

Propagation of Tropical Lilythorn (*Catesbaea melanocarpa* Krug & Urb.): A Federally Endangered Tree on St. Croix

Michael Morgan, Daryl Richards, and Thomas W. Zimmerman

Agroforestry Research Specialist, University of the Virgin Islands, Agricultural Experiment Station, Kingshill, St. Croix, U.S. Virgin Islands; Biotechnology Analyst, University of the Virgin Islands, Agricultural Experiment Station, Kingshill, St. Croix, U.S. Virgin Islands; Research Associate Professor Biotechnology and Agroforestry, University of the Virgin Islands Agricultural Experiment Station, Kingshill, St. Croix, U.S. Virgin Islands.

Abstract

Tropical lilythorn (*Catesbaea melanocarpa* Krug and Urb.) is a small, thorny tree with white flowers that is found on only one site on St. Croix, two sites in Puerto Rico, and in a few other islands. It is a federally endangered plant species. At the University of the Virgin Islands, we are studying this species' ecology and developing propagation protocols. The goal is to plant tropical lilythorn seedlings in protected areas on the island of St. Croix because the one site where the species currently grows is not protected from development. This article summarizes nursery and field observations during propagation efforts over the previous 8 years.

Introduction

Tropical lilythorn (*Catesbaea melanocarpa* Krug and Urb.) is a thorny tree with striking white flowers. It is a member of the Rubiaceae, or coffee, family. Tropical lilythorn is a federally endangered plant species (Daley and Valiulis 2013). The Endangered Species Act forbids the destruction of these trees, and collection of botanical samples and seeds are regulated by permit. If the species were more common and not endangered, this small tree with its white flowers and black berries could be an attractive plant around buildings, on small lots, or in garden areas. At present, the most important use of the species is the provision of ecosystem services such as biodiversity, soil conservation, and pollinator habitat.

Tropical lilythorn was first botanically described on the island of Antigua in the mid-19th century and on St. Croix in 1881 (U.S. Department of the Interior, Fish and Wildlife Service 2005). Tropical lilythorn is found

in one isolated site on St. Croix, two sites in Puerto Rico, the island nations of Antigua and Barbuda, the Cayman Islands, and the French Overseas Department of Guadeloupe (Rivera and Foote 2005, Lindsay et. al. 2015). On the island of Guadeloupe and another small island in the archipelago of Guadeloupe, the species occurs on the dry west coast, growing among succulents like cactus (Francius 2017). The existing population of tropical lilythorn on St. Croix is endangered by wild-fires and habitat destruction because it grows on private land that is subject to development pressure and is thus outside of protected areas (Daley and Valiulis 2013).

Through a research grant provided by the U.S. Fish and Wildlife Foundation, the agroforestry and biotechnology program of the University of the Virgin Islands (UVI) is studying the phenology, population distribution, and propagation techniques of tropical lilythorn to establish protected populations at the Sandy Point National Wildlife Refuge, Salt River/Columbus Landing National Historical Site, and the private Southgate Reserve on St. Croix.

Description

Tropical lilythorn is a small, thorny tree that grows up to 10 ft (3 m) tall (figure 1). It has paired, simple, oblong, and shiny green leaves 0.2 to 1 in (5 to 25 mm) long. The thorns are green and occur in pairs in the space between the pairs of leaves (figure 2). Pairs of thorns alternate between facing in the vertical or horizontal plane. Each thorn is 0.4 to 0.8 in (1 to 2 cm) long. The flowers are white and fragrant and grow solitary or paired in the angles formed by the leaf and the branch (figure 3). The fruit is a black berry about 0.25 in (5 to 6 mm) in diameter (figure 4) (River and Foote



Figure 1. Tropical lilythorn is a small tree bearing showy, white flowers. (Photo by Michael Morgan, 2014)



Figure 2. Both Leaves and thorns of tropical lilythorn occur in pairs. (Photo by Michael Morgan, 2014)



Figure 3. The white, fragrant flowers of tropical lilythorn grow solitary or paired. (Photo by Michael Morgan, 2020)

2005). From a sample of 30 tropical lilythorn fruit, we determined that each fruit weighs approximately 0.17 g and contains an average of 13 seeds. The seeds are very small (1 g contains \pm 450 seeds) (figure 5).

Ecology

On St. Croix, tropical lilythorn grows on one site on the south shore. The site is a flat plain dotted with small islands of trees and has been periodically grazed, burned, and cut for hay (figure 6). Tropical lilythorn tends to grow on the edges or interior of these tree islands and are almost never found growing in the open. Trees commonly found in the tree islands are: tamarind (*Tamarindus indica* L.), divi (*Caesalpinia coriaria* [Jacq.] Willd.), logwood (*Haematoxylon campechianum* L.), and white manjack (*Cordia alba* Roem. & Schult.). The first three species are nitrogen fixers and the fourth has white, edible berries that attract birds. Seeds of logwood are dispersed by the wind. Seeds of both tamarind and divi are dispersed by ruminants, such as cattle and deer, who eat their woody pods and pass the seeds via their digestive tracts (CABI 2009, Parrotta 1990). Both ruminant species are present onsite. Fruit-eating bats may also disperse the seeds of tamarind. Occasionally, opened fruit pods can be seen still hanging from the branches of a tamarind tree. The seeds are covered in an edible, sticky sweet and sour pulp. If this pulp is attractive to people, it is likely attractive to bats as well.



Figure 4. Tropical lilythorn fruits are small, black berries containing approximately 13 seeds each. (Photos by Michael Morgan, 2013).

The tree-like cactus (*Pilosocereus royennii* [L.] Byles & Rowley) is also a frequent component of the tree islands (figure 7). Interestingly, tan-tan (*Leucaena leucocephala* [Lam.] de Wit) is not found in these tree islands, even though it fixes nitrogen and is the most common tree on St. Croix. Perhaps this is because it does not produce a bird-edible fruit and its relatively open crown is less favored by birds for perches when compared with other tree species.

Tropical lilythorn likely favors these tree islands because they provide some protection. The shade of the trees, particularly the deep shade of tamarind, inhibits growth of grasses which outcompete tropical lilythorn seedlings and young plants for light, water, and nutrients. Most importantly, inhibition of grasses also provides protection against wildfire, because grasses are an important fuel for fire when they are dry. Furthermore,

the spines of logwood and the branchy forms of divi and white manjack make it difficult for large animals such as cattle, horses, (and people), to enter these tree islands, thus protecting the tropical lilythorn plants from grazing, trampling, or other damage.

Tropical lilythorn rarely grows in full sun, except when an over-topping tree dies and creates a gap in the tree island or the tree island dies through senescence or fire. It is not that tropical lilythorn cannot tolerate full sun, but rather its seedlings and young plants cannot compete with tall grass. For example, we have observed that 1- to 2-ft (30- to 60-cm) tall nursery-grown plants can grow more than 3 feet (1 m) in full sunlight in 1 year if kept free of competition from grass and other weeds.

Flowering and fruiting occur year-round for tropical lilythorn. Plants can produce fruits and flowers when they are 20 in (50 cm) tall in droughty, sunlit spots. In moister, shadier sites, plants do not produce flowers and fruits until they are about 40 in (100 cm) tall. Occasional rains induce flowering, which may or may not lead to successful and abundant fruiting. In dry conditions, tropical lilythorn has been observed to flower within 1 year of outplanting.

Bees and wasps pollinate tropical lilythorn flowers that develop into purple-black berries. Seeds are dispersed by birds, which eat the berries, or the fruits fall off the tree and germinate underneath. It is unknown which bird species eat tropical lilythorn fruits, but we do know birds eat them because half-eaten fruits have been found on branches and on the ground. The island of St. Croix has a relatively low number of bird species. Some likely seed-eating bird species seen onsite are common ground dove (*Columbina passerina*),



Figure 5. The seeds of tropical lilythorn are very tiny. (Photo by Michael Morgan, 2013)



Figure 6. On St. Croix, the federally endangered tropical lilythorn grows on the edges of tree islands in one site. The tree islands are surrounded by grassy habitat. (Photo by Michael Morgan, 2019)

zenaida dove (*Zenaida aurita*), and the pearly-eyed thrasher (*Margathrops fugatus*). Maybe the original seed disperser of tropical lilythorn is now an extinct bird species.

Tropical lilythorn seeds may also be dispersed by rodents. We placed two camera traps in a tree island and observed black rats (*Rattus rattus*) at night climbing the branches and eating the fruits (Yriogen 2021). Black rats are arboreal and can be found in the wooded areas of St. Croix. It is unknown, however, if the tiny seeds of tropical lilythorn can

pass intact through the digestive tract of a rat. Both black rats and brown rats (*R. norvegicus*) are not native to the Caribbean but were established in the Neotropics soon after European contact in the 15th century. Rats are found everywhere in the Virgin Islands except some isolated cays, although brown rats appear to be more urban than black rats.

Propagation Protocols

We have successfully grown tropical lilythorn via seeds but with limited success via vegetative cuttings.



Figure 7. Tree islands where tropical lilythorn occur on St. Croix contain several species, including a tree-like cactus. (Photo by Michael Morgan, 2019)

Seed Propagation

Once berries are ripe, extract the seeds by crushing the fruit between one's fingers. Then, dry the crushed fruits for 3 days. Since the seeds are so small (figure 5), it is impossible to sow them individually. Thus, it is best to mix them with sand and sow them onto the surface of germination trays.

We sow 0.04 oz (1 g) of seed per 15- by 20-in (37.5- by 50-cm) trays filled with a 1:1 medium of sand and amended peat moss, such as Promix™ (Premier Tech Horticulture, Quakertown, PA). The sand mixed with the seeds should be fine but not too fine. The sand used in the germination trays should be coarser than the sand used to spread the seeds. Seeds and seedlings should be watered with a mister or by using the fine-spray setting on a hose nozzle whenever the planting substrate starts to dry.

Tropical lilythorn seeds will start to germinate approximately 17 days after sowing (figure 8). Typical germination is about 18 percent. Germination peaks around day 60. After one or two pairs of adult leaves emerge, seedlings should be transplanted into individual pots filled with a well-drained growing medium (figure 9). We use a 2:1:1 mix of peat moss, sand, and topsoil.

Tropical lilythorn needs fertilization during propagation because the tiny seeds have low food reserves and planting substrates like sand and peatmoss are low in nutrients. Although the plants are bright green when



Figure 8. Tropical lilythorn seeds sown onto a substrate of sand and peat will germinate in 2 to 3 weeks. (Photo by Michael Morgan, 2021)



Figure 9. After adult leaves emerge, tropical lilythorn seedlings can be transplanted into individual pots and will be ready for outplanting when they are 1 to 3 ft (30 to 90 cm) tall. (Photo by Michael Morgan, 2021)

they germinate, they soon turn yellow and die unless they are periodically fertilized. It is important, however, not to over fertilize, as this species appears sensitive to high levels of nitrogen. We recommend applying a fertilizer with low NPK (nitrogen, phosphorus, and potassium) levels, such as fish emulsion fertilizer (4-1-1), Milorganite™ (6-4-0; Milorganite, Milwaukee, WI), or composted manures every 3 weeks or whenever the seedlings start turning yellow. We found that fertilizers with high NPK levels (e.g., 20-20-20 or 14-14-14) are too strong and will burn the young plants.

Depending on the planting site conditions, seedlings can be outplanted when they are 1 to 3 ft (30 to 90 cm) tall. If the site is kept clear of weeds and grass, tropical lilythorn plants growing in full sun can reach a height of 6.5 ft (2 m) in 2 years, after which they tend to become bushy.

Vegetative Propagation

We tried to propagate tropical lilythorn through vegetative cuttings, but had very limited success. Out of 216 cuttings, only 3 produced viable plants. We tested six concentrations of the rooting hormone IBA (Indole-3-butyric acid): 0, 0.01, 0.03, 0.08, 1.6, and 3.0 percent (figure 10; Hormex Rooting Powder, Maia Products, Inc., Westlake Village, CA). Cuttings were placed in planting-tray cells filled with a 1:1 substrate of sand and Promix™. Cuttings (6 in [15 cm]) were taken from sections of young branches from both previous year's growth and current year's growth. The



Figure 10. Cuttings of tropical lilythorn were treated with varying rates of rooting hormone. (Photo by Michael Morgan, 2021)

basal end of each cutting was dipped into its assigned rooting powder concentration and then planted into one of the filled planting-tray cells (figure 11). The trays were kept in a shaded location and watered daily (except for weekends) with a hose kept on the mist setting.

We considered propagation a success if the cuttings started to put out a new vertical shoot with new leaves. Two cuttings treated with 0.03 percent IBA and one treated with 0.08 percent IBA were successful. We noticed that it took a long time for cuttings to get established or to die. Cuttings were planted at the beginning of December 2020. Noticeable mortality did not occur until the beginning of April 2021, 5 months after striking into the planting substrate. In mid-May 2021, 74 of the best looking cuttings were transplanted into larger

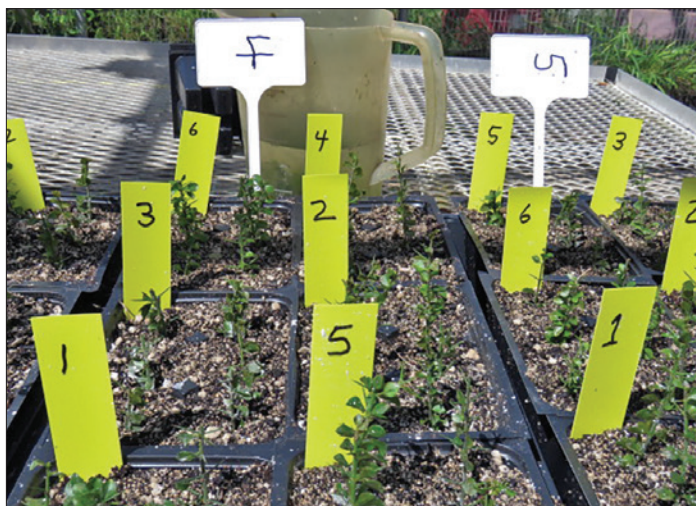


Figure 11. Tropical lilythorn cuttings were placed in individual cells after treatment with varying rates of rooting hormone. (Photo by Michael Morgan, 2021)

pots with an enriched planting substrate consisting of a 1:1:1 mixture of local Virgin Islands topsoil (Sion clay), sand, and Promix™. Topsoil has more nutrients than sand or Pro-mix™. Nonetheless, cuttings continued to slowly die, and by June 2021, only three viable plants remained (figure 12). We examined each of the dead cuttings and none had callus tissue. We intend to



Figure 12. After 6 months, only 3 of 216 tropical lilythorn cuttings were viable. Research into vegetative propagation of this species is ongoing. (Photo by Michael Morgan, 2021)

continue studying vegetative propagation of tropical lilythorn, although seed propagation may be the best approach.

Conclusion

Tropical lilythorn is a federally endangered plant species. To mitigate its endangered status, we need to produce many plants and get them established into wild, protected areas. We have developed a successful seed propagation protocol, but are still working to determine if it can be successfully propagated vegetatively. Additionally, we continue to work toward a better understanding of tropical lilythorn's ecology.

Acknowledgments

This research was funded by a grant from the USDA McIntyre-Stennis program and a grant from the U.S. Fish and Wildlife Foundation. The following UVI students helped with seed collection and plant propagation: Eliam Sánchez-Perez, Che Smith, Tyrone Pascal, and Juliet Ruggiero. Environmental professionals Brian Daley, David Hamada, and Jen Valiulis helped with locating populations of this species on St. Croix.

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