the invasion of the MELASTOMATACEAE

(Miconia calvescens)
Introduction to Miconia

- Physical Description
- Natural Habitat
- Life Cycle
What Is *Miconia calvescens*?

The Melastomataceae are herbs, shrubs, or trees comprising about 200 genera and 4,000 species that are further characterized by having the major leaf veins usually 3-9 palmate and running in a parallel fashion from the base of the blade to near the leaf tip. The leaves are opposite and decussate or rarely alternate by abortion of one of the members of a pair; stipules are absent. The flowers are bisexual and actinomorphic to rather zygomorphic, at least with respect to the androecium and style. The perianth is biseriate, arising from a perigynous or epigynous zone. The calyx most commonly consists of 5 valvate sepals but these may be coalesced into a hoodlike calyptra. The corolla commonly has 5 distinct petals. The androecium most often consist of two whorls, each with the stamens equaling the number of petals but rarely has only one whorl or numerous stamens. The stamens may be dimorphic but the functional ones are typically claw-like, commonly with knee-like joints and appendaged anthers that open usually by terminal pores. The gynoecium consists of a single compound pistil of mostly 4-14 carpels, a single style and stigma, and a superior or more commonly inferior ovary mostly with 4-14 locules and very numerous axile ovules. The fruit is a capsule or berry.

(from www.botany.hawaii.edu/faculty/carr/melastomat.htm)
What Is *Miconia calvescens*?
What Is *Miconia calvescens*?

- Miconia’s native range covers South America from 20° N (Mexico, Guatemala, and Belize) to 20° S (Brazil and Argentina), between 45m and 1830m in altitude.

- These regions receive 1800–2000mm precipitation per year.

- The type of miconia with large, purple-sided leaves is found mainly in Mexico, Guatemala, Belize, and Costa Rica.

- Miconia thrives in sunlight or shade.

- Other names for miconia: velvet tree, velvetleaf, bush currant, purple plague
Miconia life cycle

- Miconia seeds can remain dormant in soil for several years.
- Disturbance of areas by hurricane damage, animals, or human activity — especially canopy removal — can allow miconia to germinate.
- In 4–5 years, at 3–4m height, Miconia begins flowering.
- Full sized trees are around 8m high (some known up to 15m).
- Flowering occurs twice or three times a year, somewhat synchronized between all the miconia in an area, and may be triggered by weather events.
Miconia life cycle

• Flowering trees produce 50 to over 200 inflorescences (flower clusters)

• Each inflorescence contains 1000-3000 whitish-pink, sweet-scented flowers, which last for 12 to 24 hours, possibly pollinated by small flies.

• Fruits are 6mm, dark purple, and sweet tasting, containing 50-200 .5mm seeds, often distributed by birds.

• The remaining fruit falls to ground forming dense seed banks in the soil; dirt clinging to animals or transferred by human activity can spread these seeds elsewhere.
Typical mature Miconia seed production:

<table>
<thead>
<tr>
<th>Inflorescences</th>
<th>Fruit per inflorescence</th>
<th>Seeds per fruit</th>
<th>Times per year</th>
<th>Total seeds per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>300</td>
<td>100</td>
<td>×3</td>
<td>9,000,000</td>
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</tbody>
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The Miconia Threat Begins

- Miconia travels to Tahiti
- Miconia in Tahiti
- Miconia travels to Hawai’i
- Recognition of the problem
• In 1937, ornamental *Miconia Calvescens*, attractive plants with vivid purple leaves, are imported to the Papeari Botanical Garden in Tahiti.

• Dispersal of miconia seeds by birds starts the spread of miconia to other parts of the island.

• As it turns out, miconia grows very well in Tahiti...

• By the 1980s, the spread of miconia begins to gain public attention,

by which time it was already too late...
• Miconia now covers 60 to 70% of the island, and has spread to many of the other islands in French Polynesia.

• Shorter native plants are blocked from sunlight by towering miconia.

• 1/4 of native species are threatened with extinction!

• Miconia’s shallow root systems lead to erosion and landslides (photo).
Miconia comes to Hawai‘i

• In 1961, a miconia tree was put in the Wahiawa Botanical Garden on Oahu.

• By 1964, miconia was also present on Big Island.

• By the early 1970s, miconia appeared on Maui.

• Miconia found on Kauai is thought to have originated in the early 1980s.

• As in Tahiti, miconia thrives in Hawaii’s climate.
Reports of the destruction caused by miconia in Tahiti reached the attention of Hawai’ians by the mid 1980s. By this time, Tahiti was already a lost cause — but there was still time to avert disaster in Hawai’i, as the miconia infestations were still localized.

Miconia was recognized as a Hawaii State Noxious Weed in 1992, as attempts began to contain the spread...
Miconia Under Siege

- Initial removal attempts
- Containment program
- Progress Report
In 1991–1993, a massive volunteer effort manually removed 20,000 miconia trees from private land. The end of the miconia threat seemed to be near.

Aerial surveying in September of 1993 located a previously unknown infestation larger than any of the others, covering 250,000 acres of state-owned land.

Apparently, a larger effort was needed...
Aerial application of herbicide Garlon 4 (triclopyr ester) was started in January 1994.

Triclopyr ester interferes with plant growth hormones, causing rapid growth that ruptures cell walls.

Helicopter surveillance was used to locate and monitor miconia infestations.

Miconia is contained, but not eradicated...
Miconia Distribution Overview

- Kauai
- Oahu
- Maui
- Big Island

Legend:
- Present
- Absent (no habitat)
- May be present (search needed)
- No info

Image from: www.hear.org
Miconia Distribution Overview

Miconia calvescens Verified Distribution on Kauai (Jan. 1996)

Highways
M. calvescens Distribution
Contour Interval (1000 Foot)

Hawaiian Islands
Area Enlarged Above

Prepared by the Hawaii Ecosystems at Risk Project (11/96)
Miconia Distribution Overview

Miconia calvescens Verified Distribution on Oahu (Jan. 1996)

Prepared by the Hawaii Ecosystems at Risk Project (10/96)
Miconia Distribution Overview

Miconia calvescens Verified Distribution on Maui (Mar. 1997)

Prepared by the Hawaii Ecosystems at Risk Project (02/97)

The Hawaiian Islands
Area Enlarged Above

Highways
M. calvescens Distribution
Contour Interval (1000 Foot)
Miconia Distribution Overview
Miconia Today

- Who’s fighting miconia
- On the front lines of the battle
- Public Education campaigns
Agencies Involved

• Operation Miconia, part of BIISC, is the main force in the war against miconia.

• The state legislature provided funds for a 64 person Emergency Environmental Work Force (EEWF), which made great progress during 2002.

• Various environmental groups such as the National Wildlife Federation help with publicity and research efforts.
Current Tactics

Helicopter surveillance locates miconia trees
Once a tree is located, a removal team must be sent in to destroy it; the miconia is often growing in places only accessible by helicopter. The removal team may have to rappel down steep slopes to reach the tree.

After leaving an infested site, “decontamination” of clothes and equipment by pressure washing is necessary to prevent moving seeds to other areas.

preparing for the mission >
Miconia removal instructions >

CONTROL METHODS FOR MICONIA
Big Island HOTLINE Phone — 961-3299

HELP STOP THE MICONIA INVASION ON THE ISLAND OF HAWAII. FOLLOW THESE SIMPLE STEPS:

- BE SAFE! Call us for help if the terrain is dangerous or the plants just too numerous.
- THOROUGHLY CLEAN ALL EQUIPMENT, CLOTHING AND FOOTWEAR BEFORE LEAVING THE INFESTED AREA. Miconia seeds are tiny and are easily carried to new, uninfested areas.
- NEVER DUMP MICONIA PLANTS OR PARTS IN AN UNINFESTED AREA. Leave them to decompose in the contaminated area. Hang uprooted seedlings away from the soil and moist surfaces. They must dry out completely to die.

TO CONTROL MICONIA ON YOUR OWN PROPERTY:

- SEEDLINGS AND SAPLINGS CAN EASILY BE PULLED UP BY HAND. They should be hung away from moist surfaces to dry out completely.
- FOR TREES THAT CAN’T BE PULLED UP EASILY, cut shallow notches, ½” deep with a machete or ax, into the bark completely around the trunk. Place the notches not more than a foot off the ground. The idea is to cut-notches that will hold liquid herbicide. Spray or brush on enough undiluted Ortho-Brush-Be-Gon® to completely wet the notched bark. The herbicide will be taken up by the plant and kill the roots. This step is VERY important to prevent re-sprouting. This herbicide is approved for home and farm use, is safe if used according to instructions, and is available at most garden shops. After two months, the plant should be dead. If need be, remoth and apply another dose of herbicide.
- FLOWERING TREES MUST BE TREATED AS SOON AS POSSIBLE. Stopping seed production and dispersal is key to controlling the infestation. Please report all flowering trees to our Miconia Control Field Team. We need to inspect the surrounding area for seedlings.
- REVISIT EVERY TREATED SITE at six month intervals to remove seedlings. The tiny seeds are viable for up to SIX YEARS in the soil. Keeping vigilant for at least a year insures you really eradicated the infestation.
Looking to the Future

- Biological warfare
- The fungus with a really long name
- Will it ever end?
Natural Enemies?

- Robert Burkhard from the Hawaii Dept. of Agriculture (HDOA) collected species from miconia’s natural habitat in Costa Rica that damaged the plant.

- Over several trips, over 50 species of insects were collected and returned for study. 2 of these species have been identified.
Insects aren’t the only cause of harm to miconia. Burkhard also collected 6 specimens of diseased plants. Pathogens appeared to be the largest contributor to miconia damage in its natural habitat.

Eloise Killgore from HDOA took up the study of these pathogens, and published the paper “Prospective Biological Control of Miconia calvescens in Hawai‘i With a Non-Indigenous Fungus Colletotrichum Gloeosporides (Penz.) Sacc. f.sp. miconiae” for the First Regional Conference on Miconia Control, August 1997.
Colletotrichum gloeosporioides miconiae

• Killgore recommended use of C.g.m., which appears to only attack Miconia calvescens.

• C.g.m. is a fungus, the spores of which are spread by wind-driven rain.

• The fungus causes leaf-spotting and eventual defoliation of miconia.

• An application for field release of the fungus was approved by state and federal agencies by July 1997. Initial release at 2 test sites showed favorable results...
Colletotrichum gloeosporioides miconiae

- C.g.m. was released more extensively in 1998. The fungus succeeded in spreading on its own to other miconia sites.

- Application of the fungus continues to the present, as a project of the Tri-Isle Resources Conservation and Development (RC&D).

- Since C.g.m. didn’t eradicate miconia in its natural habitat, it can’t be expected to completely solve the problem in Hawai’i.
What Next?

• Containment seems to be currently working, but requires continuous effort along several fronts.

• There is no immediate hope for eradication.

• Miconia’s proliferacy and long-lived seed banks may never allow complete eradication.

• Future advances could come with discovery of better natural enemies of miconia, genetically engineered anti-miconia pathogens, better remote sensing technology to find trees...
the invasion of the MELASTOMATACEAE
(Miconia calvescens)
(to be continued...)
Selected Bibliography and Sources For Further Information

- http://www.hear.org/ (Hawaiian Ecosystems at Risk, links to many other resources)
- http://www.hear.org/MiconiaInHawaii/ (Miconia specific links and information)
- http://www.hear.org/projectmiconia/ (see what’s currently being done)
- HNIS Report for Miconia calvescens (good source for habitat, biology, and history; available from www.hear.org/MiconiaInHawaii/)
- http://www.botany.hawaii.edu/faculty/cw_smith/mc_control.htm (natural predators of miconia)
- http://www.hi.nrcs.usda.gov/partnerships/trircd/ (Tri-Isle RCD)
- http://www.google.com (search on miconia will turn up many more resources)