey where we talked with Ivan Olinsky and Andrea Bonneville about a new NCEP test plot they plan on developing there. This will provide a needed eastern U.S. outpost for IOCS.

These visits will be detailed in the next edition of *Malus*, but before I turn to this issue, I must note as well the fun I also had on family vacations where we visited the lovely Crabapple Falls in North Carolina along the Blue Ridge Parkway and Crabapple Elementary School and the Crabapple Government Center in Crabapple, Georgia. I like the sound of Crabapple Government. *Malus* rules!

Speaking of this issue and of peregrination, in this case potential peregrination of crabapple seed, readers should check out Andrea Tietmeyer and Peter Bristol's article on their Chicago Botanic Garden research on the potential invasibility of crabapples. The issue of invasive species, from plants to insects and disease pathogens, is a critical issue for horticulturists and as they indicate, one in which clear standards and research is often heard to find.

Jim Chatfield
President, IOCS
Ohio State University Extension

The Potential Invasibility of Crabapple Varieties and Cultivars in the Chicago Region: A Preliminary Study

by Andrea Tietmeyer and Peter W. Bristol, Chicago Botanic Garden

Abstract

In the northern Illinois area, crabapples (*Malus* sp.) are used extensively in the horticultural trade as a versatile and seasonally interesting small tree. Every year a number of crabapple trees representing numerous varieties and cultivars are introduced into the landscape. The effort to breed and select a tree with abundant small ornamental fruit, disease and insect resistance, and that is adaptable to various climates and soil conditions has potentially increased its capability to become invasive. The purpose of this study was to collect baseline data to assist in the evaluation of the potential invasiveness of this small tree and some of its varieties and cultivars in the Chicago region. Results show that certain taxa have qualities that indeed make them potentially more invasive than others. These results, as well areas where further study is needed, will be discussed. It is hoped that this and subsequent studies will help provide the framework for further research into predicting the potential invasive ability of different cultivars and varieties of horticulturally popular plant species.

Introduction

In the northern Illinois area, crabapples are used extensively in the horticultural trade as a versatile and seasonally interesting small tree. With large displays of spring flowers, good fall leaf color, interesting bark texture, and fruit displays that can last through the winter months, providing color as well as food for birds, there is a lot to recommend the

¹Taken from the International Ornamental Crabapple Society's lists and the Minnesota Landscape Arboretum's lists (2001)

²Chicago region as defined by Swink and Wilhelm (1994) in *Plants of the Chicago Region*, includes the following 22 counties: Walworth, Racine, and Kenosha counties in Wisconsin; Boone, McHenry, Lake, DeKalb, Kane, DuPage, Cook, Kendall, Will Grundy and Kankakee counties in Illinois; Lake, Newton, Porter, Jasper, LaPorte, Starke, and St. Joseph counties in Indiana; and Berrien County, Michigan.

³Dirr's Manual of Woody Landscape Plants

use of this species. The International Ornamental Crabapple Society lists over 800 selections and cultivars of crabapples grown to date, with approximately 200 of these currently commercially available. Each selection or cultivar brings with it a different host of traits. Traits that are often selected for include habit, size, flower color and production, fall leaf color, fruit production & display, and disease resistance. Every year a number of crabapple trees representing numerous varieties and cultivars are introduced into the landscape.

The Chicago Botanic Garden has 13 species and varieties and 80 cultivars of crabapples planted on site, for a total count of 690 individuals. In the fall of 2001, the Garden established an Invasive Species Policy, in which individual species were classified according to their potential level of invasiveness in the Chicago region. Crabapples (*Malus* sp.) were listed as E, for evaluate, a classification designated to taxa with potentially invasive tendencies, and where the risk posed by each cultivar is not known. For species designated E, the policy calls for evaluation of wild type species and cultivars and, ultimately, the removal of any taxon or cultivar determined to be invasive in the Chicago region.

The problem of predicting the invasive ability of a species has been addressed sporadically in the literature since the mid-1960's (Baker 1965, 1974, Roy 1990, Remanjeck & Richardson 1996, Reichard & Hamilton 1997). The National Management Plan formulated by the National Invasive Species Council states "A risk based approach is strongly recommended for both intentional and unintentional introductions because it can provide a standardized process to evaluate the risk of invasive species and their pathways... If done properly, risk assessments can provide a framework where scientific, technical, and other relevant information can be organized into a comprehensive format that is useful to managers, decision makers, and other interested individuals." To date, no proven method has been developed to predict the invasive ability of a given species with 100% accuracy. This makes the problem of predicting the invasive ability of individual cultivars especially difficult.

The purpose of this study was to collect baseline data to assist in the evaluation of the potential invasiveness of this small tree and some of its varieties and cultivars in the Chicago region. The effort to breed and

select a tree with abundant small ornamental fruit, disease and insect resistance, and that is adaptable to various climates and soil conditions have increased its capability to become invasive. Crabapples reproduce via seed, and common dispersers are birds that eat the small fruits and deposit the seeds in new locations. Rodents and other mammals also will transport whole fruits and seeds. Thus, our attention was directed to assessing whether or not seed production and subsequent seed viability differs among different cultivars of this species. It was hypothesized that different cultivars would exhibit different germination levels and allow the authors to rank cultivars by levels of germination. For this, 50 seeds from the fruit of 50 crabapple cultivars in two different locations were collected and germinated under greenhouse conditions in an attempt to quantify average seed production per fruit and percent seed viability by cultivar.

Materials and Methods

The species

The crabapple is circum-boreal occurring in North America and Europe and Asia in north temperature growing zones. There are only 9 species native to North America. Father John Fiala lumps these as varieties of three species: *Malus coronaria*, *M. ioensis*, and *M. fusca*. Both *M. coronaria* and *M. ioensis* occur naturally in Northern Illinois. Most of the interest in crabapples originated after introductions of Asian species from plant expeditions at the end of the 19th and beginning of the 20th century. Members of this genus (*Malus*) tend to be cross fertile and will hybridize freely. It has been found that the number of seeds per fruit ranges greatly between cultivars (using an individual to represent the cultivar), from only 1 seed per fruit to 7 seeds per fruit. Crabapples are alternate bearers, meaning that in some years fruit set will be heavier than in others.

Study Design-Seed Collection and Preparation

Two sources for crabapples were chosen: the Longenecker Horticultural Gardens within the University of Wisconsin Arboretum, Madison, Wisconsin, and the Chicago Botanic Garden. These two sites were chosen because their collections contained plants that were verified true to name. Dr. Edward Hasselkus, Professor Emeritus of Horticulture and a recognized authority on crabapples, developed a verified collection of crabapples at the Longenecker Horticultural Gardens. The Chicago

Botanic Garden's collection was verified by Dr. Thomas Green, formerly of the Morton Arboretum and former Executive Director of the International Ornamental Crabapple Society.

Due to the preliminary nature of this study, the number of cultivars studied was limited to 50 or less. On October 6, 2001, fruit from one individual plant of 27 cultivars at Longenecker Gardens was collected by the authors. On October 12 and 15, fruit from an additional 16 cultivars was collected from the Chicago Botanic Garden. Propagation methods followed protocols from Dirr & Heuser (1987), Young & Young (1992) and Zimmerman (1968). All fruit was put into plastic bags and stored in a refrigerator for a week, then extracted. Seed from each individual fruit was counted and the average of number of seed per fruit was calculated for each variety or cultivar.

Study Design-Germination Trials

Fifty seeds per cultivar were randomly selected, cleaned and stratified for 90 days in plastic bags, by cultivar, with damp sand at 38° F. After ninety days, (on January 16, 2002) all seeds were removed from cold stratification. At that time it was noticed that 35 of the seed lots had at least one seed already germinating, indicating that the seed had received the proper conditions to break dormancy. Counts were taken of already-germinated seedlings and they were then destroyed. The remaining ungerminated seeds were broadcast sown on a FaFard plug mix in an 801 cell pack (4.5" x 4.5") by cultivar, and covered lightly with a 1/8" media layer. The seed packs were placed directly onto bottom heat Biotherm™ tubes set at 70° F, and under intermittent mist running on a cycle of 6 seconds every 20 minutes.

The first seedling counts were performed during a five day period on January 28, 31, and February 1, 2002. During this time, all fully expanded cotyledons were counted, recorded by cultivar, and then removed with tweezers so as not to disturb any of the un-germinated seeds. A second count of all the seed packs was performed on February 11, and the final count on February 25.

Analysis

Averages and standard deviations were calculated among varieties and cultivars for measurements of seeds produced per fruit and percent germination. Chi-square tests for independence were performed to determine where significant differences existed in measures of percent germination between varieties and cultivars.

Results

Number of seeds per fruit

An average of 3.33 ± 1.51 seeds per fruit was recorded among all 43 varieties and cultivars. Extremes were found with *Malus* Canterbury™, which averaged .88 seeds per fruit, while *M.* 'Sutyzam' and *M.* 'Snow Magic' averaged 7 seeds per fruit. (Table 1)

Percent seed germination

Seventy five percent of the 2,078 cleaned, stratified and sown seeds germinated either while in stratification or after sowing. Twenty three percent of the total germinated seed germinated after 90 days in cold moist stratification, and 94% of the total germinated seed had germinated by the first observation date (February 1), which was 16 days after seeds were removed from stratification. All varieties and cultivars but one, *M.* 'Orange Crush', had at least one seed germinated by February 1.

There was a noted difference in percent germination among all 43 varieties and cultivars, with an average of $74\% \pm 25\%$ germination. Seven cultivars, *M.* 'Orange Crush', *M.* 'Mary Potter', *M.* 'Indian Summer', *M.* 'Selkirk', *M. floribunda*, *M.* 'Adirondack', and *M.* 'Red Peacock' had germination rates less than 39%. All other cultivars had germination rates greater than 65%. Chi squared tests showed that these seven cultivars had significantly lower percent germination rates than did all others ($n=1$, $p<0.05$ when $X^2 \geq 3.84$). (Table 1)

Table 1: The forty-three studied cultivars and varieties of *Malus* sp., arranged by percent germination. The seven **bolded** cultivars and varieties had significantly lower percent germination than all others (n=1, p<0.05 when $X^2 \geq 3.84$).

Name	Location	Number of Seeds per Fruit	Percent Germination
<i>Malus baccata</i> var. <i>mandshurica</i>	Longenecker	3.59	1.00
<i>Malus</i> American Spirit™	Longenecker	3.26	1.00
<i>Malus</i> 'Canary'	Longenecker	6.44	0.98
<i>Malus</i> Molten Lava®	Longenecker	4.16	0.98
<i>Malus</i> 'Adams'	CBG	1.51	0.94
<i>Malus</i> Centurion®	Longenecker	5.73	0.94
<i>Malus</i> Christmas Holly®	Longenecker	2.93	0.94
<i>Malus</i> 'Naragansett'	Longenecker	3.60	0.94
<i>Malus</i> 'Snow Drift'	CBG	3.25	0.94
<i>Malus</i> 'Donald Wyman'	CBG	2.34	0.92
<i>Malus</i> 'Pink Satin'	Longenecker	3.16	0.92
<i>Malus</i> 'Coral Cascade'	Longenecker	2.83	0.90
<i>Malus</i> 'Spring Song'	Longenecker	4.40	0.90
<i>Malus</i> Sugar Tyme®	Longenecker	7.00	0.90
<i>Malus</i> Red Jewel®	CBG	4.03	0.88
<i>Malus baccata</i>	Longenecker	3.90	0.88
<i>Malus</i> 'Red Jade'	CBG	4.16	0.86
<i>Malus</i> 'Purple Prince'	Longenecker	3.53	0.84
<i>Malus</i> 'Sinai Fire'	Longenecker	4.43	0.84
<i>Malus</i> 'Strawberry Parfait'	Longenecker	4.16	0.84
<i>Malus baccata</i> 'Jackii'	CBG	2.93	0.84
<i>Malus baccata</i> 'Walters'	Longenecker	2.83	0.84
<i>Malus</i> 'Professor Sprenger'	Longenecker	5.53	0.82

Table 1: The forty-three studied cultivars and varieties of *Malus* sp., arranged by percent germination. The seven **bolded** cultivars and varieties had significantly lower percent germination than all others (n=1, p<0.05 when $X^2 \geq 3.84$).

Name	Location	Number of Seeds per Fruit	Percent Germination
<i>Malus</i> 'Snow Magic'	Longenecker	7.00	0.82
<i>Malus</i> Morning Sun™	Longenecker	3.39	0.80
<i>Malus</i> Pink Princess™	Longenecker	1.00	0.79
<i>Malus</i> Harvest Gold®	CBG	1.71	0.78
<i>Malus sargentii</i> 'Candymint'	Longenecker	1.70	0.76
<i>Malus</i> 'Canterbury'	Longenecker	0.88	0.74
<i>Malus</i> 'Amberina'	Longenecker	2.40	0.72
<i>Malus</i> 'Indian Magic'	CBG	4.63	0.72
<i>Malus</i> 'Prairifire'	CBG	1.92	0.72
<i>Malus</i> 'Prairie Maid'	Longenecker	1.25	0.70
<i>Malus</i> x <i>zumii</i> 'Calocarpa'	CBG	1.64	0.70
<i>Malus</i> 'Profusion'	CBG	3.03	0.68
<i>Malus sargentii</i>	CBG	2.71	0.66
<i>Malus</i> 'Red Peacock'	Longenecker	4.32	0.38
<i>Malus</i> 'Adirondack'	Longenecker	1.12	0.37
<i>Malus</i> floribunda	CBG	2.55	0.30
<i>Malus</i> 'Selkirk'	CBG	4.09	0.24
<i>Malus</i> 'Indian Summer'	CBG	3.44	0.10
<i>Malus</i> 'Mary Potter'	CBG	2.67	0.10
<i>Malus</i> 'Orange Crush'	Longenecker	2.06	0.04

Conclusions

The results of this preliminary study show that there are indeed differences in quantitative characteristics among varieties and cultivars of horticulturally used crabapples. The characteristics measured in this study (% seed germination and number of seed per fruit) may or may not mean an increased invasive potential for certain varieties or cultivars over others. However, species that are considered the most successful invasives often produce high rates of viable seed that have fairly generalized germination requirements. Based on the preliminary results shown here, predictions of potential invasibility may be possible for varieties and cultivars of species in the genus *Malus*.

Future studies will include limiting the number of varieties and cultivars studied while increasing the sample size for each to account for potential individual-level and environmental differences. For each of the chosen cultivars and varieties, a number of additional characteristics that have been highlighted in the literature as potential predictors of invasiveness will be quantified (Reichard & Hamilton 1997). Characteristics to be studied further include:

1. Length of flowering period, as flowering period for invasives is, on average, 1.7 months longer than for non-invasives.
2. Length of fruit display as, on average, seed remains on invasive species 1.9 months longer than non-invasives.
3. Volume of fruit production, as a combination of high fruit production and high seed per fruit counts will dramatically increase the seed rain of an individual.
4. Extent of fruit production over a number of years. This is to equalize fruit-production predictions for these alternate-bearing trees.
5. Seed germination studies will include a number of treatments on seed from fruit collected at different times, as plants with germination requirements that can be fulfilled in a number of different environments are those that are most likely to be invasive.

It is hoped that this and subsequent studies will help provide the framework for further research into predicting the potential invasive ability of different cultivars and varieties of horticulturally popular plant species.

Literature Cited

- (1) Baker, H.G. 1975. Characteristics and modes of origin of weeds. Pages 147-152 in Baker H.G. and Stebbins, eds. *The Genetics of Colonizing Species*. New York.
- (2) Baker, H.G. 1974. The evolution of weeds. *Annual Review of Systematics and Evolution* 5:1-24.
- (3) Dirr, M.A. and C.W. Heuser. 1987. *The reference manual of woody plant propagation: from seed to tissue culture*. Varsity Press, Inc., Athens, GA.
- (4) Fiala, Fr. John L. 1994. *Flowering Crabapples, The Genus Malus*. Timber Press, Portland, Oregon.
- (5) National Invasive Species Council. 2001. *Management Plan, Meeting the Invasive Species Challenge*. January 18, 2001.
- (6) Reichard, S.H. and C.W. Hamilton. 1997. Predicting invasions of woody plants introduced into North America *Conservation Biology* 11(1): 193-203.
- (7) Roy, J. 1990. In search of the characteristics of plant invaders. Pages 335-352 in diCasti, A., J. Hansen, and M. Debussche, eds. *Biological invasions in Europe and the Mediterranean Basin*. Kluwer Academic Publications, Dordrecht.
- (8) Rejmanek, M. and D.M. Richardson. 1996. What attributes make some plant species more invasive? *Ecology* 77:1655-1661.
- (9) Young, J.A. and C.G. Young. 1992. *Seeds of Woody Plants in North America*. Dioscorides Press:Portland, Oregon.
- (10) Zimmerman, R.H. 1968. A Note on *Malus* Seed Germination. *The Plant Propagator* 14(4): 7-11.

Apple Scab on Crabapple at Secrest Arboretum in Wooster, Ohio: 2001

by James A. Chatfield, Erik A. Draper, Daniel A. Herms and Kenneth D. Cochran

Introduction

Apple scab pressure was high at the Secrest Arboretum of the Ohio Agricultural Research and Development Center of the Ohio State University in 2001. Yet, even under this considerable disease pressure, 20 of the 63 taxa showed no evidence of apple scab in 2001 and a total of 30 never received a rating that exceeded 1 (no aesthetic impact) on any evaluation date. Twenty-one taxa received a rating of 3 or higher on at least one date in 2001, indicating substantial defoliation and aesthetic impact (Table 1).

Materials and Methods

Sixty three crabapple taxa were planted in 1997-1998 at the Secrest Arboretum of OARDC (Wooster, Ohio) in a completely randomized design. There were five replicate plants for each taxa with the exception of *M. Brandywine*[®], *M. 'Canary'*, *M. 'Dolgo'*, *M. 'Indian Magic'*, *M. King Arthur*[®] and *M. Royal Scepter*[™], for which there were four replicates, and *M. Hamlet*[®], for which there were three. Plants were mulched with composted yard waste and irrigated as needed during the year of transplanting. Weeds were controlled with spot applications of glyphosate. On 13 June, 9 July, 2 August, and 19 September 2001, all trees were rated on a scale of 0-5, with 0 = no scab observed; 1 = less than 5% of leaves affected and no aesthetic impact; 2 = 5-20% of leaves affected, with some yellowing but little or no defoliation, moderate aesthetic impact; 3 = 20-50% of leaves affected, significant defoliation and/or leaf yellowing, substantial aesthetic impact; 4 = 50-80% of leaves affected, severe foliar discoloration and defoliation, severe aesthetic impact; and 5 = 80-100% of foliage affected, with 90-100% defoliation.

Results and Discussion

Apple scab ratings of crabapples at Secrest Arboretum for the 2001 season are presented in Table 1. Following are key findings.

1. A third of the crabapple taxa in the plot exhibited significant defoliation and substantial negative aesthetic effect in 2001 (Table 1).
2. Despite this level of scab pressure, nearly a third of the crabapple taxa in the plot exhibited no apple scab incidence in 2001 (Table 1). Furthermore, nearly half of the crabapples in the plot did not exhibit aesthetic impact from apple scab in 2001. This data, coupled with similar data from previous years, suggests that landscape managers have the option of selecting a wide palette of crabapples with little or no scab problems.
3. For the second year in row, *M. 'Prairifire'* crabapple did exhibit some scab in the plot, though it was minor. This is of some concern because scab was not seen on *M. 'Prairifire'* for several decades in the current and a former plots at Secrest Arboretum. Though the level of scab was minor on *M. 'Prairifire'*, its presence in 2000 and 2001 raises the question of whether there is a new race of the apple scab fungus (*Venturia inaequalis*) in the arboretum.

Table 1: Apple Scab at Secrest Arboretum in Wooster, Ohio in 2001.

Crabapple Taxon	Sept. 19	Aug. 2	July 9	June 13
<i>M. 'Adams'</i>	3.00kl	3.00gh	2.60ijk	2.60g
<i>M. 'Adirondack'</i>	0.00a	0.00a	0.00a	0.00a
<i>M. American Masterpiece</i> [®]	4.80q	3.60ij	3.00l	2.00f
<i>M. American Salute</i> [™]	3.20lm	3.00gh	1.80gh	2.00f
<i>M. American Spirit</i> [™]	3.20lm	3.00gh	3.00l	2.00f
<i>M. American Triumph</i> [™]	5.00q	3.40ij	2.60jk	2.00f

Table 1: Apple Scab at Secrest Arboretum in Wooster, Ohio in 2001.

Crabapple Taxon	Sept. 19	Aug. 2	July 9	June 13
<i>M. Anne E</i> [®]	1.60ef	1.80c	1.20ef	1.00bc
<i>M. buccata</i> 'Jackii'	0.00a	0.00a	0.00a	0.00a
<i>M. 'Bob White'</i>	0.00a	0.00a	0.00a	0.00a
<i>M. Brandywine</i> [®]	3.50mn	2.25de	1.60fg	2.00f
<i>M. 'Callaway'</i>	0.00a	0.00a	0.00a	0.00a
<i>M. Camelot</i> [®]	0.00a	0.00a	0.00a	0.00a
<i>M. 'Canary'</i>	3.00kl	3.00gh	1.80gh	2.00f
<i>M. Canterbury</i> [™]	0.00a	0.00a	0.00a	0.00a
<i>M. Cinderella</i> [®]	1.60ef	0.00a	1.00de	1.00bc
<i>M. Coralburst</i> [®]	2.00fgh	2.00cd	2.40ijk	1.40cde
<i>M. 'David'</i>	1.00cd	1.00b	0.80de	0.75b
<i>M. 'Dolgo'</i>	0.00a	0.00a	0.00a	0.00a
<i>M. 'Donald Wyman'</i>	2.75jkl	2.00cd	2.00ghi	3.00g
<i>M. 'Doubloons'</i>	3.60nm	3.00gh	1.80gh	1.60def
<i>M. Excalibur</i> [™]	0.40a	0.00a	0.00a	0.00a
<i>M. floribunda</i>	2.25ghi	2.00cd	1.80gh	1.80ef
<i>M. Foxfire</i> [™]	0.00a	0.00a	0.00a	0.00a
<i>M. Guinevere</i> [®]	0.00a	0.00a	0.00a	0.00a
<i>M. Hamlet</i> [®]	0.00a	0.00a	0.00a	0.00a
<i>M. Harvest Gold</i> [®]	3.60nm	3.00gh	3.00l	2.00f
<i>M. Holiday Gold</i> [™]	0.20ab	0.00a	0.25ab	0.00a
<i>M. 'Indian Magic'</i>	4.75q	3.00gh	3.00l	1.50de
<i>M. 'Jewelberry'</i>	4.20op	3.20hi	3.00l	2.00f
<i>M. King Arthur</i> [®]	0.50ab	0.00a	0.00a	0.00
<i>M. Lancelot</i> [®]	1.00cd	1.00b	0.40abc	0.00a

Table 1: Apple Scab at Secrest Arboretum in Wooster, Ohio in 2001.

Crabapple Taxon	Sept. 19	Aug. 2	July 9	June 13
<i>M. Lollipop</i> [™]	0.00a	0.00a	0.00a	0.00a
<i>M. 'Louisa'</i>	0.00a	0.00a	0.00a	0.00a
<i>M. 'Mary Potter'</i>	2.00fgh	2.40def	1.00de	1.80ef
<i>M. Molten Lava</i> [®]	2.20ghi	2.40def	1.00de	1.00bc
<i>M. Pink Princess</i> [™]	1.40ef	1.00b	0.60bcd	0.00a
<i>M. 'Pink Satin'</i>	4.60pq	4.00j	3.00l	2.00f
<i>M. 'Prairie Maid'</i>	0.00a	0.00a	0.00a	0.00a
<i>M. 'Prairifire'</i>	0.60bc	0.60b	0.80cde	0.00a
<i>M. 'Professor Sprenger'</i>	2.75jkl	2.75fg	1.00de	1.50de
<i>M. 'Purple Prince'</i>	0.00a	1.00b	0.50	0.00a
<i>M. 'Rawhide'</i>	0.00a	0.00a	0.00a	0.00a
<i>M. 'Red Jade'</i>	2.20ghi	2.40def	1.00de	1.50de
<i>M. Red Jewel</i> [®]	0.60bc	0.80b	0.25ab	0.00a
<i>M. 'Red Splendor'</i>	2.60hij	2.60efg	1.60fg	1.00bc
<i>M. Royal Fountain</i> [®]	3.00kl	2.80fgh	2.00ghi	2.00f
<i>M. Royal Scepter</i> [™]	4.75q	3.20hi	2.00ghi	1.60def
<i>M. sargentii</i>	0.00a	0.00a	0.00a	0.00a
<i>M. sargentii</i> 'Candymint'	0.20ab	0.60b	0.20ab	0.00a
<i>M. sargentii</i> Firebird [®]	0.00a	0.00a	0.00a	0.00a
<i>M. sargentii</i> 'Tina'	0.00a	0.00a	0.00a	0.00a
<i>M. 'Sentinel'</i>	1.80efg	2.00cd	1.20ef	1.00bc
<i>M. 'Silver Drift'</i>	3.00kl	2.40def	2.00ghi	2.00f
<i>M. 'Silver Moon'</i>	0.00a	0.00a	0.00a	0.00a
<i>M. Sinai Fire'</i>	0.00a	0.00a	0.60bcd	0.00a
<i>M. 'Snowdrift'</i>	4.20op	3.00gh	2.20hij	2.00f

Table 1: Apple Scab at Secret Arboretum in Wooster, Ohio in 2001.

Crabapple Taxon	Sept. 19	Aug. 2	July 9	June 13
<i>M.</i> 'Spring Snow'	4.00no	2.80fgh	2.00ghi	2.00f
<i>M.</i> 'Strawberry Parfait'	0.00a	0.00a	0.00a	0.00a
<i>M.</i> Sugar Tyme®	2.40ijk	2.00cd	1.80gh	1.40cde
<i>M.</i> 'Thunderchild'	3.00kl	2.60efg	1.80gh	1.20cd
<i>M.</i> trans. Golden Raindrops®	0.00a	0.00a	0.00a	0.00a
<i>M.</i> Weeping Candied Apple®	4.80q	4.00j	3.75m	3.00g
<i>M.</i> White Cascade®	4.80q	3.00gh	3.00l	2.00f
Grand Mean	1.74	1.47	1.12	0.93
LSD	0.47	0.42	0.47	0.44

* 0 = no scab observed; 1 = less than 5% of leaves affected and no aesthetic impact; 2 = 5-20% of leaves affected, with some yellowing but little or no defoliation, moderate aesthetic impact; 3 = 20-50% of leaves affected, significant defoliation and/or leaf yellowing, substantial aesthetic impact; 4 = 50-80% of leaves affected, severe foliar discoloration and defoliation, severe aesthetic impact; and 5 = 80-100% of foliage affected, with 90-100% defoliation.

** Means in a column with the same letter are not significantly different (LSD test, $p < 0.05$).

Royal Raindrops™ Crabapple

by Keith Warren

Every now and then a new cultivar comes along which jumps out from the crowd and creates real excitement. *Malus* Royal Raindrops™ seems to be one of those. When I first showed this tree to our sales staff, their collective eyes widened; this was a tree that they saw demand for. True to this impression, we sold out of our first crop almost immediately.

Malus Royal Raindrops™ stands out from the crowd of other crab cultivars with its bright purple-red new foliage, persistent summer color, and superior density of its branches and foliage. Most similar to *M.* 'Prairifire' in overall appearance, *M.* Royal Raindrops™ has a deeper purple summer color, deeply cut foliage, and better branching in the nursery row. And that's impressive, as *M.* 'Prairifire' is by far our largest selling crab.

The story of *M.* Royal Raindrops™ starts with another J. Frank Schmidt & Son Co. introduction, *M.* Golden Raindrops® (see *Malus* Vol. 8, (2), Fall 1994). *M.* Golden Raindrops® has turned out to be a great crab in areas where fireblight is not a disease concern. In warm, high humidity areas where fireblight is a problem, *M.* Golden Raindrops® has proven to be susceptible. Out here in the cool, damp Pacific Northwest, scab is as nasty as it gets, but fireblight is virtually unknown. Here, and in other locations where fireblight is not a threat, *M.* Golden Raindrops® still excels for its glossy cutleaf foliage, its tiny golden fruit, and its heavy bloom display.

The beauty of *M.* Golden Raindrops® and my concern about fireblight induced me to begin a breeding and selection program to improve it. First, I wanted to find a fireblight resistant cultivar holding onto the strengths of *M.* Golden Raindrops®. And secondly, I hoped that I could come up with a purple foliated version of the tree.

In one of my early efforts, I used open pollinated seed from nursery rows. I grew around one thousand seedlings from this seed to

flowering and fruiting stage, and among the seedlings, I found three with purple foliage. I grew these and others on to larger size, propagated them, and planted them out in a test block. These trees were regularly inoculated with scab, and for the first time I had the ability to artificially inoculate with fireblight as well. I kept only the trees with the best resistance to both scab and fireblight. From this group of seedlings, I selected the selection 'JFS-KW5' to be introduced under the trade name *M. Royal Raindrops*[™].

Malus Royal Raindrops[™] features a bright pink, single flower in dense displays. As the flower ages, the petals become cream-pink in the center, with deep pink color remaining at the outer margins. This provides a different appearance, but is just as attractive as the bright pink of the newly opened flowers. As the foliage emerges, it is deep purple in color and deeply lobed to the point of being "cutleaf" (but not cut quite as deeply as its parent, *M. Golden Raindrops*[®]).

In mid-summer, *M. Royal Raindrops*[™] is a real standout. It develops a canopy with better density than other purple foliaged crabs. Its foliage color is significantly deeper and brighter than *M. 'Prairifire'*, the most comparable tree in the nursery. And its high degree of scab resistance means that the foliage stays on the tree. Combining this with its high level of fireblight resistance means this is one of the toughest crabs around.

In fall, its tiny, 1/4" fruits color maroon red and persist on the tree until the end of the year. Another advantage of *M. Royal Raindrops*[™] is that it develops an attractive orange fall color, an unexpected bonus among crabs. And in winter, it displays smooth, purple-brown bark which is more attractive than most crabs. Truly a tree for all seasons, *M. Royal Raindrops*[™] is certainly one of the most promising new crabs I have seen.

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Wooster, OH 44691
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(440) 256-1110

Editor

David Guthery
Johnson's Nursery, Inc.
W180 N6275 Marcy Rd.
Menomonee Falls, WI 53051
(262)252-4988

Publisher

Jackie Wencka
Johnson's Nursery, Inc.
W180 N6275 Marcy Rd.
Menomonee Falls, WI53051
(262)252-4988

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A comparison of *M. Royal Raindrops*[™] and *M. 'Prairifire'* for heat coloration. (Photo by David Guthery)



Jim Chatfield displays the power of crabapples at Crabapple, Georgia. (Photo by Erik Draper)