

Protection and Conservation of Endangered
Mahogany Mistletoe (*Phoradendron rubrum*) at
Key Largo Hammocks State Botanical Site

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As with many of our projects, the unpublished field notes of the late botanist George N. Avery proved invaluable during the course of our work.

Renate H. Skinner reviewed the first addition of this report, which was prepared in October, 2000.

INTRODUCTION

The mahogany mistletoe (*Phoradendron rubrum* (L.) Griseb) is a perennial parasitic herb in the Viscaceae (Wunderlin 1998). Its sole host is the West Indian mahogany tree (*Swietenia mahagoni*). It is endemic to the upper Florida Keys, the Bahamas, and Cuba (Correll & Correll 1980). It is listed as endangered by the Florida Department of Agriculture and Consumer Services and as critically imperiled by the Florida Natural Areas Inventory. It is currently known in the United States only at Key Largo Hammocks State Botanical Site on North Key Largo, Monroe County. It has been historically recorded for Key Largo, and reported (Cooley 1963) but unverified for Sands Key and Old Rhodes Key in Biscayne National Park.

J.M. Crevasse first collected mahogany mistletoe in southern Florida in 1941 on Key Largo from an unspecified station. It was collected again in 1944 on the “south end” of Key Largo by S.J. Lynch, but has not been documented there since. Frank C. Craighead discovered the second specified station in 1963 in what is now known as New Mahogany Hammock (hammock L1/10b in Weiner 1980). Most of this hammock is now within Key Largo Hammocks State Botanical Site, but part of it lies within the privately owned Ocean Reef Club. Craighead first observed this station during an aerial survey flown at 50 feet above the canopy (Cooley 1963). George N. Avery searched for these plants without luck, and then the hammock burned during a dry period in the mid-1960s and the plants at that station were presumed extirpated. Crafton Clift found the third station in 1976 in Crossroads Hammock (hammock L1/9 in Weiner 1980). Avery and Clift collected a specimen of these plants in May of that year. There were several plants on one tree. Fruits were also collected and accessioned by Fairchild Tropical Garden (#76-288). By 1977, extensive logging was occurring in this hammock. Art Weiner and Karen Achor (in Weiner 1980), who conducted a survey of the hammock in that year, did not observe mahogany mistletoe during their visit. However, Avery and Florida Park Service biologist Renate H. Skinner collected branches of the Crossroads Hammocks host tree around 1980 after it had been poached (R.H. Skinner, personal communication, 18 April 2001). For a number of years afterward, the mahogany mistletoe was thought to be extirpated in southern Florida.

Joseph Nemecek (Florida Department of Environmental Protection) rediscovered mahogany mistletoe in southern Florida in March 1998 at a fourth station on the edge of Avery Hammock (hammock L1/6 in Weiner 1980). This station is located immediately adjacent to Dispatch Slough, a salt water marsh and dwarf mangrove swamp, which diagonally transects the northern end of Key Largo Hammock State Botanical Site. G.D. Gann, J.A. Duquesnel (Florida Department of Environmental Protection), and J.G. Duquesnel (Florida Department of Environmental Protection) verified this station on April 9, 1999. More than 20 individual “plants”¹ were found growing on three trees. The plants were fruiting and in good condition. The trees were designated as Mahogany Tree 1, Mahogany Tree 2, and Mahogany Tree 3. Mahogany Tree 1 was located in the ecotone

¹ The issue of what constitutes an individual mahogany mistletoe plant still needs some work. Individual “plants” were defined as any individual stem emerging from the mahogany tree or any group of stems closely bunched together or issuing from a common stem. It has been suggested that all “plants” on an individual mahogany may actually be a single clone.

with Dispatch slough on exposed Key Largo limestone with little organic litter accumulation. It was a smaller tree (ca. 10 feet in height) in good condition. Mahogany Tree 2 and Mahogany Tree 3 were both located within the edge of Avery Hammock in conditions more typical of rockland hammock habitat. Both trees were only partially flushed with leaves and exhibited past storm damage – each had been partially uprooted in the past, but now appeared to be stable.

On May 11, 1999, J.A. Duquesnel and D. Garvue (Fairchild Tropical Garden) visited the Avery Hammock station. They found that the smallest tree (Mahogany Tree 1) had died along with all five of the mahogany mistletoe plants. There was no apparent sign of injury or cause of demise of the tree, although the conditions had been quite dry. The other two trees and mistletoe plants were observed in good condition. On May 15, 1999, G.D. Gann and J.A. Duquesnel revisited the Avery Hammock station and counted the number of mahogany mistletoe plants on the two remaining trees. Mahogany Tree 2 had eight live plants and Mahogany Tree 3 had 11 live plants. No reproductive activity was noted. Avery Hammock was surveyed in the vicinity of the known population, and an isolated island in Displach Slough was searched at that time. No additional mahogany mistletoe plants were located.

On April 24, 2000, G.D. Gann, J.A. Duquesnel, J.G. Duquesnel, and others monitored the Avery Hammock station. Neither Mahogany Tree 2 nor Mahogany Tree 3 showed any signs of leaf flushing as a result of a long dry season. However a higher number of mahogany mistletoe plants were observed than in the previous year with 11 being observed on Mahogany Tree 2 and 15 being observed on Mahogany Tree 3. Mistletoe stems on both trees appeared in good condition. All three known host trees were mapped using a Trimble GPS unit and the Florida Department of Environmental Protection downloaded the coordinates at the Florida Park Service, District 5 office in Key Largo. The entire eastern ecotone of Avery Hammock from Old State Road 905 to New State Road 905 was searched on April 24, but no new mistletoe plants were found.

In May, 2000 J.A. Duquesnel initiated a more intensive monitoring program of the Avery Hammock station and sought funds from the Florida Department of Environmental Protection, Bureau of Natural and Cultural Resources to allow Institute for Regional Conservation staff to conduct further searches for mahogany mistletoe at Key Largo Hammocks State Botanical Site and to contribute to the development of a mahogany mistletoe protection and conservation program at Key Largo Hammocks State Botanical Site. This project was initiated on July 11, 2000.

OBJECTIVES

- 1) Survey potential habitat for additional mahogany mistletoe to determine if additional plants are present within the known historic range in Key Largo Hammocks State Botanical Site;
- 2) Provide a general description of mahogany mistletoe habitat and habitat for its host, West Indian mahogany;
- 3) Develop monitoring protocols for known or newly found occurrences of mahogany mistletoe;

- 4) Develop conservation goals including an analysis of possible augmentation or reintroduction needs.

METHODS

- 1) Survey the entire length of the ecotone of Dispatch Slough within Key Largo Hammocks State Botanical Site, on both the east and west sides.
- 2) Search all hammocks within Key Largo Hammocks State Botanical Site known to have historically contained mahogany mistletoe;
- 3) Search all other hammocks within the known range of mahogany mistletoe within Key Largo Hammocks State Botanical Site (i.e. Oak Trail Hammock, which lies north of Card Sound Road and east of SR 905 on the eastern side of Dispatch Slough).
- 4) Note general habitat requirements of mahogany mistletoe and West Indian mahogany during the surveys;
- 5) Develop recommendations for further surveys;
- 6) Develop monitoring protocols for all occurrences;
- 7) Develop conservation goals including an analysis of possible augmentation or reintroduction needs.

RESULTS OF FIELD SURVEYS

No new plants of mahogany mistletoe were observed during the course of this project. Field surveys for additional mahogany mistletoe were conducted on four days – July 11, August 21, October 2, and October 16, 2000. The previously un-searched portions of the Dispatch Slough ecotone within Key Largo Hammocks State Botanical Site were searched on July 11, and August 21, 2000. Crossroads Hammock was searched on August 21, 2000. Oak Trail Hammock and New Mahogany Hammock were searched on August 2, 2000. Avery Hammock was searched on October 2, 2000 and October 16, 2000. Within each hammock, transects were walked with two to three observers walking within visual contact of each other. All West Indian mahogany trees seen while walking the transects were individually inspected for mahogany mistletoe. Due to constraints of time and resources, the transects were not designed to cover every square foot of each hammock. Nevertheless, the vast majority of West Indian mahogany trees present within the survey area was inspected.

MAHOGANY MISTLETOE HABITAT

Although Ward (1978) reported that mahogany mistletoe grows on other hardwoods in the Bahamas, Correll & Correll (1982), did not concur, stating that it is specific to *Swietenia*. West Indian mahogany is widespread at Key Largo Hammocks State Botanical Site, on Key Largo, and within its historical distribution in southern Florida – the upper Florida Keys and the extreme southern mainland along the northern shores of Florida Bay in Everglades National Park. West Indian Mahogany is found in two natural communities defined by the Florida Natural Areas Inventory: rockland hammock and coastal berm (FNAI 1997). Although West Indian mahogany was extensively logged in southern Florida through the late 1970s, the tree has recovered throughout most of its southern Florida range.

With the exception of the occurrence at Avery Hammock, all records have indicated that the mahogany mistletoe grows on large mahogany trees. On August 30, 2000 J.A. Duquesnel measured the three trees at the Avery Hammock station. Mahogany Tree 1 had two stems at breast height, which measured 6.5" and 2.6" dbh respectively. This was the tree that died in the spring of 1999. Mahogany Tree 2 measured 11.0" dbh and Mahogany Tree 3 measured 8.2" dbh. Mahogany Tree 3 had the largest number of stems in both 1999 and 2000.

Each of the four hammocks surveyed differed from one another in both composition and past anthropomorphic disturbance. Both located on the eastern side of Dispatch Slough, Oak Trail Hammock and New Mahogany Hammock each showed extensive signs of past damage. The canopy in many areas was composed mostly of early successional species such as gumbo-limbo (*Bursera simaruba*) and wild tamarind (*Lysiloma latisiliquum*). West Indian mahogany was absent or rare throughout much of these hammocks. New Mahogany Hammock contained a large number of fresh water depressions that were filled with water and contained golden leather fern (*Acrostichum aureum*) and pond-apple (*Annona glabra*). One or more West Indian mahogany trees were observed growing on the margins of nearly all of these depressions. Despite large areas of past disturbance, Oak Trail Hammock contains large numbers of mature West Indian mahogany trees, especially to the south of the former skeet range. Near the southern end it contains large areas dominated by braken (*Pteridium aquilinum* var. *caudatum*) undergoing an extremely slow process of hardwood invasion and canopy development.

Crossroads Hammock was wetter than the other hammocks as evidenced by a large population of wormvine orchid (*Vanilla barbellata*). Despite Karen Achor's reports of extensive logging in Crossroads Hammock, it was in relatively good condition with large numbers of large West Indian mahogany trees present. Large numbers of cut stumps, presumably including West Indian mahogany, were found throughout the forest. Avery Hammock contains the largest area of intact hammock. This is one of the stations for redberry stopper (*Eugenia confusa*), a slow growing species that can be used as an indicator of hammock maturity where large trees are present. Nevertheless, large areas of past disturbance are found in the northern half of this hammock. While West Indian mahogany trees could be found nearly throughout Crossroads Hammock, the center of the undisturbed portions of Avery Hammock was nearly devoid of mahogany. In all hammocks, more West Indian mahogany trees could be found closer to the ecotone with Dispatch Slough than in the center of the forests. Although each hammock edge differed, typical species present within or near the edge of the hammocks included silver thatch palm (*Thrinax morrisii*), poisonwood (*Metopium toxiferum*), wild dilly (*Manilkara jaimiqui* ssp. *emarginata*), and joewood (*Jacquinia keyensis*).

RECOMMENDATIONS FOR FURTHER SURVEYS

Based on historical data and recent field surveys, extensive habitat exists for mahogany mistletoe throughout Key Largo in Key Largo Hammocks State Botanical Site, Crocodile Lake National Wildlife Refuge, John Pennekamp Coral Reef State Park and other private and publicly owned sites. The potential area for mahogany mistletoe, however, is too large to survey using the methods employed during this study. One area that has not been

surveyed warrants further attention – the remnant hammocks on the Ocean Reef property to the east of SR 905 and to the east and north of Old SR 905. If possible, permission should be secured to survey these forests from the ground. Otherwise aerial surveys of Key Largo should be conducted in a low flying aircraft during the dry season when the West Indian mahogany trees are leafless or nearly leafless. If resources permit, all hammocks within Biscayne National Park should be surveyed as well. Frank Craighead thought he observed plants there in 1963, but he could not be certain. Several objects were observed in the canopy of West Indian mahogany during this project that could be confused with mahogany mistletoe from the air. These include vining plants such as wild allamanda (*Pentalinon luteum*), and Havana greenbrier (*Smilax havanensis*), as well as nests constructed by squirrels or birds. Any aerial observation of mahogany mistletoe must be verified by ground surveys.

MONITORING RECOMMENDATIONS

Mahogany mistletoe is critically imperiled in southern Florida and could still be lost due to a variety of factors including hurricane, drought, fire, exotic species invasion, and management error. Due to its extreme rarity, mahogany mistletoe should be monitored on a monthly basis during the dry season (January – June) and quarterly during the wet season (July – December). General conditions of the host trees and mistletoe stems should be observed. A count of mistletoe stems should be made in May of each year, and some effort should be made to determine if individual stems represent different plants or just the visible portion of a single clone – something we were unable to determine during this project. Finally, the area surveyed during this project should be surveyed for new plants every five years.

PROTECTION AND CONSERVATION GOALS

The first goal is to protect the last known population of mahogany mistletoe in the United States. Damage to existing plants or even extirpation could be caused by natural factors such as hurricanes or human caused factors such as the off target damage from herbicide applications. The best way to reduce the risk of human caused damage is to map the plants, train staff to be aware of the location of the plants and their special needs, and monitor the population on a regular basis.

Damage or extirpation from natural causes is more difficult to prevent, but increasing the number of plants in the population can reduce risks of extirpation. The population of mahogany mistletoe at Key Largo Hammocks State Botanical Site could be increased through the augmentation of the Avery Hammock population and/or through the reintroduction of extirpated occurrences at Crossroads Hammock, New Mahogany Hammock or other hammocks within Key Largo Hammocks State Botanical Site. Both of these options should be considered within the near future. The reintroduction of mahogany mistletoe to other preserves within its historical range should also be considered.

Many potential host trees exist in Avery Hammock, in Crossroad Hammock, and to a lesser degree in Oak Trail Hammock and New Mahogany Hammock. In addition, numerous potential host trees can be found throughout other parts of Key Largo.

Propagules can potentially be obtained from the Avery Hammock population, although germination tests need to be conducted to test for seed viability. The Avery Hammock plants were observed in fruit both in April 1999 and May 2000. Germ plasm is also potentially available from Fairchild Tropical Garden where living plants from the extirpated Crossroads Hammock occurrence are maintained.

Techniques for establishing mahogany mistletoe have been developed (Campbell 1995), but rigorous testing of methods still need to be conducted. Nevertheless, based on available information and the experience of Fairchild Tropical Garden staff and others, the propagation and establishment of mahogany mistletoe seems technically feasible. Assistance from Fairchild Tropical Garden or another technically competent organization should be obtained to help develop a formal augmentation and/or reintroduction proposal.

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