BIG ISLAND MELASTOME ACTION COMMITTEE: *MICONIA CALVESCENS* CONTROL PROGRAM OVERVIEW

LE COMITÉ D'ACTION CONTRE LES MÉLASTOMATACÉES DE LA BIG ISLAND : UN BILAN DU PROGRAMME DE LUTTE CONTRE MICONIA CALVESCENS

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The realization that *Miconia calvescens* posed a significant threat to the island of Hawai'i (the Big Island) was slow in coming. In fact, the species had been sold in nurseries for several years. Early efforts to control *M.c.* by the 4-H Club languished after the Hawaii Department of Agriculture declined to assist. Later, an interagency consortium developed a management program after a similar program on Maui demonstrated that containment of *M.c.* was possible. A number of mechanical and chemical control strategies are used. There are over 100 separate sites, individual infestation areas where flowering trees have been found, and are scattered over 100,000 acres. Control efforts focus on the distribution and mapping of the infestations, public awareness and education, and on the eliminating outlying satellite cores with the intention of stopping the spread into new unspoiled areas. Mapping efforts have been concentrated on roadways and in subdivisions, where *M.c.* have been reported by hotline callers and confirmed. Survey work in remote areas will soon be necessary as well. All types of media, news releases, televisions and newspapers, public meetings and slide presentations, and the flyers that have a picture and information about the plant and how to report sightings are all part of the public education process. All known satellite populations have had initial treatment done on their highest concentration cores.

La prise de conscience que Miconia calvescens *constitue une menace significative pour l'île de Hawai'i (la Big island) fut lente à venir. En fait, l'espèce était vendue dans les pépinières pendant de nombreuses années. Des efforts précoces pour lutter contre* M.c. *menés par le Club 4-H s 'étiolèrent après que le Department d 'Agriculture de Hawaii ait decliné son aide. Plus tard, un consortium inter-services a développé un programme de gestion après qu'un programme similaire lancé à Maui montra que le contrôle de* M.c. *était possible. Un nombre de strategies de lutte mécaniques et chimiques ont été utilisées. Il y a plus de 100 sites différents, zones infestées particulières où des arbres en fleurs ont été trouvés, et dispersés sur 50 000 ha. Les efforts de lutte reposent sur la distribution et la cartographie des zones infestées, l'information et l'éducation du public, et l'élimination du centre des populations satellites isolées avec pour but de stopper l'extension dans de nouvelles zones non touchées. Les efforts de cartographie se sont concentrés sur les bords de routes et les subdivisions où* M.c. *a été signalé par téléphone sur la hotline et dont la position a été confirmée. Un travail d'inspection dans les zones isolées devra être bientôt nécessaire. De nombreux types de média, communiqués de presse, télévisions et journeaux, réunions publiques et présentations de diapositives, et des dépliants avec un dessin et des informations sur la plante et expliquant comment signaler les plantes aperçues, ont fait partie du processus d'éducation du public. Toutes les populations satellites connues ont été initialement traitées en leurs centres de plus grande concentration.*

Horticulturists brought *M.c.* to Hawai'i some time in the mid 1950's to '60's. It is unclear at this time whether the first plant was on O'ahu or on Hawai'i, both islands report the possible presence of *M.c.* during that time. It was thought of as an attractive ornamental plant with spectacular foliage. The plant is native to Central and South America, where climatic conditions are much like those in Hawai'i. This species adapted well to it's new

environment, moisture was abundant and there were no apparent natural enemies. A report from a Hilo resident, Kay Nishioka, on the island of Hawai'i (the Big Island) places the plant on the island some time between 1955 and 1959 (Nelson Ho, pers. comm., 1998). A second report on the Big Island, from caretakers at the Volcano Store (pers. comm., 1997) have potted *M.c.* plants in Volcano in 1959 but *M.c.* has not been seen there during recent surveys. The first occurrence of *M.c.* from O'ahu data suggested a tree in Wahiawa Botanical Gardens in the early '60's, possibly as early as 1961 (Conant and Nagai, this volume).

There are few records between 1965 and 1975, although it is apparent the original plants were left to grow into trees. By the early to mid 1970's nurserymen propagated *M.c.* for sale and distribution, especially on the Big Island. Commercial sales continued for several more years, and previously planted trees matured. The Big Island was under a silent attack and the public still had no idea. Young trees emerged as far away as 400m from the mother trees, and hundreds and perhaps thousands of hectares of land were being contaminated. Satellite *M.c.* populations emerged from nearly 100 confirmed locations across the Big Island.

M.c. is a major threat to the forests of the Big Island because the island's rural and undeveloped lands are so widespread with subdivisions and nurseries near native forests. *M.c.* was transported around Hilo, into Puna, and across the island to Kona. *Anthurium* blight may have been an indirect contributor to the spread of *M.c.* as well. In the 1980's many flower farms were hit with the disease and abandoned. Some of these farmers were propagating *M.c.*, and others were believed to have cinder potting mixes that were brought from other *M.c.* contaminated areas. Many of the abandoned farms are infested with saplings and seedlings numbering in the thousands. The plants are now in much more remote areas, places where people rarely go.

Today it is believed that most locations with intentionally planted *M.c.* have been rediscovered on the island of Hawai'i. In many locations the original trees were destroyed several years ago. All that remain are their offspring, some now mature. Hundreds or thousands of young plants are commonly found at these sites. The contaminated areas range in size from a very compact 10 meters around an individual matured tree, to large parcels of 250 hectares or greater. In the steep gulches of North Hilo, *M.c.* has been spread upstream by birds traveling along it's course.

EARLY EFFORTS

Information gathered from many Big Island residents led to the conclusion that most intentional plantings occurred from the early 1970's to mid '80's. By 1982, *M.c.* seedlings were considered a nuisance in many of the originally planted locations. Kay Nishioka noticed *M.c.* scattered throughout the Hirose Nursery property in Hilo and being concerned what could become of her yard, she was alarmed. By June of 1982 she had the tree destroyed, but not before many seedlings emerged.

Joyce Davis, a botanist with Hawaii Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW), was also searching for information on the plant. In September of 1982 Ms. Davis received a response to an inquiry to the National Museum of Natural History - Smithsonian Institution. F.R. Fosberg, who had personally seen the long-term results of this very same problem in a recent trip to Tahiti, recommended immediate action : "it makes the most dense shade I have ever seen in a forest. The combination of dark green and dark purple in the leaves lets almost no light through. Its own seedlings are about all that can grow under a dense stand of it".

Ms. Davis launched a public awareness campaign to alert more people of the need to control this pest weed. She displayed live *M.c.* specimens at the Hawaii County Fair in September of 1982. A new satellite population was being established in the undeveloped forest lots on the block of Mamaki and Awa streets in Panaewa. She destroyed the plant. Elsewhere around Hilo town people with mature trees were beginning to note the abundant reproduction. They were among the first to destroy the mature trees in their yards but not before seeds were already scattered by birds.

Kay Nishioka, also working for DLNR at the time as well as being an active volunteer for the 4-H Club, decided to form a work detail to battle *M.c.*. The Cougars 4-H Club distributed letters explaining *M.c.* as a bad pest, and requested distribution information and general help in the destruction process. In October 1982 an article in the Hawaii Tribune Herald announced the start of the *M.c.* plant eradication program by this group. A thousand mature trees and several thousand seedlings were destroyed or at least set back several seasons. Cutting trees was the most common control method, herbicides were sometimes used on the stumps but many resprouted.

In February 1983 a letter was written to Jack Suwa, Chairman of the Hawaii State Board of Agriculture, expressing their concerns. In response they were informed that considerations were being made to place *M.c.* and all melastomes on the Department's Noxious Weed List, as a "potential pest of our environment". In June, another work trip, this time to the Carlsmith property above Onomea Bay, was conducted. The largest trees then measured 15cm basal diameter, however the majority ranged between 5cm and 10cm. More effective control methods and a strategy were needed as the problem was beyond their control. The State of Hawaii Department of Agriculture (HDOA) took note of the location, visited the site but left it alone because *M.c.* was not on the Noxious Weed List yet. It didn't appear to be a problem big enough to warrant concern, and the 4-H Club was handling it. By 1984, 4-H work stopped, overwhelmed by the scope of the infestation. She presented the problem to the Board of Agriculture once again and strongly recommended immediate attention. No work was recorded on the Big Island for the eight-year period following the last 4-H Club efforts, from 1984 until 1992.

Statewide efforts combined to create a full-color poster with photographs and information about the problem and what to do. It was prepared by the Conservation Council for Hawaii, the Noxious Plants Task Force, Betsy H. Gagné and Steven L. Montgomery, in coordination with the Committee on Introduced Species. Support for the preparation of the poster was provided by DLNR-DOFAW, Hawaiian Botanical Society, Waimea Arboretum Foundation, Sierra Club Hawaii Chapter and Maui Group, National Audubon Society and Hawaii Audubon Society. A photograph of a *M.c.* tree and close-up images of leaves and fruit were printed on the cover along with information about the destruction it could cause, what to do and who to call if *M.c.* were found. These posters and subsequent printings have produced many reports by the public. Much of the initial location data throughout the islands was generated from this endeavor.

In 1992 HDOA resumed considering *M.c.* as a candidate to the Noxious Weed List, and as time was available, crews on the Big Island resumed control work at all of the previously known sites. Mature stands were cut back in several locations. HDOA crews worked along the Belt Highway from Onomea to Papaikou, in Hilo town to Panaewa and to Waiakea Uka, destroying mature trees. They responded to telephone reports from the public and charted the new information. Work also began in Puna at several satellite populations. Mature trees were destroyed in a large infestation at Leilani Estates on Kupono St., at Ainaloa from Coconut to Pearl, in Nanawale and in Kurtistown cane fields. Some trees were also destroyed in the Kona district. It was a productive start that lasted only three months. A conflict with a property owner caused the crews to discontinue control work on private programs. In July, researchers of the Haleakala National Park (HALE) contributed another $15K to support the continued research of chemical treatments and methods of

destruction and, by August, *M.c.* was placed on the Noxious Weed List. HDOA was now mandated to take action.

Three significant events occurred in 1993 along with continued public education and monitoring. Jean-Yves Meyer of Tahiti visited Maui. His interest in the *M.c.* problem of Tahiti and the news of it beginning in Hawai'i brought him to the Islands to contribute his knowledge and recruit help in finding a solution that could spare what was left of the Tahitian forests, as well as those in Hawai'i. In a helicopter survey of some State forests, Robert Hobdy, a forester for DLNR discovered a large population of *M.c.* above Hana, in a remote area well away from roads and homes. He estimated a core of 1ha in size. This increased the magnitude of the Hana site considerably, increasing the estimated core size to an estimated at 7ha, with satellite populations scattered throughout 18ha of forest (Randy Bartlett, pers. comm., 1997). And also in 1993 the Maui MAC received a grant of $97,000 for biological control research and public education on melastomes.

Randy Bartlett, as spokesperson for MAC, presented information to lead agency representatives of the State and Federal governments. Another meeting was called on the Big Island to relay the new information and to form the Big Island Miconia Action Committee (BIMAC). The committee applied for and received a $6,000 grant from the County Council.

DEVELOPMENT OF THE CURRENT CONTROL CAMPAIGN

Statewide *M.c.* awareness advanced considerably in 1995. Several activities were sponsored and organized and many *M.c.* sightings were reported. School children as well as adults were learning of the danger, and assisted in locating and destroying the pest. Many new sightings were recorded, one of them from Kaua'i, the fourth Hawaiian island infested with this pest. A single naturalized population was discovered there from a tree planted in a botanical garden. On O'ahu, the Sierra Club joined control efforts led by Patrick Conant, HDOA, enlisted the help of volunteers to scout for and uproot seedlings in contaminated gullies on the southern side of the Koolau mountain range, from Kalihi to Manoa Valleys (Conant and Nagai, this volume).

Efforts increased on the Big Island using the County $6,000 funding. The Hawaii Resource Conservation and Development Committee hired Sheri Amundsen of Maptech, Inc. to survey and map *M.c.* distribution in lower Puna. Additionally, a "*Miconia* Hotline" telephone was installed. Several hundred calls came in during the first year the line was placed in service. Each sighting report was recorded and drive-by verifications were made throughout lower Puna and in Hilo. Each confirmed sight was recorded in the global information satellite (GIS) location database. BIMAC obtained the information it needed to organize the next step in the plan, the hiring of a full-time *Miconia* control team.

Also in 1995, additional funding and resources from US Forest Service, HDOA, and University of Hawaii continued the search for biological control agents. USFS contributed $8,000, and $113,400 came from the State through HDOA funds. Control efforts and public education were also supported by these funds.

By December of 1996, the Big Island had a full time three person team in operation, fully functional and funded for six months. The team began responding to hotline calls from the prior year, visiting callers to confirm sightings and destroying any trees found. Information gathered was recorded on maps so the infested parcels could be identified and the owners contacted. Helicopter flights were utilized to survey remote areas around known populations. US Geological Survey-Biological Ressource Division (USGS-BRD) at HAVO contributed $10,000 in helicopter reconnaissance charter time. DLNR-DOFAW provided $30,000 in field crew time to assist with the control efforts.

Governor Cayetano launched the statewide campaign “Operation *Miconia*”, in March of 1996, supporting the efforts. The Nature Conservancy (TNC) contributed $50,000 to a technological research effort in spectral analysis. A three-year grant of $70,000 per year was also awarded in 1996 to fund biological control research and monitoring. By 1997, the statewide campaign to battle *M.c.* was well under way on all islands. Field crews destroyed thousands of mature trees buying time for the biological control researchers to develop the ultimate solution.

ACTIVITIES OF THE CURRENT BIMAC PROGRAM

Encouraged by the success of the initial contract with the County, BIMAC requested additional funding. They obtained $100,000 to continue the effort on the Big Island. The funds were used to leverage additional grants from other agencies. The USFS contributed $50,000 and the National Fish and Wildlife Foundation (NFWF) provided $25,000 through the “Pulling Together Initiative". Another grant from the National Park Service “Challenge Cost Share” program afforded the team an additional $29,000 for personnel support. New partners joined BIMAC in 1997 and 1998 to assist and support the program. MLS Hawaii, Inc., a private company, has donated access to their data base which gives the team vital property ownership information. The team can now quickly and easily determine who and where the property owners are and establish contact with them. The Estate of James Campbell, a private company and large parcel landowner, has donated $10,000 to support control efforts. Alu Like is another federally funded partner. Another large landowner, Kamehameha Schools/Bishop Estate, has recently joined BIMAC meetings to obtain more information and to assist in the future success of the program.

With a full-time team in the field a few significant facts were quickly established. People were the primary dispersal agents, the earliest known trees were by houses or other buildings. Nearly 100 satellite populations were discovered from sea level to 800m elevation on the Big Island, mostly along the eastern and south eastern coast of the island. Two populations were also discovered on the west coast of the island in the Kona district, and a third has been reported but not yet confirmed. Control efforts were focused initially on these satellites, working from the outside, towards the core populations of Hilo. Dense stands of mature *M.c.* were treated first. BIMAC organized a systematic approach to the problem.

BIMAC MAPPING AND DATA TRACKING

Early *M.c.* introductions were near sea level, consequently the incidence of mature trees were greatest in this area, approximately 3,000 trees per ha in the more concentrated sites. Because *M.c.* was used in landscape plantings, sightings of roadside plants were used successfully in targeting mature, flowering trees nearby. Generally, tree densities lessened with increasing elevation. Early mappings shows 1,250 mature trees per ha at satellite populations in the 185m to 450m elevation range, and 250 (or less) mature trees par ha, at satellite populations in elevations above 450m.

The field team has been recording distribution information with as much detail as possible. When a site with a mature tree (or trees) is confirmed, information is collected regarding property ownership and occupancy. Locations are recorded on road maps or hand drawn maps, the information is then processed to determine the plat and parcels that are affected. The Real Property Tax Office of the County of Hawaii maintains ownership parcel maps for tax purposes. Parcel maps and a data base contain information on parcel acreage, dimensions, ownership and occupancy. These maps are currently the best method of monitoring *M.c.* because they offer convenient tracking information. Individual properties can be determined and individual flowering trees can be accurately plotted within the parcels on these maps. The most detailed map, known as the “plat”, has been divided into individual parcels and each parcel has a unique number known as its “TMK”. Work files are created for each affected plat. Our files contain a copy of the map and all information regarding the

affected parcels. Records of control access requests, control work dates and plant quantities and sizes, correspondence and any other information are stored in these work files.

Fig. 1. *M.c.* distribution on the island of Hawai'i (Big island)

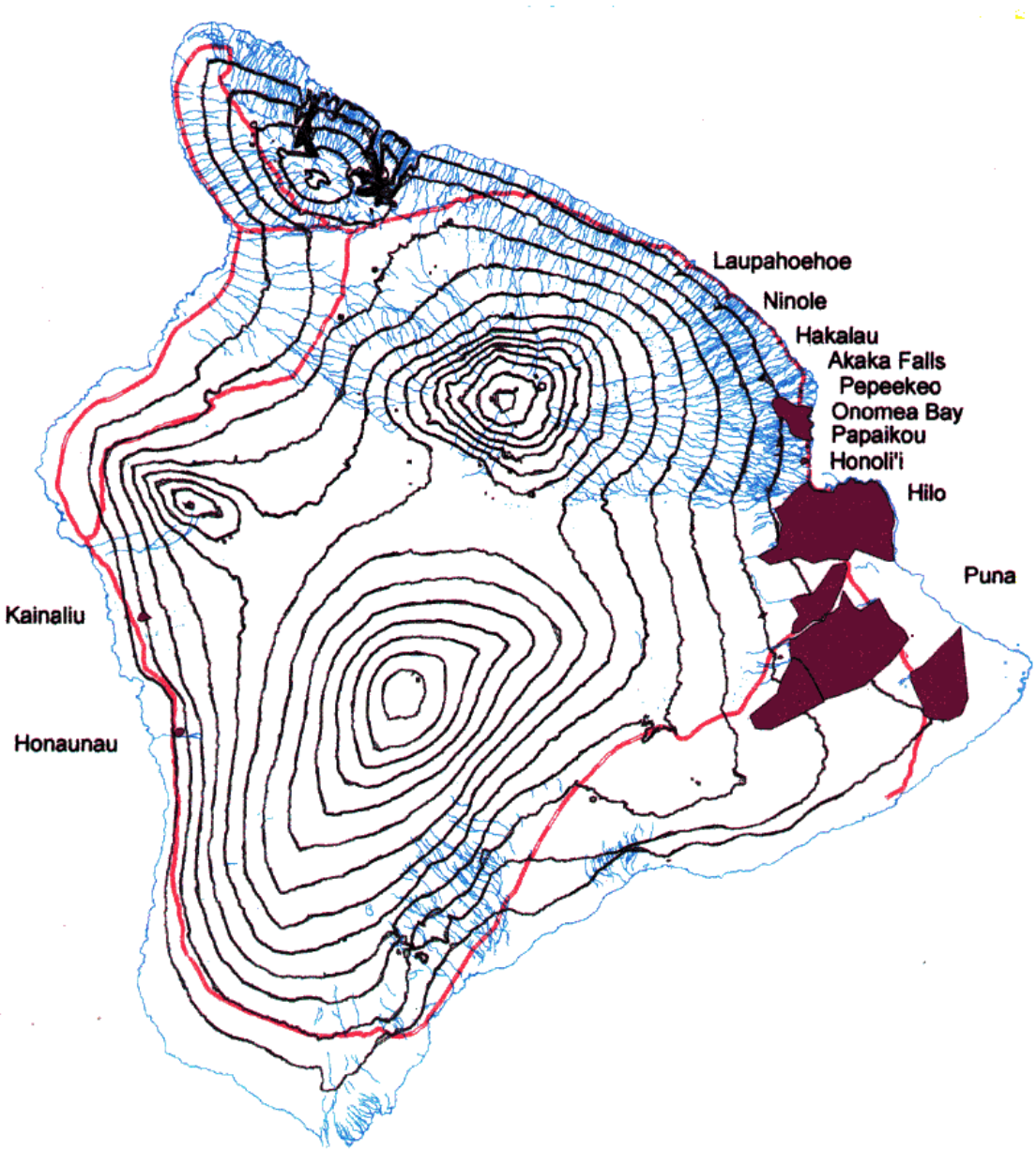
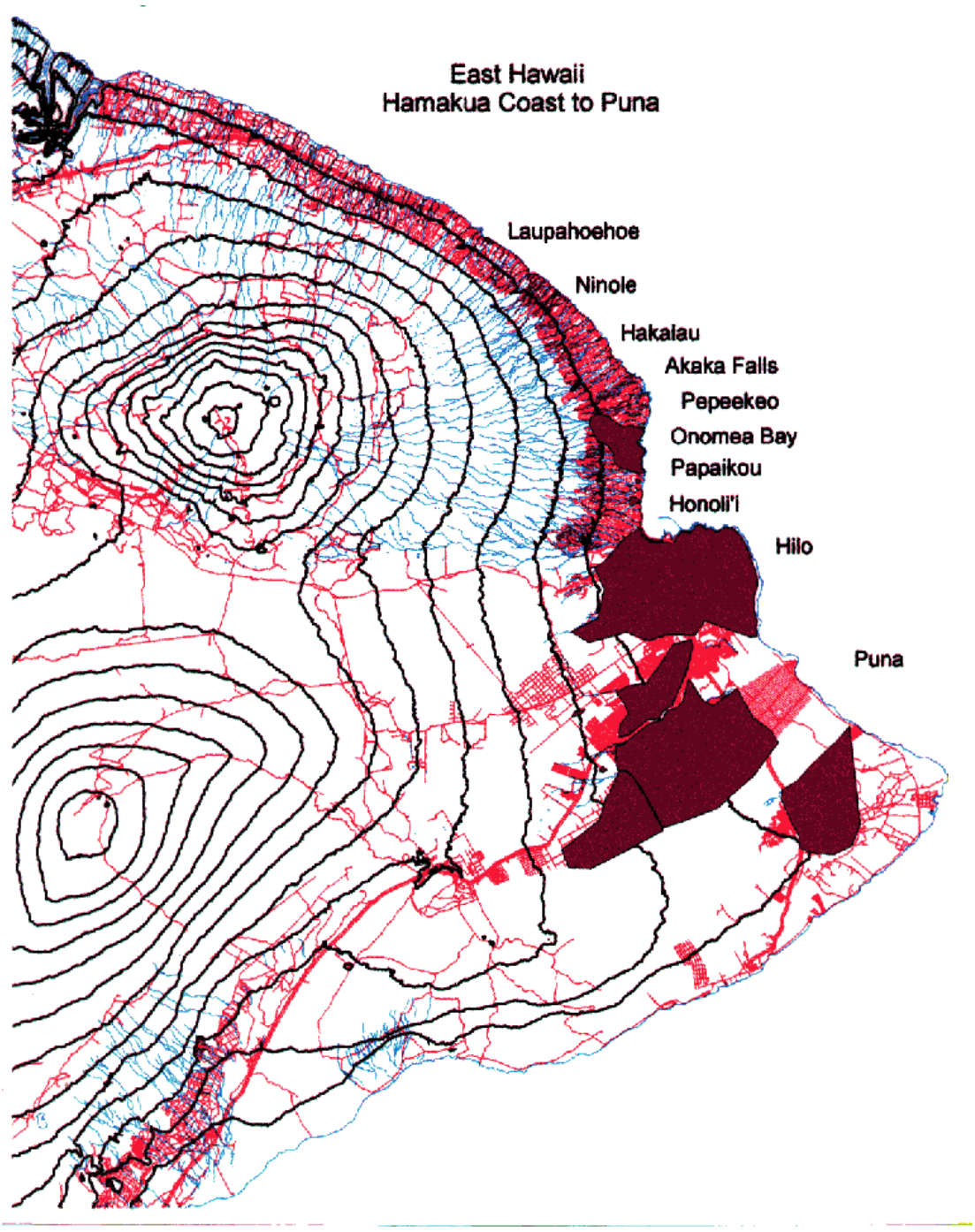


Fig. 2. *M.c.* distribution on East Hawai'i : Hamakua Coast to Puna



To get a better overall picture of the problem known *M.c.* locations have also been recorded on US Geological Survey quadrangle maps (1:24,000). These maps are primarily used in planning surveys and control strategies. They provide an overall picture of the infestations and areas at risk. Aerial photographs are also used for more refined plotting and to show features not included on quad maps.

A wall-sized map with *M.c.* locations and management units was produced. *M.c.* locations were marked, and unit boundaries were defined around groups of identified and potential sites. Twenty seven management units were created. Surveys have since concluded that five of these units are free from *M.c.* The original reports were most likely plant identification errors. Indian Rubber (*Ficus elastica*) trees are commonly mistaken as *M.c.* These units will continue to be surveyed annually as a precaution. This wall map is used to display the problem in an island-wide context and is frequently referred to in strategy discussions. It is also used as a visual aid for public education and has been reproduced on color slide film and shown during presentations.

Digitized maps are being developed and will be extremely useful when plotting the precise locations of remote plants. All *M.c.* found on helicopter surveys are marked by global positioning satellite receivers. These coordinates are downloaded to a data base and can be seen in an overlay on a digitized USGS quad map. Sites along the westernmost boundaries will be among the first to be plotted. It will aid in the planning of survey work and will be the baseline for all control efforts.

Once digitized, distribution and control information can be analyzed in any number of ways and used as a tool to monitor control efforts. This will also allow the information to be more widely circulated for reporting and presentation purposes as well as in an ".html" format for posting on the "www". Federal cooperators have hardware and software to do the work and are in the process of recording the data in GIS format.

The "*Miconia* Hotline" is still being monitored and new reports verified by the team. These calls continue to be a good source of information as well as a way to inform callers of the progress of the program. Hotline calls are logged onto a form, the callers get answers to their questions, and meetings are scheduled to verify the sightings.

Surveys continue through all the subdivisions, towns, and other roadways that are within range of known *M.c.* infestations. Although it is believed that most locations visible to the public have been reported, it is also believed that many remote populations have not been located. Remote areas are surveyed by air. Helicopters are the most effective means of surveys in remote areas without roads. From the air large infestations can be spotted easily. We do not expect to find large contiguous populations of mature trees. Unfortunately, helicopter overflights are not appreciated in most developed areas, so most surveys in rural subdivisions will have to be completed from the ground.

Another important item to consider is that flying over an area will not necessarily reveal all *M.c.*, only the ones large enough to be detected through the surrounding vegetation. Once an area has been surveyed by air, it should be monitored annually for several years to be sure that no smaller trees are growing and becoming mature. Hunters have reported *M.c.* in North Hilo forests. These reports need follow up on foot as many of these areas have already been flown without sighting large *M.c.*

CURRENT CONTROL EFFORTS ON THE BIG ISLAND

A full-time control effort has been operating on the Big Island, beginning at the most remote locations. Larger crews from DLNR-DOFAW have been available on a part-time basis for treating larger populations. Once the core populations were destroyed, work began

in the buffer areas around each core. Control lines were set up around the infested locations to begin measuring the extent of the infestation from the core outward and to structure the field work into easily managed blocks. With assistance from the forestry crews, the team is able to cover much more ground in less time. There are over 100 individual work sites to attack and several remote area reports to be checked.

The first hired member of the team was responsible for strategic planning, tactics, logistics, records, public awareness and daily crew functions. A weed control technician now leads the field staff and temporary personnel resources at the scheduled work sites. Another technician has also been with the team since it's inception. The public awareness coordinator has been surveying subdivisions and speaking with residents throughout the infested districts since May 1997. There is funding to carry this four person team through May 1998.

In July the team was awarded federal "Challenge" money which allowed the team two more workers for six months. One position was dedicated to enhancing the field team with an experienced weed controller and the other for public awareness. The latter conduct road-side surveys, makes door-to-door contacts to inform residents of *M.c.* and gathers information. The historical information obtained is important in reconstructing the introduction of *M.c.* into new areas and in tracking down the locations of parent trees.

Satellite populations have been reduced significantly and the crews are closing in on core populations. High elevation satellite populations nearest the forest reserves have been treated first. In upper Puna, *M.c.* occurred up to the 800m elevation level. The field team is currently setting up large blocks of work in preparation of additional control workers. DLNR forestry crews are scheduled to work with the team one to two weeks per month. With a crew size of six to eight persons large parcels can be controlled efficiently by systematically walking thorough them. Workers side by side, equal distance apart, and within sight of each other, can sweep an entire parcel from one end to the other leaving no piece of the parcel uninspected. Additionally, the team has incorporated the use of portable stands to hold an informational sign near the equipment and vehicles on the roadsides. This tells the local traffic and pedestrians that *M.c.* work is being conducted.

CONTROL METHODS

Currently field crews use chemical and mechanical. It is challenging, resource-intensive but essential work that in conjunction with successful biological controls should prove to be a winning combination in the battle against the weed. Chemical and mechanical control methods have evolved during the control effort. Young plants can be effectively controlled during dry weather by pulling them and hanging them in surrounding vegetation to desiccate. During the rainy season young plants have been found sprouting new roots from the entire main stem on plants up to 30cm in height, without being in contact with soil six weeks after being uprooted. Dense populations of seedlings may also be effectively and efficiently controlled with foliar application of herbicide. Current practice in dense stands is to control mature and near-mature trees, with follow up in three to four months to assess results. By then the herbicide should have taken effect and newly emerging plant densities can be evaluated for future control. In areas that have scattered *M.c.* all plants are destroyed regardless of age.

Plants too large to uproot require herbicide treatment to prevent resprouting. Several methods have been found effective as long as treatment guidelines are correctly implemented and all stems are treated with herbicide. Cut stump and frill and squirt methods have been the standard methods for destroying large *M.c.* on the Big Island. With the cut stump method, the entire stem is severed from the stump. The stump is immediately treated with herbicide, and care taken to treat all of the exposed cambium. With the frill and

squirt method, the bark of large trees is frilled with angling cuts into the cambium of the main stem. A series of cuts are made around the entire circumference. Herbicide is then squirted into the frills. The success of both methods is dependent on thoroughly treating the full circumference of the tree according to label requirements of the herbicide. Best control with these methods has been with undiluted Garlon-4, active ingredient triclopyr. Post treatment surveys have located numerous sprouting stumps after these treatments. We suspect that many of these are the result of missed application after the trees were cut. Some may also be due to inadequate treatment of the cambium. Rain may have been a factor. We have now started using long-lasting dyes in the herbicide mix to quickly ascertain whether stems have been treated.

Field trials with low volume and thin-line basal applications of Remedy or Garlon-4, both containing the active ingredient triclopyr, have been encouraging. In the fall of 1997, low volume basal application with 20% Remedy or Garlon-4 in diesel oil was adopted as a standard control method. Bas-Oil Red dye is used in the herbicide mix to allow quick visual confirmation of treatment. This method has the benefit that the tree does not have to be cut. Only the base of the tree is sprayed with the herbicide allowing fast and effective treatment. Again it is essential that the entire circumference of the tree be treated. Field trials have shown that this method is very effective on all sizes of plants, it is effective even in light to moderate rainfall. Further trials are needed for safe and effective pre-emergent control of seedlings and for foliar control of trees on steep banks and other locations where access to the base is difficult.

PUBLIC AWARENESS AND EDUCATION

Through many types of public awareness activities and information resources, the *Miconia* Control Program has increased in motivation and strength by the number of individuals, businesses, organizations, and agencies who support the program. The program does not exist in one agency alone. The responsibility is shared by many. Continued support of all kinds will be necessary for several more years to completely remove this threat once and for all.

Community outreach is aimed at presenting effective information to those who are in or who own threatened areas and to any other interested persons. Presentations including slide shows, detailed maps, and sometimes a fresh specimen for examination are presented to communities and groups. Local status reports for individual communities are submitted to the editors of community newsletters, encouraging members to keep a watchful eye in their areas. It also alerts residents to known areas within their communities where *M.c.* have already been found.

Road surveys have produced evidence that not all people have been informed of the threat. Some people are still growing *M.c.*. In other cases people are finding seedlings in their properties and assume that once uprooted, the problem is gone. As people within the community realize that they have this particular problem, they talk among themselves and if there are more plants they are soon reported to the team.

Personal contacts during road surveys have been an effective way to educate the public. When there is a need to survey a certain area, the team goes road-by-road, door-to-door, speaking to as many people as possible. Informational posters with colored photographs of the plant, information about the problem and a phone number to report a finding are handed out. A fresh sample of a real plant is also carried since identifying it by a photo is often difficult. In some suspect areas that have no reported sightings, posters with pictures and fresh samples are displayed in public areas. In many cases someone will recognize it and call the hotline to report it.

Informational meetings and presentations during regular business meetings give the field team the opportunity to encourage participation and volunteer efforts from groups as well as giving the group an updated report on the status of the control program. Acceptance by the community is important and becoming familiar with the field team gives them comfort in knowing what is happening and who the people are around them.

Keakealani Outdoor Education Center (KOEC) in Volcano Village teaches students and teachers alike about the dangers of alien invasions and makes special effort to focus on *M.c.*. Display boards with photos, information and slide shows are presented. Many students are inspired to study it more, creating science projects and volunteering to help the team. Many of the reports to the hotline are from students who have learned of the problem in school or at excursions to KOEC. Educators from around the state have learned of this threat from KOEC. Some have gone into the field to experience it for themselves and to share the important lessons that were learned about the environment.

Information dissemination is also carried out in other social functions and forms of media. Display boards and literature are brought by the team to fairs and other gatherings. Presence at these functions gives the public the opportunity to learn more about the problem, what is being done and what they can do to help. Information is also presented on television. A film producer on Maui created a selection of informational, 30-second, film footage of people destroying the plants with phone numbers to call for more information or to report sightings. News reporters have incorporated *M.c.* into their reports on the environment, newspapers and magazines are doing the same. BIMAC has submitted press releases to the local newspapers, radio and television stations, reporting new funding sources, status and current plans of the attack.

Community action groups have been organized. Some communities are assisting in the control work for their areas. Early control efforts were done in the Puna subdivisions of Nanawale and Leilani Estates. Leilani Estates has been diligent in requesting participation by their members and have also contributed funds to purchase the necessary herbicides. Concerned residents in Fern Acres and Fern Forest have helped to reduce the threat in their area as well. Organizations such as the Outdoor Circle and the Rotary Clubs have also participated in eradication projects, as well as individual and family efforts around peoples homes.

The team is currently organizing a training program for groups of interested people who wish to assist in the project. They present it to all new workers whether funded or volunteer. The need to understand the problem of dispersal and prevention of contamination, knowledge of things to watch out for and other safety issues for field work will are taught. With proper coordination and training, *M.c.* can be controlled by volunteer efforts in some locations. Ideally, a group could ‘adopt’ a favorite site, monitor it and control it at least annually. They can refer to the team for guidance, support, and in some cases supplies. Team members be scheduled to accompany them at sites until such time their leadership is not necessary. The team will monitor the sites annually and reports will be generated to reflect progress.

DISCUSSION

M.c. is present on four of the Hawaiian Islands, i.e., Hawai’i, Maui, O’ahu, and Kaua’i (Medeiros *et al.* , 1997). Of all of these islands, Hawaii - The Big Island, is the largest (the rest of the island chain combined covers less area) and has the most serious problem. With 10,433 sq km of land, much of it covered by dense remote rainforests, it appeared there would never be enough financing for the entire program. *M.c.* was already naturalized in several places near remote forests and something had to be done immediately.

Maui land managers discovered their problem by chance, from the air, and were quick to respond. O'ahu and Kaua'i had a few small populations (Conant and Nagai, this volume). Only the Big Island had so many separate populations. As long as any island has *M.c.*, the other islands are vulnerable. People on the Big Island were already helping to move it around the island from place to place. In a pot it is easy to intercept as long as there are agricultural checks between islands before flights but inspectors can't stop people wearing muddy shoes. Or carrying that special pair of hiking boots that they never travel without for that matter. *M.c.* seeds are very small (Meyer, 1996). Anyone walking beneath a *M.c.* canopy or old site could carry seeds in their hair, on their clothes, or on equipment from one place to another. Hapu'u (*Cibotium spp.)* fiber is another source of new infestations.

Finally Big Island resource managers took action. Convinced by those on Maui that *M.c.* could still be controlled and that forming a partnership now was necessary, as well as possible and not too late an effort, BIMAC was formed and a team was hired. The problem was a great challenge due to the size of the island and the size of area infested. Other problems encountered were difficult terrain, steep slopes, and thick vegetation. The number of owners with *M.c.* infested land is in the thousands. All of them had to be notified and willing to cooperate. With limited funding, the team needed to act fast, be efficient and keep the campaign alive in the minds of the public. The help of all agencies is necessary.

Maui resource managers had a much easier time because the problem was recognized much earlier than on the Big Island. This early action prevented more land from being infested. They were also fortunate to have the worst situation on a parcel of State land, where the work could be done without contacting many owners.

As stated by Randy Bartlett, motivating force of the Big Island committee, "The lifeblood of our State's economy is not Tourism, as those in the Tourism industry would have you believe, it is our environment. People travel here to enjoy our unique environment with its wonderful weather. Everyone in the state depends on our native rainforests to provide the watershed capacity to fulfill our potable & agricultural water needs".

All of the urgency is necessary, the best possible control by chemical, mechanical, and biological means must continue, until more effective methods are found. Researchers and scientists are hard at work searching for natural enemies to help control this pest (Killgore, Sugiyama and Barreto, this volume). The answer to stopping the spread is by people using labor intensive and time-consuming methods. The answer to total eradication lies with some sort of natural enemy to continue working even when people stop to rest. Some hopeful signs are already on the horizon but they will take several years to develop.

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APPENDIX : PARTICIPANTS AND SUPPORTERS OF OPERATION *MICONIA* IN HAWAI'I

Federal Agencies

BRD	Biological Resources Division
HALE	Haleakala National Park
HAVO	Hawaii Volcanoes National Park
NBS	National Biological Survey
NFWF	National Fish and Wildlife Foundation
NPS	National Park Service
RM	Resources Management Division
USFS	Unites States Forest Service
USGS	United States Geological Survey

State Agencies

DLNR	Hawaii Department of Land and Natural Resources
DOFAW	Division of Forestry and Wildlife
HDOA	Hawaii Department of Agriculture
KOEC	Keakealani Outdoor Education Center
UH	University of Hawai'i at Manoa

County Involvement

Hawaii County Council
Hawaii County Office of Research and Development
Maui County Council

Other Involved Organizations & Individuals

BIMAC	Big Island Miconia (Melastome) Action Committee
	Cougars 4-H Club
	Donn Carlsmith, Onomea property owner
EWMP	East Maui Watershed Partnership
	Hawaii Resource Conservation and Development Committee
	Maptech, Inc.
MAC	Melastome Action Committee - Maui
RCUH	Research Corporation of the University of Hawai'i
	Sierra Club Hawaii Chapter
TNCH	The Nature Conservancy of Hawaii
Tri-Isle RC&D	Tri-Isle Resource Conservation & Development Committee