TITLE: **Evaluation of the Crabapple (*Malus*) Collection and Assessment of the Crabapple Slope**

AUTHOR: **Micah Christensen**

The Charles C. Holman Endowed Rose and Flower Garden Intern

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ABSTRACT:

This project began in response to space on the slope for more crabapple trees and a need to evaluate the current crabapple collection. As such, this project examined the collection as a whole with special attention to the slope. The Morris Arboretum had 48 crabapple trees as of 2018. The vast majority were planted in two locations: the slope by the rose garden and on the farm between the community garden and the executive director's residence. The initial examination of the collection showed only two native crabapple specimens (*Malus coronaria*) both with a provenance of Maryland. Propagation of a tree with more local provenance was done to improve and expand the *Malus* collection. The four parts to this project included development and implementation of evaluation criteria, soil testing of the slope, recommendations of crabapple cultivars to fill empty spaces on the slope, and propagation of a native crabapple (*Malus coronaria*) with local provenance.

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BACKGROUND

Crabapples are in the genus *Malus* along with common culinary apples. The difference between crabapples and apples is simply size. Crabapple trees produce smaller fruit than apple trees. Generally, two inches is considered the cutoff between crabapples and apples (Hinkamp). The Morris Arboretum's *Malus* collection included 48 trees in 2018 including: 'Rambo' (a culinary apple), many ornamental crabapples, some straight species crabapples, and two native wild collected *Malus coronaria* hybrids. The vast majority were planted in two locations: the slope by the rose garden and on the farm between the community garden and the executive director's residence.

An initial look at the collection to form the plans for this project showed a lack of native crabapples (*Malus coronaria*). Our only specimens were two very young *Malus coronaria* hybrids with a provenance of Beltsville, Maryland. Since *Malus coronaria* is native to southeastern Pennsylvania as well, this project included a wild collection from Willistown Township, Pennsylvania to improve and expand the *Malus* collection.

Nearly all of the dwarf ornamental cultivars are growing on display for the public on the slope. When the slope was designed, cultivars noted for high disease resistance were selected; however, now it has become apparent that many of the cultivars are either less resistant in our area or the diseases have adapted significantly. This presented an opportunity to begin evaluating our collection. In addition, the wet weather throughout 2018 increased disease pressure making it clear which cultivars truly had high disease resistance—unfortunately this included only a few trees on the slope. The evaluation results were used to help inform new cultivar recommendations. In preparation for planting additional crabapples, this project included testing the soil on the crabapple slope.

METHODS

Evaluation of the Collection

Evaluation criteria and methods had to be developed simultaneously with conducting the first evaluation of the collection since the crabapple trees were already losing their leaves due to disease when this project began in mid-August 2018. This led to differences in the data collected for the first evaluations compared to the final evaluations. For example, the first two evaluations recorded only the estimated percentage of disease covering an average leaf and the estimated percentage of canopy coverage or leaves still left on the tree.

Since ornamental crabapples tend to be grown almost entirely for their spring flowers, and the slope is intended to showcase disease resistant cultivars, the crabapple collection was evaluated for categories related to flower quality, disease and pest resistance, and aesthetic fruit value. Early on this was recorded and evaluated as flower quality, fruit quality, fruit color, aesthetic foliage value, overall disease and pest resistance, and overall specimen health. The evaluation criteria were later streamlined to hopefully allow the whole collection to be evaluated in just a couple hours using a rubric with just four categories developed over the course of several evaluations.

Propagation of Malus coronaria

Propagating a native wild crabapple with local provenance first required finding a nearby *Malus coronaria* tree. Tim Block, Ph.D., director of botany at Morris Arboretum, was consulted and knew of three potential locations. One location was along the Wissahickon Trail between Dekalb Pike (US 202) and North Wales Road—probably around GPS coordinates 40.186333, -75.275833. Another location was along the edge of a field along the Perkiomen Creek just upstream from the East Greenville Water Authority facility at approximately 40.409038, -75.521107. The third location was a parking lot for a soccer field by Willisbrook Preserve in Willistown Township.

Due to unforeseen circumstances, Dr. Block was unable to come on the collection trip. To avoid possibly collecting from the wrong crabapple tree, the third location was chosen. The tree was unmistakable since it was growing by itself on the edge of a soccer field parking lot by Willisbrook Preserve (Photo 1). Plenty of crabapple fruits were collected along with two small branches for herbarium specimens. The collection form (Figure 1) is included in the APPENDIX. Other *Malus* species were noted in the area and likely pollinated the collected fruit, so the resulting trees from this propagation project have been accessioned as *Malus coronaria* hybrids. The branches were placed in a field press and later given to Dr. Block for mounting.

Photo 1. Wild *Malus Coronaria*

Once collected, the fruits were placed in a plastic bag for partial fermentation. Initially, the fruits did not begin fermenting likely because they were stored outside in the cold. To speed up the process, the fruits were brought inside and some water was added to the bag. Once the fruits began softening, they were mushed inside the bag and fermented about a week longer.

The seeds were removed and cleaned with direction from Shelley Dillard, Morris Arboretum propagator. Unfortunately, there does not seem to be a good way to clean crabapple seeds with James A. Young and Cheryl G. Young's Seeds of Woody Plants in North America even describing the process as "accepted, though cumbersome" (219). Strainers of various size mesh were used to remove much of the pulp and skin (Photo 2). The rest was removed by running water into a large container with the seeds and fruit debris. The fruit debris was carefully rinsed out; however, many of the seeds were still within the endocarp and had to be removed by hand. Once cleaned, the seeds were soaked in water overnight.

Photo 2. Cleaning Crabapple Seeds

Seeds with imperfections or that appeared damaged were removed leaving 110 seeds. These seeds were accessioned as 2018-203*# *Malus coronaria* (hybrid) and divided into three treatments. Each treatment was given a different length of cold stratification since there were plenty of seeds and sources did not agree on the recommended stratification time. Various sources recommend between 1 month and 4 months of cold stratification (Crossley, Plants for a Future, Lady Bird Johnson Wildflower Center, University of Florida). Each treatment was placed into a separate Ziploc bag with moist perlite and placed in the fridge for cold stratification on Dec 6, 2018. The bags were checked by Vinnie Galatolo, Morris Arboretum propagation intern and Shelley Dillard at the beginning of each month for correct moisture level and any early germination. The first bag was cold stratified for 2 months; the second bag was cold stratified for 3 months; and the third bag was cold stratified for 4 months.

As each treatment was removed from cold stratification, it was sown in the mist house into *Trichoderma* treated soilless medium composed of two parts Fafard 4M soilless medium and 1 part perlite. Other *Malus* species propagated at Morris have germinated quickly—often even in the fridge during stratification (Morris Arboretum Greenhouse Propagation Records). *Malus coronaria*, however, might take longer to germinate as Plants for a Future lists the germination time as 12 months or longer. In contrast, Crossley lists a 93% germination rate after just 30 days for stratified *M. coronaria* seeds.

RESULTS and DISCUSSION

Evaluation of the Collection

Initial evaluations showed that including a few extra categories greatly increased the amount of time needed to evaluate the entire collection. Early on, overall specimen health, fruit color, and many notes were taken. These non-essential categories were removed. The criteria categories settled upon were: flower quality, fruit quality, foliage appearance, and disease and pest resistance. It was decided to evaluate foliage appearance separate from disease and pest resistance because fire blight and certain caterpillars are serious without affecting overall appearance as much as foliar diseases.

A rubric (Table 1) was developed with a 0-4 scale where 0 represents dead or none and is included in the APPENDIX. The rubric uses a 0-4 scale where 0 represents none or dead. This allows typical specimens to be rated from 1-4 removing the tendency to frequently rate specimens as exactly average. Over time the compiled evaluations should show which cultivars are consistently excellent.

Originally this project only included the crabapples on the slope. When it was expanded to include the whole collection, some of the specimens were a challenge to locate. Once located, finding the specimen on the evaluation form also took some time because the specimens were sorted alphabetically often causing the accession number to be the only way to distinguish between adjacent rows. Additionally, because the crabapples are meant to be aesthetically pleasing rather than for production, the crabapples are not growing in straight lines. Efficiently weaving through the whole crabapple collection without missing a specimen or coming to the same specimen more than once can be challenging.

Maps, pictures, and evaluation forms were created to address these difficulties and to hopefully allow someone new to Morris Arboretum or unfamiliar with the crabapple collection to easily and efficiently evaluate the whole crabapple collection. Maps were provided by Elinor Goff and mark paths connecting each specimen along with notes were added. The pictures are labelled to help interpret the maps more easily. The evaluation form was sorted to include the specimens in the order they are encountered following the maps. These resources are saved to the shared drive under {S:\Morris\Horticulture\NoBackups\Crabapple\Micah Project} in the "Evaluations Materials" folder.

Evaluating the crabapple slope is only essential at a few key times of year: spring for flower quality, late summer until just after first frost for foliage appearance and disease and pest resistance, and fall for fruit quality. While losing leaves, the crabapples should be evaluated about once every 1-3 weeks for foliage appearance and disease and pest resistance. The fruit is best evaluated slightly later as some of the cultivars just have green fruit until it ripens late—though *Malus* 'Centzam' CENTURION fruit looks amazing early and then fades to a dull easily overlooked color well before many of the other cultivars. During the middle of summer and winter, it is not worth evaluating the collection.

The final evaluations of the season on Sept. 24, 2018 and Nov. 4, 2018 showed *M. sargentii*, *M. baccata*, *M. sieboldii*, *M. hupehensis*, *M. halliana*, *M.* x *purpurea* 'Eleyi', *Malus* 'Sutyzam' SUGAR TYME, *Malus* 'Jewelberry', *Malus* 'Centzam' CENTURION, *Malus* 'Bob White', and *Malus* 'Mary Potter' had high disease resistance based on holding their leaves into the fall as well as an absence of fire blight (Table 2 in the appendix). It is worth noting that only one of the four *M. sieboldii* in the collection scored a 4 in both foliage appearance and pest and disease resistance because this species seems to be more susceptible to fireblight. Also, earlier in the season (Sept. 14, 2018), *M.* x *purpurea* 'Eleyi' only scored a 2 for both foliage appearance and disease and pest resistance. Including *M.* x *purpurea* 'Eleyi' as a highly disease resistant cultivar may be incorrect. Other conclusions are less useful from the evaluations at the time of this report as the large majority of cultivars had similar quality attractive fruits and this project ended before the crabapples flowered.

While evaluating the *Malus* collection, the closer look led to the discovery and correction of a minor database error with Malus 'Auberina' now correctly listed and labeled as Malus 'Amberina'.

Crabapple Slope Soil Test

Soil samples were taken following the "Soil Test Information Form" for Penn State's soil test kit. The top of the slope has been regraded over the years—most recently in 1993 for the addition of the loop path—and fill soil was potentially added in the process (*pers. comm.* Elinor Goff, Vince Marrocco, and Bob Gutowski). Two separate composite soil samples were taken from the crabapple slope in case fill soil had an impact. Each composite sample was composed of 17 individual samples taken to 8 inches deep with a soil sampling tube. The soil seemed to be either shallow or just very rocky. One composite sample was from the top of the slope where fill soil may have been added in the area between *Malus* 'Amberina' (1993-130*A), the service road, and *Malus* 'Indian Summer' (1983—150*B). The second composite sample was taken from the rest of the slope using the existing crabapple trees as the boundaries and considering *Malus* 'White Angle' (1977-032*A) as a part of the Baxter Garden rather than the crabapple slope. The individual samples were mixed into their respective composite samples and mailed with completed "landscape plant" category forms to Penn State for testing.

The soil tests showed a difference between the soil at the top of the slope compared to the rest of the slope (Table 3). The top of the slope had a pH of 6.4 compared to a pH of 5.5 for the rest of the slope. The top of the slope also had 2.375 times more magnesium and 0.62 times as much phosphorus. Differences in the soil pH between the top and rest of the slope were expected from past construction and regrading projects. The large difference in magnesium levels was less expected but does match past soil tests along the service road in other sections.

The Penn State Extension report recommended amending the whole slope with 3.5 lbs per 100 square feet of 5-10-10 and 0.5 lbs per 100 square feet of 0-46-0. The report also recommended amending just the lower section of the slope with 11 lb/100 square feet dolomitic limestone alone or 11 lb/100 square feet calcitic limestone along with 1 lb/100 square feet of Epsom salts (MGSO4) in order to raise the pH, calcium, and magnesium levels.

Recommended Cultivars for the Crabapple Slope

The crabapple trees already on the slope as of 2018 were chosen for their reported disease resistance. Following this precedent, recommendations for additional trees placed a high importance on disease resistance. Other considerations included cultivars particularly suited for homeowners, cultivars with interesting stories, and cultivars with particularly early or late flowering.

Since many of the cultivars in the collection were purchased as disease resistant but have not performed that way, disease resistant straight species in the collection were used as guides for recommendations. The evaluations of the collection from 9/24/2018 and 11/2/2018 were used to identify the more disease resistant species and cultivars as the evaluation methods and rubric were well developed by that point. Cultivars already growing on the slope were not considered for recommendations of additional trees. The species or cultivars with high disease resistance considered for the slope included *M. sargentii*, *M. baccata*, *M. sieboldii*, *M. hupehensis*, *M. halliana*, and *Malus* 'Mary Potter' (Table 2 in the appendix).

Google searches were conducted to discover whether cultivars existed for the more disease resistant species. Other searches were conducted to look for cultivars that are fruitless, self-fertile, multi-purpose, particularly colorful in the fall, and/or historical. Once potential

cultivars were found, Morris Arboretum's Collection Connection was referenced to ensure the cultivars were not grown before and removed for disease problems. For example, *Malus* 'Prairifire' is known for excellent fall foliage but was grown at Morris and removed because of problems with apple cedar rust. After considering disease resistance, mature size, historical value, and multi-purpose uses, the recommended cultivars include *Malus sargentii* 'Parrsi' PINK PRINCESS, *M. sargentii* 'Tina', *Malus* x 'JFS-KW5' ROYAL RAINDROPS, *Malus* 'Whitney', and *Malus* 'Hewes' as the most highly recommended for the slope.

Searching for cultivars with particularly early or late flowering times was unsuccessful. Agricultural apple cultivars are carefully noted for their blooming times so that a compatible cultivar can be grown as a pollinator; however, blooming times for ornamental crabapples are far less frequently listed. The winter 2001 issue of Holden Arboretum's *Arboretum Leaves* was referenced as it contains a list categorizing bloom times for some cultivars. Unfortunately, *Malus* 'Dolgo' was the only very early cultivar listed and grows too big for the crabapple slope. Similarly, for late blooming, only four cultivars were listed: *Malus* 'Adirondack', *Malus* 'Silver Moon', *Malus* 'Schmidtcutleaf' GOLDEN RAINDROPS and *Malus* 'Prairie Maid'. *Malus* 'Adirondack' has been grown at Morris before and was removed because of poor growth. *Malus* 'Schmidtcutleaf' GOLDEN RAINDROPS and *Malus* 'Silver Moon' have low disease resistance (Morton, Schmidt). Finally, *Malus* 'Prairie Maid' would be a good addition to the collection, but it is not commercially available.

While nearly all of the disease resistant straight species in our collection have cultivars that could have been considered for the slope, google searches showed many of them have extremely limited supply or are simply not commercially available in the United States. Similarly, fruitless or sterile cultivars were found to exist, but it appeared unlikely to find a source that would have them in stock. Cultivars or species that would have been recommended but at the time appeared to be unrealistic to source were included in Table 4.

Another problem was encountered while locating potential retail sources for *Malus baccata* 'Dolgo'. This cultivar is known to be white flowered; however at least one retailer is selling a pink flowered cultivar labeled as *Malus* 'Dolgo'. It is possible the description is just misleading because *M. baccata* 'Dolgo' is known for having pink buds but white flowers. The source recommended below in the CONCLUSION and RECOMMENDATIONS section sells white flowered *M. baccata* 'Dolgo'.

Propagation of Malus coronaria

The collection trip resulted in two herbarium specimens currently in the Morris Arboretum collection. The first two treatments of wild collected seeds were removed from cold stratification and sown into soilless medium on Feb 7 and March 6. The final treatment will be removed from cold stratification and sown on April 8. As of March 6, 2019, the wild collected seeds from a local *Malus coronaria* have not germinated yet.

Photo 3. Bubble-like Bulge on Damaged Crabapple Seeds

If none of the seeds germinate, one of many possible explanations may be the seeds were damaged by the partial fermentation. The partial fermentation might be the cause for some of the obviously damaged seeds with bubble-like clear bulges that were removed before cold stratification. While it would be extremely tedious, perhaps the safest method for separating crabapple seeds from the fruit is simply cutting open each fruit and removing the seeds.

CONCLUSION and RECOMMENDATIONS

Future evaluations of the collection will increase the accuracy of the results as they are compiled by showing which cultivars consistently produce an abundance of flowers, attractive fruit, and disease resistant growth over years of varying weather. In addition, any personal biases should average out as evaluations from multiple staff members are combined.

The Penn State Extension report recommended amending the whole crabapple slope with 3.5 lbs per 100 square feet of 5-10-10 and 0.5 lbs per 100 square feet of 0-46-0. The report also recommended amending just the lower section of the slope with 11 lb/100 square feet dolomitic limestone alone or 11 lb/100 square feet calcitic limestone along with 1 lb/100 square feet of Epsom salts (MGSO4) in order to raise the pH, calcium, and magnesium levels.

As the crabapple slope is improved over the coming years, it is strongly recommended to design and implement some interpretive signs for the cultivars with historical significance or amazing stories. For example, *Malus* ‘Rambo’ is less ornamental than the cultivars growing around it but is just as spectacular a cultivar if the story behind it is known. An interpretive sign for *Malus* ‘Rambo’ would increase guests’ appreciation for the specimen by explaining its connection to the character Rambo and telling the story of how *Malus* ‘Rambo’ became a favorite early American apple cultivar (recommended sources are included in the appendix). Similarly, if *Malus* ‘Hewes’ or one of the multi-purpose cultivars are added to the slope, guests will be able to more fully appreciate and enjoy the specimens if there is an interpretive sign explaining the stories and uses of these cultivars.

Recommended Cultivars for the Crabapple Slope

Photo 4. {http://www.affordabletrees.com/ product/crabapple-pink-princess/}

Malus sargentii 'Parrsi' PINK PRINCESS

Pink Princess is disease resistant, loaded with pink flowers in the spring, and adorned with little red fruits in the fall and winter. Pink Princess is a dwarf form of *M. sargentii* that grows to 8 feet tall with a spread of 10 to 15 feet wide. Pink Princess is available from Bower and Branch as of fall 2018 for $325 per tree Size B (6-7 feet tall).

Photo 5. {https://shop.monrovia.com/ tina-sargent-crabapple-25473.html}

M. sargentii 'Tina'

Tina is disease resistant, small enough to fit in nearly any garden, white flowered in spring, and full of little red fruits in the fall and winter. Tina grows to only 5 feet tall by 5 feet wide. Tina is available from Bower and Branch as of fall 2018 for $325 per tree Size B (5 feet tall).

Photo 6. {https://www.atreehugger.com/flowering-trees/crabapple-trees/royal-raindrops-crabapple.html, http://vwgarden.blogspot.com/2012/01/royal-raindrops-crabapple-photos.html}

Malus x 'JFS-KW5' ROYAL RAINDROPS

Royal Raindrops is disease resistant and provides four seasons of interest. In the spring, Royal Raindrops has pink flowers which are followed by purple-bronze leaves in the summer. When fall comes, the leaves turn red-orange before falling to reveal tiny red fruits for the winter. Royal Raindrops is on the larger side for the slope growing to 15-20 feet tall and 12-16 feet wide. Golden Raindrops is available from Bower and Branch as of fall 2018 for $145 per tree Size A (5-6 feet tall).

Photo 7. {https://www.treesofantiquity.com/index.php?main_page=product_info&products_id=189}

Malus 'Whitney'

Whitney is a great multi-purpose crabapple for homeowners. It is one of the few crabapples that is self-pollinating, and in addition is sometimes sold on dwarf rootstock. This allows gardeners with limited space to grow a single 10 foot apple tree and still get fruit. Whitney produces showy white flowers in the spring followed by fruits that are good fresh or used in preserves, cider, or cooking. Whitney is available from Stark Bro's Nursery as of fall 2018 for $26.99 as a bare-root, 3-4 tall (3/8th inch diameter) plant on semi-dwarf rootstock. Dwarf rootstock plants were out of stock at the time but would be preferable.

Photo 8. {https://www.monticelloshop.org/670270.html}

Malus 'Hewes'

Hewes Crab is a historic cultivar that has been grown for 300 years. Hewes Crab is a great representative of an early US crabapple cultivar and their historic use. Like most crabapples bred early in US history, Hewes Crab is intended for cider making. Often available on semi-dwarf rootstock, this cultivar would provide an interesting talking point for our collection on the slope. Hewes is available from Burnt Ridge Nursery as of fall 2018 for $22.00 on semi-dwarf M111 rootstock.

Photo 9. {https://ecommons.cornell.edu/handle/1813/882}

HONORABLE MENTION: *Malus* 'Prairie Maid'

Prairie Maid is disease resistant according to Dawes Arboretum and particularly late flowering. The flowers are pink followed by orange-red fruits in the fall. Prairie Maid grows to about 15 feet tall and 15 feet wide. Unfortunately, it does not appear to be commercially available. It may be possible to propagate a specimen from Dawes Arboretum, The New York Botanical Garden, Holden Arboretum, or Cornell University.

Photo 10. {https://www.chiefrivernursery.com/store/Dolgo-Crabapple-Seedlings.html, http://www.burntridgenursery.com/Crabapple-Trees/products/13/}

HONORABLE MENTION: *Malus baccata* 'Dolgo'

Dolgo is a disease resistant, multi-purpose cultivar that produces very early, showy white flowers followed by edible fruits which are high in pectin and great for making preserves. It is the only cultivar the Holden Arboretum lists under their category of very early flowering. Dolgo grows to about 35 feet tall by 30 feet wide which is too large for the crabapple slope, but this cultivar's disease resistance and multi-purpose qualities make it a worthy consideration for another area of the garden—perhaps between the community garden and the executive director's residence. Another option could be purchasing Dolgo on M7 rootstock. While Dolgo is not commonly sold grafted, Cummins Nursery states that Dolgo grafted to M7 rootstock grows to about 10 feet tall. Available on its own roots from Burnt Ridge Nursery as of fall 2018 for $19.50.

Photo 11. {http://www.gmtoday.com/content/m_magazine/2014/June/m_062014_75.asp}

HONORABLE MENTION: *Malus* 'Mary Potter'

The crabapple collection includes two Mary Potter trees on the farm-side, but none on the public-side. Both of them have shown high disease resistance and it is worth considering this cultivar for the slope if there is room.

Photo 12. {https://www.craigmarloch.co.uk/plants-c10/trees-c9/ornamental-trees-c198/malus-tschonoskii-p3803}

HONORABLE MENTION: *Malus tschonoskii*

M. tschonoskii is disease resistant and known for its exceptional fall foliage. Unfortunately, this species does not appear to be commercially available in the US as of 2018; however, this species is native to Japan and presents an opportunity to wild-collect a species of crabapple not currently in our collection. The Scott Arboretum and Holden Arboretum both have specimens and may be willing to allow Morris to propagate their specimens if wild-collection is unrealistic.

ACKNOWLEDGEMENTS

I would like to thank Vince for his guidance and support throughout my project, Shelley for guiding me through crabapple propagation and allowing me to use her greenhouse, Tim for locating wild *Malus coronaria* in the area, Bob Gutowski for sharing his knowledge of Morris history related to the crabapple slope, Elinor for providing maps and her vast knowledge of the living collection, and the section leaders and horticulture staff for their help throughout my project.

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APPENDIX

RECOMENDED SOURCES for MALUS 'RAMBO' INTERPRETIVE SIGNS

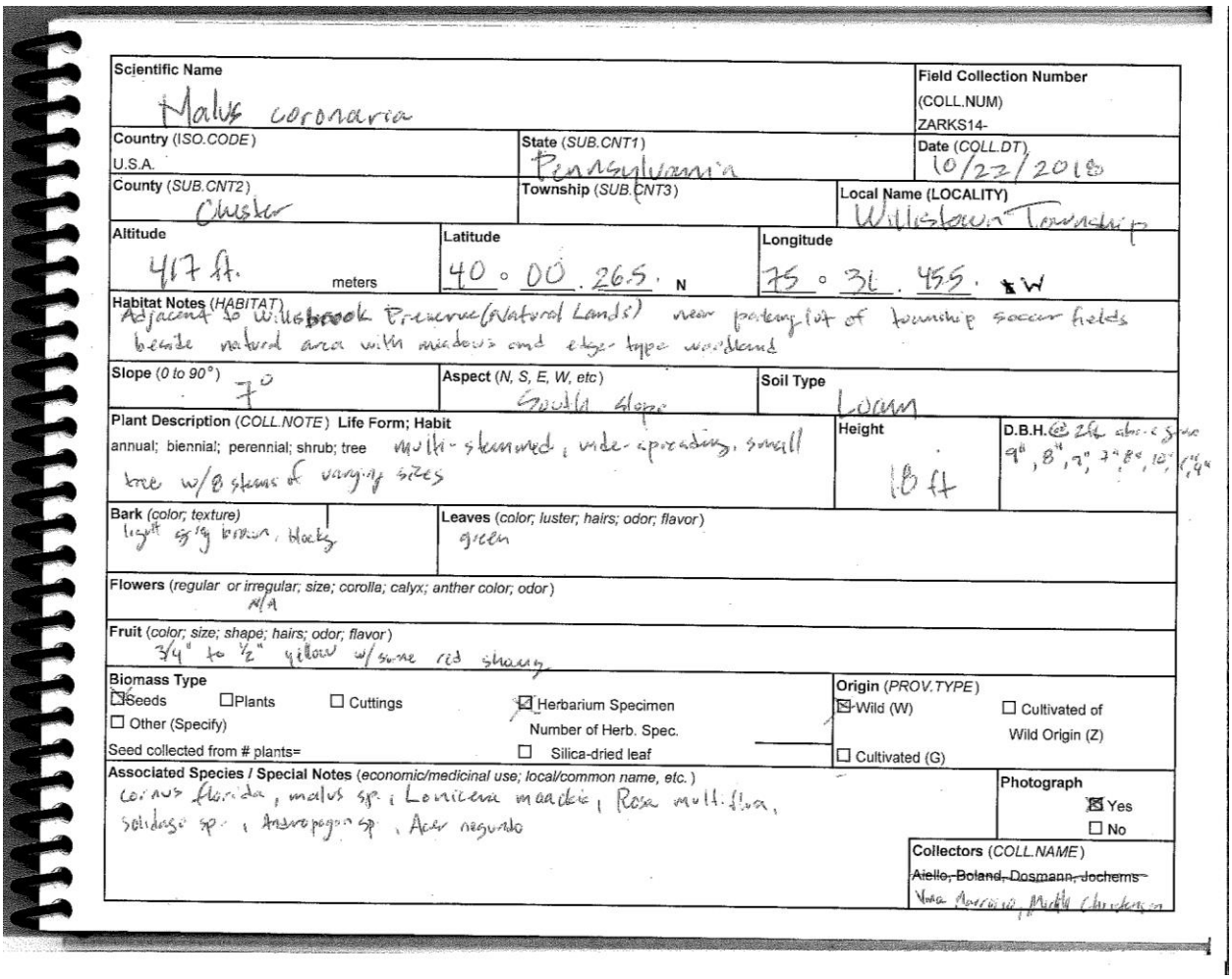
These two sources document the origins behind *Malus* 'Rambo' with the Peter Kalm source explaining the history and the William Coxe source providing a historic description of the cultivar including its recommended culinary uses.

Coxe, William. *A View of the Cultivation of Fruit Trees: And the Management of Orchards and Cider*. 1817. "No. 26 Rambo, or Romanite". Page 116. **Page available for free through Google Books.**

Kalm, Peter. *The America of 1750; Peter Kalm's travels in North America; the English version of 1770, rev. from the original Swedish and edited by Adolph B. Benson, with a translation of new material from Kalm's diary notes.* "Addenda to the Diary". Pages 712-713. **Available from the University of Pennsylvania library.**

Figures

Figure 1. Collection Form.



Scientific Name: Malus coronaria

Field Collection Number (COLL.NUM): ZARKS14-

Country (ISO.CODE): U.S.A.

State (SUB.CNT1): Pennsylvania

Date (COLL.DT): 10/22/2018

County (SUB.CNT2): Chester

Township (SUB.CNT3):

Local Name (LOCALITY): Willistown Township

Altitude: 417 ft. meters

Latitude: 40 . 00 . 26.5 . N

Longitude: 75 . 31 . 45.5 . W

Habitat Notes (HABITAT): Adjacent to Willistbrook Preserve (Natural Lands) near parking lot of township soccer fields beside natural area with meadows and edge-type woodland

Slope (0 to 90°): 7°

Aspect (N, S, E, W, etc): South slope

Soil Type: Loam

Plant Description (COLL.NOTE) Life Form; Habit: annual; biennial; perennial; shrub; tree multi-stemmed, wide-spreading, small tree w/8 stems of varying sizes

Height: 18 ft

D.B.H. @ the above stems: 9", 8", 9", 7", 8", 10", 7", 4"

Bark (color; texture): light ashy brown, blocky

Leaves (color; luster; hairs; odor; flavor): green

Flowers (regular or irregular; size; corolla; calyx; anther color; odor): N/A

Fruit (color; size; shape; hairs; odor; flavor): 3/4" to 1/2" yellow w/some red showing

Biomass Type: ☐ Seeds ☐ Plants ☐ Cuttings ☒ Herbarium Specimen ☐ Other (Specify)

Number of Herb. Spec.

Seed collected from # plants=

☐ Silica-dried leaf

Origin (PROV.TYPE): ☒ Wild (W) ☐ Cultivated of Wild Origin (Z) ☐ Cultivated (G)

Associated Species / Special Notes (economic/medicinal use; local/common name, etc.): cornus florida, malus sp., Lonicera maackii, Rosa multiflora, solidago sp., Andropogon sp., Acer negundo

Photograph: ☒ Yes ☐ No

Collectors (COLL.NAME): ~~Aiello, Boland, Dosmann, Jochems~~ Yoga Morrison, Molly Christenson

Tables

Rating*	4	3	2	1	0
Flower Aesthetics	Loaded with impressive flowers	Abundant attractive flowers	Some flowers of decent quality	Very few flowers or flowers are unattractive	None
Fruit Aesthetics	Fruit is eye-catching.	Fruit is notable but not spectacular	Fruit has a little value but is barely noticeable	Fruit is easily overlooked and unimpressive	None
Foliage Aesthetics	Defects cover no more than 5% of leaf	Defects cover >5% of leaf	Defects cover >10% of leaf	Unsightly	Dead
Disease/Pests	No significant disease. No more than 5% leaf coverage. No or very minimal fire blight. No caterpillars.	Non-significant disease presence. >5% disease coverage of leaf. Some minor fire blight. Some caterpillars.	Significant disease presence. >10% leaf coverage. Concerning amounts of fire blight. Many caterpillar tents.	Alarming amount of disease or pests.	Dead

Table 1. Evaluation Rubric. *only intended for evaluation of mature trees.

Accession #	Species, Common, or Cultivar name	Foliage	Disease	Date of Evaluation
1981-265*A	Malus sp.	4	4	9/24/2018
1986-217*B	Malus baccata (Siberian)	4	4	11/2/2018
1986-217*C	Malus baccata (Siberian)	4	4	11/2/2018
1965-051*A	Bob White crabapple	4	4	11/2/2018
1983-147*A	Centurion crabapple	4	4	9/24/2018
1985-027*A	Malus halliana (Halls)	4	4	11/2/2018
1954-1475*A	Malus hupehensis (Tea)	4	4	11/2/2018
1960-354*C	Malus hupehensis (Tea)	4	4	11/2/2018
1983-151*A	Malus 'Jewelberry'	4	4	11/2/2018
1983-151*B	Malus 'Jewelberry'	4	4	9/24/2018
1957-543*A	Malus 'Mary Potter'	4	4	9/24/2018
1977-033*A	Malus x purpurea 'Eleyi' (Eley Purple)	4	4	11/2/2018
1941-265*A	Malus sargentii	4	4	11/2/2018
1941-265*B	Malus sargentii	4	4	9/24/2018
1986-218*A	Malus sieboldii (Toringo)	4	4	11/2/2018
1992-139*A	Malus 'Sugar Tyme'	4	4	9/24/2018

Table 2. Species and Cultivars with Excellent Disease Resistance.

LABORATORY RESULTS: Upper Slope									
[1]pH	[2]P lb/A	Exchangeable Cations (meq/100g)					% Saturation of the CEC		
		[3]Acidity	[2]K	[2]Mg	[2]Ca	[4]CEC	K	Mg	Ca
6.4	62	3.4	0.2	1.9	4.7	10.3	2.3	18.4	46.1
Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations									
LABORATORY RESULTS: Lower Slope									
[1]pH	[2]P lb/A	Exchangeable Cations (meq/100g)					% Saturation of the CEC		
		[3]Acidity	[2]K	[2]Mg	[2]Ca	[4]CEC	K	Mg	Ca
5.5	100	6.9	0.4	0.8	3.2	11.2	3.2	6.9	28.4
Test Methods: [1]1:1 soil:water pH, [2]Mehlich 3 (ICP), [3]Mehlich Buffer pH, [4]Summation of Cations									

Table 3. Penn State Extension Soil Test Results

Cultivar	Species	Disease Resistant	Other
'Aros'	*M. sieboldii*	Y	
'Cardinal'	*M. hupehensis**	Y	
'Prairie Maid'	*Malus*	Y	Late flowering
'Butterball'	*Malus*	?	Ornamental + culinary, self-fertile
'Spring Snow'	*Malus*	?	Fruitless: no mess from fruit
'Merilee'	*Malus*	?	Fruitless: no mess from fruit
'Prairie Rose'	*Malus*	?	Fruitless: no mess from fruit

*According to Missouri Botanical Garden, *Malus* 'Cardinal' is incorrectly sold as *M. hupehensis*; however, it is known for having high disease resistance and still worth considering as an addition to the collection.

Table 4. Recommended Cultivars that were Unrealistic to Source.