Combined Proceedings IPPS 73:210-216. 2023.

Myrica rubra, a New Ornamental with Edible Fruit and its Propagation Challenges

Zachary Hutzell[a] and Donglin Zhang

Department of Horticulture, University of Georgia, Athens, GA 30602, USA.

zacharyhutzell@uga.edu, donglin@uga.edu

[a]First Place – Charlie Parkerson Graduate Student Research Paper Competition

Keywords: adventitious rooting, edible ornamental, cutting propagation, indole-3-butyric acid (IBA), Yangmei, yumberry.

Summary

The successful introduction and adoption of new taxa in the ornamental market depends on developing adequate propagation protocols. If a new plant cannot be reliably and quickly propagated, nursery producers may not be able to justify large scale production of the taxon while wasting resources, labor, and time. *Myrica rubra* is a new species and its selected clones are worthy of introduction for their ornamental value and edible fruits. However, these new clones are difficult to clonally regenerate with stem cuttings. This study evaluated hormone applications and timing of cuttings to optimize the protocols for stem cutting propagation for *Myrica rubra*. Some success was achieved in rooting semi-hardwood stem cuttings taken between May 25 and September 5, with an application of 8,000 ppm indole-3-butyric acid (IBA) talc powder. Further studies should focus on the best-found protocol for rooting stem cuttings of *Myrica rubra* for large-scale clonal propagation for nursery production.

INTRODUCTION

Yangmei (*Myrica rubra*), or yumberry, is an evergreen shrub or small tree native to southeast Asia (Zheng-Yi Wu, 1999). Maturing at a height of 4.5-6.0 meters, this plant stands out as an option for use as a screening shrub and small shade tree in the southern United States (**Fig. 1**). Its fresh fruit is sold in Chinese markets at a premium price, while dried fruit can be ground and incorporated into culinary dishes, cosmetics, and traditional medicines - hence the common name "yumberry". Breeding programs in Asia have produced cultivars for fruit production and are typically propagated asexually via grafting onto seedling rootstock, which aids to maintain desirable fruit characteristics (Davies et al., 2018).

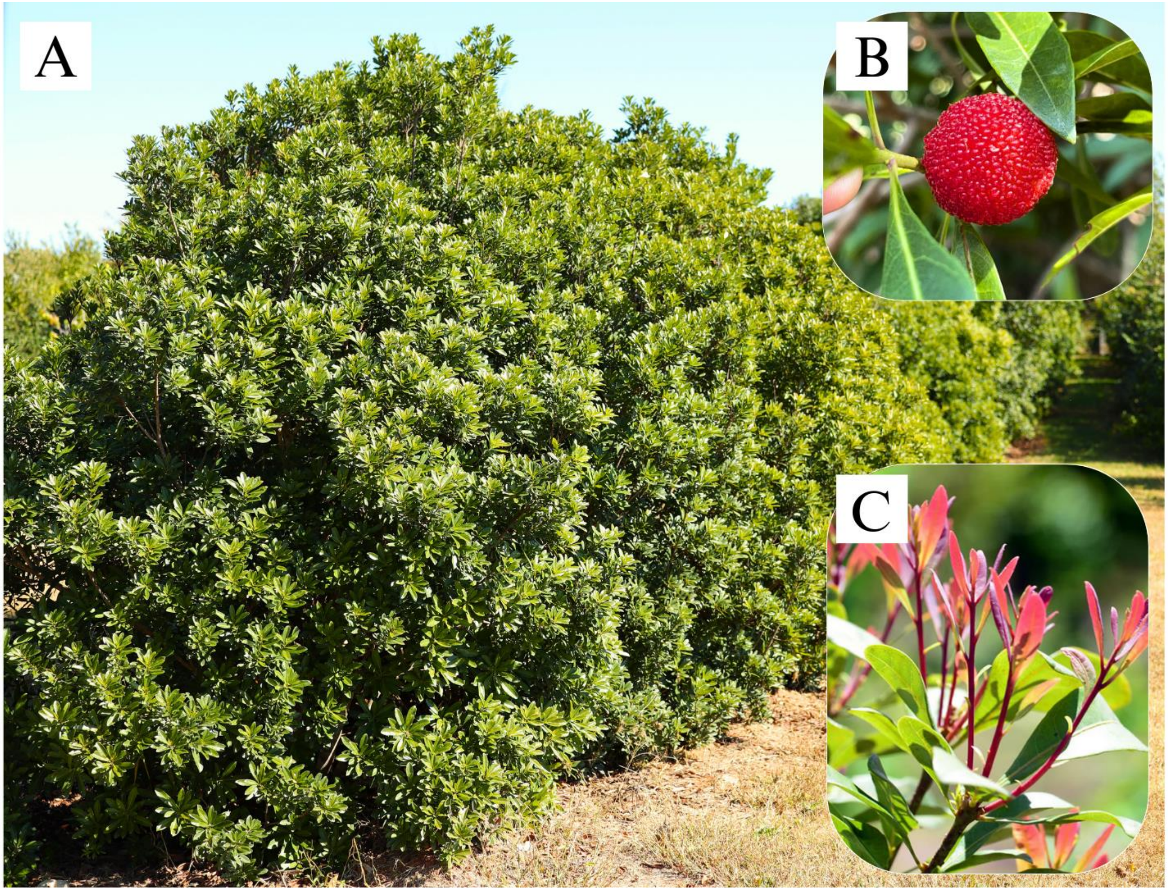

Figure 1. A) *Myrica rubra* is a 4.5-6.0m evergreen shrub or small tree. B) Fruit, approximately 3 cm (1.2 in) in diameter. C) Purple-bronze new growth.

The plant is dioecious, so male plants are separate from fruit-producing females (**Fig. 2**). This supplies a valuable opportunity, as consumers who want to produce fruit can plant females, while consumers who do not want fruit (which can be messy) can plant males. It is important to note that females need a male pollinizer to produce fruit; this can be achieved with grafting a prolific, pollen producing male branch onto a female plant.

Myrica rubra and its cultivars have not yet been introduced to the United States, which may be in part due to the plant's propagation challenges. Clonal propagation is essential for the widespread distribution of woody cultivars, as growing plants from seed can take years and produces genetic variation in offspring. For yumberry, this can result in plants of varied sizes, shapes, foliage characteristics, and fruit qualities. While grafting desirable scion onto seedling rootstock provides a viable solution, propagation via stem cuttings according to a best-practices protocol can be faster, less labor intensive, and more reliable (Davies et al., 2018).

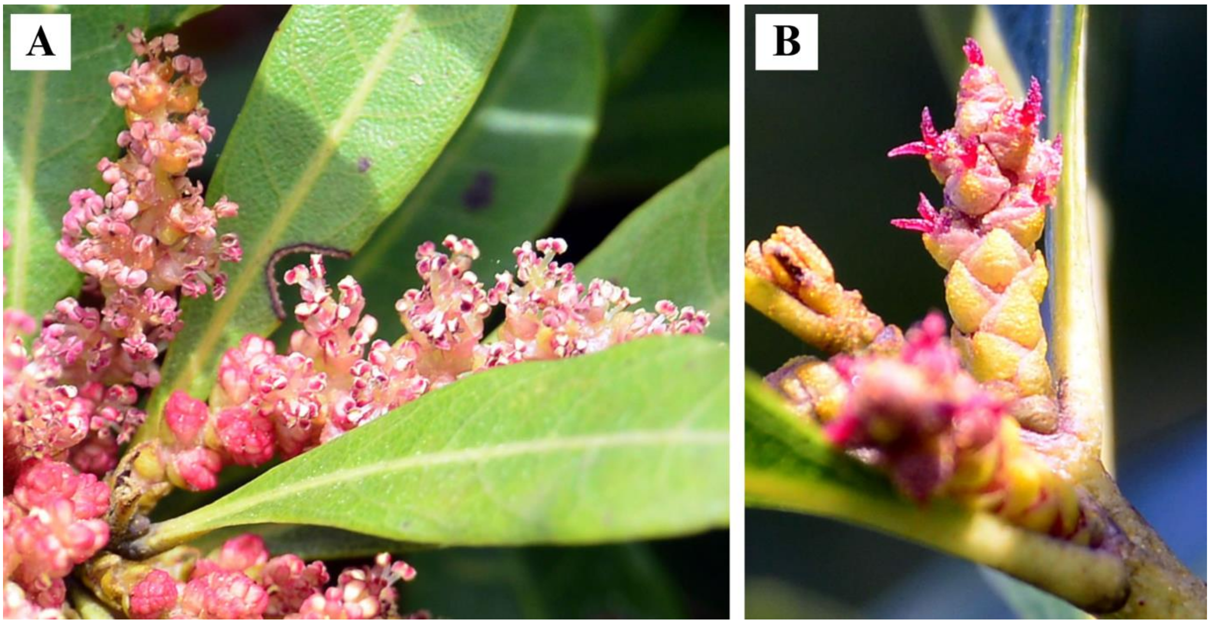

Figure 2. Male flowers (A) and female flowers (B) of *Myrica rubra.*

Developing a protocol for repeatable success in stem cutting propagation of *Myrica rubra* has proven to be a challenge for the Woody Ornamental Lab at the University of Georgia. Many factors can affect the rooting percentage and root quality of stem cuttings, including the genetics of the mother plant, the time at which cuttings are collected, nutrient cofactors, media formulation, irrigation schedule, hormone type, hormone application method, and hormone concentration (Davies et al., 2018).

Objectives of this study were to establish the best window of time to take cuttings, explore different hormone concentrations and types, application of nutrient cofactors to increase rooting percentage and quality of *Myrica rubra* – for its commercial introduction in the U.S. as a woody ornamental and edible landscape plant.

MATERIALS AND METHODS

Over the course of the last decade, a total of 75 *Myrica rubra* seedlings have been evaluated at the University of Georgia Durham Horticulture Farm. Among them, 35 have been identified as female, and 21 have been identified as male (we have not observed flowers on the remaining plants). Many of the seedlings are, as of 2023, 4.5-6.0 m tall and have displayed beautiful, purplish bronze new growth (**Fig. 1**). Individual plants were selected for cutting propagation based on ornamental qualities and fruit production, including shape, foliage color, pollen production (males), fruit size, fruit color, and fruit taste.

From 2016 to 2018, the Atlanta Botanical Garden and Woody Ornamental Lab at the University of Georgia set out to root

Myrica rubra stem cuttings. Based on prior knowledge of rooting evergreen stem cuttings, hardwood stem cuttings were taken from September to December during these three years. From May 2019 to February 2020, cuttings were taken on the 11th of every month from the same seedling to establish the best time to collect cuttings. From May 2021 to September 2022, semi-hardwood cuttings were targeted, which were collected from the first flush of growth from late spring to early summer, and the second flush of growth from mid to late summer.

To prepare the cuttings, leaves were removed from the bottom of stem cuttings. The top of stem cuttings retained leaves 2.5-5cm (1-2in) from the apical end of the stem, leaving approximately 5-7.6 cm (2-3 in) of exposed stem (**Fig. 3**). Leaves left on the stems were trimmed to reduce transpiration. Prior to hormone applications, the base of the cuttings were abraded lightly with the blade of pruning shears for wounding to better induce adventitious root formation (Davies et al., 2018).

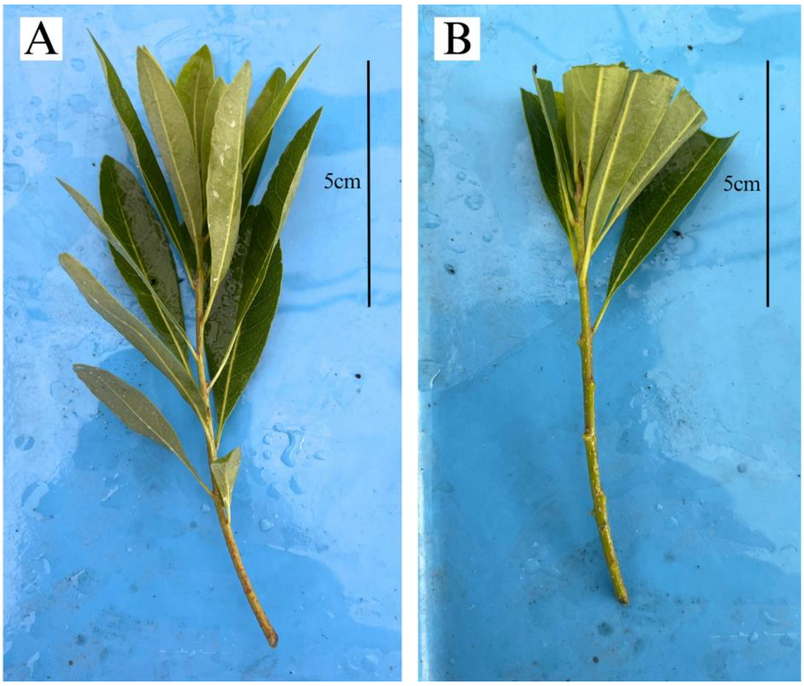

Figure 3. Semi-hardwood **s**tem cuttings are approximately 11cm (about 4.3 in) in length. A) *Myrica rubra* cutting prior to processing. B) *Myrica rubra cutting* after processing with basal leaves removed, basal end wounded, and remaining leaves trimmed.

For cutting treatments, prepared stem cuttings were soaked in a diluted solution of SUPERthrive https://en.wikipedia.org/wiki/SUPERthrive in water (approximately 10 ml SUPERthrive per 1 liter of water) for 20 minutes. SUPERthrive is marketed as a "vitamin solution" (nitrogen derived from kelp). We treated this soaking as a co-factor that could help improve the following rooting hormone application. Soaked cuttings were then dipped in Hormodin 3 talc [8000 ppm indole-3-butyric acid (IBA)].

Cuttings were then placed in 32-cell propagation trays filled with 1:1 (by volume) mix of Pro-mix, a peat-based substrate, and perlite. Cell inserts were 2 in x 2 in and 3.5 in deep. Trays with cuttings were placed under a controlled mist system in a temperature-controlled greenhouse at 24° C (75° F). Misting was scheduled to 10-sec every 10 min for the first two weeks, then 10 sec every 20 min for the second set of two weeks, and then 10 sec every 30 min until rooting data was collected.

After rooting, individual cuttings were rated on a scale of 0-5, based on quantity and length of roots. This value was referred to as "root quality". If root emergence was visible on a cutting, the cutting was considered successful. The ratio of successful cuttings to all cuttings under the treatment for each replicate was referred to as "rooting percentage". A randomized complete block design was employed for all experiments. There were eight cuttings per replication with 3, 4 or 5 replicates per treatment. Statistical analysis was conducted in R; a one-way ANOVA test at a significance level of $P = 0.05$ was used to find impacts of timing and hormone treatment on rooting of *Myrica rubra* stem cuttings.

RESULTS

From 2016 to 2018, the Atlanta Botanical Garden and Woody Ornamental Lab at the University of Georgia were unsuccessful in rooting any *Myrica rubra* (hardwood) stem cuttings. From May 2019 to February 2020, the University of Georgia found some success with semi-hardwood cuttings taken in late spring and early summer, with a highest rooting percentage of 33% (Zou et al., 2022).

Based on the success found from May 2019 to February 2020, semi-hardwood cuttings were taken in 2021 and 2022 beginning once new growth began to lignify (late May) and ceased once the second flush of growth had fully lignified (early September). For these years, increasing IBA hormone applications from 8,000ppm to 16,000ppm did not significantly affect rooting percentage (P-value = 0.879) or root quality (P-value = 0.270). The highest success found from 2021-2022 was a 45% rooting percentage and a rooting quality of 4.

The most successful treatment in our study was with semi-hardwood cuttings collected on June 16, 2020, which were soaked for 20 minutes in the SUPERthrive solution and dipped into Hormodin 3. This resulted in 79% rooting and a root quality of 3.5.

DISCUSSION

The propagation of *Myrica rubra* via stem cuttings has proven challenging. However, we can now see a clear path towards developing a successful and reliable propagation protocol (**Fig. 4**). From 2021-2022, we attempted to repeat the success found in June 2020 to reach a 79% rooting percentage. We were unsuccessful, which may be due in part to clonal differences and excess water.

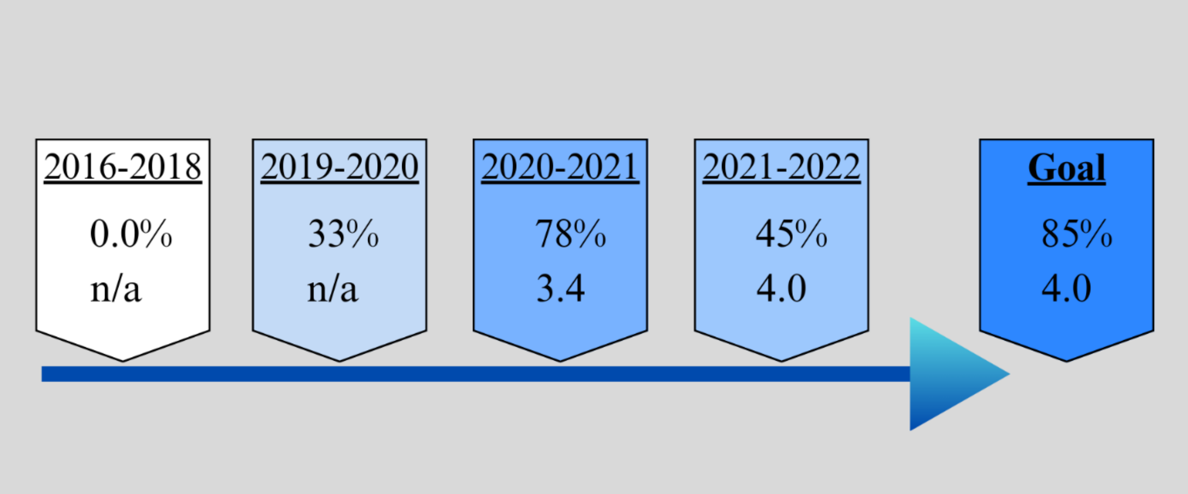

Figure 4. Timeline of progress in stem cutting propagation of *Myrica rubra*. In 2016-2018 there was no success in rooting cuttings. In 2019-2020 was 33% rooting, while the greatest success was in 2020-2021, with a maximum 78% rooting and 3.4 root quality. In 2021-2022, we were unable to repeat the success of 2020-2021. The goal of future studies is to achieve an 85% rooting success with a 4.0 root quality.

Due to a lack of significant variance in rooting percentage and root quality between periods of time within the optimal window as identified from 2021-2022 (Zou et al., 2022), semi-hardwood cuttings taken any time between May 25 and September 9 are the most viable for the clonal propagation of *Myrica rubra*. In addition, Hormodin 3 (8,000 ppm talc IBA) was found to be sufficient for hormone applications; higher concentration of IBA may not be advantageous.

One crucial factor not addressed in this study was mist scheduling. Weeks after cuttings had been placed under the mist benches with the previously described schedule, many of the cuttings deteriorated, which could be due to excess water. This may have resulted in lower rooting percentages and lower root quality. Additionally, the media of 1:1 mix of Pro-mix to perlite may compound the effects of excessive misting by retaining too much water. Optimizing a misting schedule can be tedious and taxa specific for cutting propagation, but may improve propagation success (Davies et al., 2018).

CONCLUSION

Based on our findings to date, the best protocol for clonal stem cutting propagation of *Myrica rubra* is to utilize semi-hardwood cuttings - collected between May 25 and September 5. The cuttings should be soaked in a SUPERthrive solution (10 ml of SUPERthrive into 1 L of water) for 10-20 min and dipped in Hormodin 3 IBA talc powder (8,000ppm) before sticking.

The Woody Ornamental Lab at the University of Georgia plans to conduct further studies with a factorial design in 2024. These will address mist scheduling and media water retention, to see if less water will increase rooting percentages and root quality. These studies will also explore alternate hormone formulations, such as Clonex Rooting Gel, and hormone concentrations. The Woody Ornamentals Lab also hopes to identify differences in the success of cuttings collected from different clones (seedlings), to find the impact of genetic variation on rooting percentages and root quality.

The propagation of *Myrica rubra* via stem cuttings has proven challenging. However, within six years, rooting percentages have increased from 0% to a high of 79% (**Fig. 4**). In the future, the successful and reliable propagation of *Myrica rubra* may enable the introduction of a new species and its cultivars to consumers across the United States with high ornamental and culinary value.

LITERATURE CITED

Davies, F. T., Geneve, R. L., and Wilson, S. B. (2018). Hartmann and Kester's Plant Propagation: Principles and Practices. Ninth ed. Pearson, NY, NY.

R Core Team (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>.

RStudio Team (2020). RStudio: Integrated Development for R. RStudio, PBC, Boston, MA. <http://www.rstudio.com/>.

Wickham, H. (2016). ggplot2: Elegant Graphics for Data Analysis. Spri.-Verl. New York. ISBN 978-3-319-24277-4. <https://ggplot2.tidyverse.org>.

Wu, Z. Y. and Raven, P. H. (1999). Flora of China, Vol. 4, Cycadaceae through Fagaceae. (p.276). Miss. Bot. Gar. Press.

Zou, Y. P., Zhang, D. L., and Hutzell, Z. (2022). Windows of opportunity for rooting woody stem cuttings. Comb..Proc. Intl. Plant Prop. Soc. *72*:207-214.