

**BIOLOGICAL CONTROL OF *MELALEUCA QUINQUENERVIA*  
IN SOUTHERN FLORIDA**

**Annual Report**  
**(May 23, 2009-May 22, 2010)**  
**Agreement # 58-6629-9-214**

**Submitted to:**

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**June 14, 2010**

## Executive Summary

The five-year (2009-2014) *Melaleuca quinquenervia* (melaleuca) biocontrol project agreement ( # **58-6629-9-214**) between Miami-Dade County, Department of Environmental Resources Management (DERM) and USDA-ARS, Invasive Plant Research Laboratory (IPRL) represents part of the statewide melaleuca management efforts in Florida. The current agreement calls for the development of a program for mass rearing and field release of 245,000 *Boreioglycaspis melaleucae* (psyllid) and 2000 *Oxyops vitiosa* (weevil) per year (starting May 2009) for 5 years throughout melaleuca distribution range in Miami-Dade County, Florida. Releases are to target the melaleuca invaded sites where these two biocontrol agents are not present or are present in very incipient stage.

Survey of melaleuca invaded sites in Miami-Dade County showed varying densities of biological control insects such as weevil and psyllid and an adventive foliar rust fungus (*Puccinia psidii*) inciting damages to the melaleuca population trees. Most of the melaleuca stands in Chekika areas of the Everglades National Park appeared to have lower densities of these natural enemies. Similarly, many melaleuca stands spotting undeveloped public and private lands south of Homestead-Miami Speedway and around Old-Dixie Highway (Old Card Sound Road) areas were virtually devoid of psyllids though a very low level of weevil damage was observed. Therefore, these sites were primarily targeted for psyllid and weevil redistribution during 2009-2010; these sites and others in selected areas that are deemed to have lower densities will be targeted during 2010-2011 also. During this 2009-2010 reporting period, we made a total of 34 releases totaling over 799,494 psyllids and 4,522 weevils within various melaleuca stands in these areas of Miami-Dade County. During this reporting year we concluded a long-term study designed to assess possible effect of melaleuca litter biomass on its native community invading potential and determined that slow decomposing rate of melaleuca leaves compared to sawgrass may be resulting in an accumulation of excessive amount capable of impeding recruitment of native plants. Also, we have been continuing to monitoring research sites maintained to determine the recovery of melaleuca sites and increasing site dominance by other plant species.

## **Project Background**

*Melaleuca quinquenervia* (melaleuca) is still one of the most invasive weeds in disturbed as well as undisturbed areas of the Everglades National Park and other natural areas of southern Florida. So far, three herbivorous insects, *Oxyops vitiosa* (weevil), *Boreioglycaspis melaleucae* (psyllid) and *Lophodiplosis trifida* (stem-galling cecid) have been imported from Australia and released in Florida. Additionally, a rust fungus *Puccinia psidii* already established in this area is complementing melaleuca control in the region. During the previous 10-year (1997-2007) project we released 1,424,793 biological control insects (weevils and psyllids) in 310 melaleuca infested locations within Miami-Dade County. Melaleuca in south east Florida still remains undeterred in many areas needing continuous redistribution of biological control agents to areas where they are not present or are in very low densities. The current agreement between Dade County DERM and the USDA-ARS IPRL calls for a mass rearing and field release of at least 245,000 psyllids and 2000 weevils per year (starting in May 2009) for 5 years in various melaleuca infested areas of Miami-Dade County, Florida.

As in other insect systems, various biotic (predators and parasites of the biocontrol insects and availability of suitable host tissues for rapid reproduction) and adverse abiotic (prolonged extreme temperature and rainfall) factors negatively influence population growth of biological control insects also. Targeted survey of melaleuca invaded sites in Miami-Dade County showed varying densities of weevil, psyllid and foliar rust fungus population; this was reflected in the various levels of damages incited by them on melaleuca trees. Melaleuca stands in Chekika areas have had lower densities of these natural enemies. Similarly, many melaleuca stands that spotted undeveloped public and private lands south of Homestead-Miami Speedway and around Old-Dixie Highway (Old Card Sound Road) areas were virtually devoid of psyllids though a very low level of weevil damage was observed on a few trees.

## **Plant and Insect Production Activities**

Melaleuca plant production for weevil and psyllid rearing was carried out at the USDA-ARS, Invasive Plant Research facility in Fort Lauderdale. Melaleuca saplings were potted and maintained in a screen-house as well as in the open areas in Ft Lauderdale. The plants were fertilized and trimmed regularly to induce profuse new growth. Batches of 24 plants (4-6 feet tall) were transferred periodically to each of the three aluminum-framed screen-cages (6ft x 6ft x 6ft), and inoculated with psyllid colonies. Within 6 weeks, most melaleuca tips became infested with cottony flocculants covering nymphs which eventually develop into adults.

Numbers of psyllids (adults plus late-stage winged nymphs) were estimated from insect counts of ten sampled tips per plant. These infested plants were then individually enclosed in a fine-mesh screen to contain emerging psyllids and facilitate transportation to field sites. At released sites, the screens were removed and individual plants were separated from the pots, and the root-balls placed in ca 1-gallon water contained in a plastic bag to keep the plant alive for ca 2-weeks to facilitate egg hatching, nymph development, and dispersal of adults to the surrounding melaleuca trees. Only winged nymphs and adults were counted (i.e., eggs and neonate nymphs not counted) while reporting the total number of psyllids released at a given location. Therefore, the actual numbers of psyllids released per location may be as much as 50% more than the numbers reported. Similarly, a (6ft x 6ft x 6ft) cage has been maintained for weevil production. In addition, weevils collected from southwestern Florida are temporarily enclosed in this cage and field released in Miami-Dade when we have sufficient (over 500 individuals) numbers.

## **Insect Releases by Location**

This year, weevil and psyllid population built up in nursery was slightly delayed by prolonged low temperature; similar trend was observed in field condition also. To redistribute weevils and psyllids, we had to supplement greenhouse reared populations with field collected from pockets of melaleuca populations in the southwest Florida that were sheltered by cypress canopies and had sizable populations of these biocontrol agents.

Numbers of psyllid and weevil released during this reporting year are presented in the Table 1 below. The coordinates provided represent the main melaleuca stand; but the releases were made at different spots in and adjacent stands within general area of the main stand. This year's releases were concentrated in three major areas of the southern Florida: Chekika areas of the Everglades National Park, Homestead Areas, and off of the Old Card Sound Road since they appear to have none or very incipient populations of biological control agents. Several releases were made in Miami-Dade County natural areas located south of Miami Speedway (Table 1. Release #s 10-13). This site has a dense stand of mature melaleuca trees encroaching surrounding sawgrass marches that are spotted by the melaleuca trees of varying ages and dimensions. Similarly, a total of 8 releases were made in county owned parcel off of Old Card Sound Road (Table 1, Release #s 26-33). Trees in these areas were lacking psyllid populations and had very little evidence of the presence of weevil. Due to absence of suitable plant materials for initial establishment of the insect population we trimmed branches to induce new growth so that insects can establish colonies and start building populations. Remaining releases were made in and around Chekika areas of the Everglades National Park. Next year's releases will also be concentrated in these three areas to boost the existing populations of the biocontrol insects since there still appeared to have a large number of

melaleuca stands and new regenerations as well as regrowth is occurring. This year's releases also contained large number of cecid (stem galling insects) individuals but the numbers are not being reported in this report.

**Table:** Number of biological control insects released in different locations in melaleuca invaded sites of Miami-Dade County, Florida.

| Releases<br>(2009-<br>2010) | Biocontrol<br>Insect Release<br>Locations | GPS Coordinates    |                       | Released Insect<br>Species |                | Insect<br>Life<br>Stages    | Plant Attributes<br>based on<br>dominant features |                                   |
|-----------------------------|---|--------------------|-----------------------|----------------------------|----------------|-----------------------------|---|-----------------------------------|
|                             |   | Longitude          | Latitude              | Psyllid<br>(#s)            | Weevil<br>(#s) |                             | Plant<br>Life<br>Stages                           | Branch<br>Tip<br>Stages<br>(1-5)* |
| 1                           | ~ 0.1 miles from<br>P237                  | N 25° 38'<br>53.7" | W 80°<br>31'<br>29.7" | 32397                      | 0              | Adults<br>& Late<br>Instars | Saplings  | 3,4,5                             |
| 2                           | ~ 1.5 miles<br>from P244                  | N 25° 41'<br>42.2" | W 80°<br>29'<br>45.2" | 15092                      | 92             | Adults<br>& Late<br>Instars | Trees &<br>Saplings                               | 2,3,4                             |
| 3                           | ~ 1/3 mile<br>from P242                   | N 25° 38'<br>00.4" | W 80°<br>31'<br>49.5" | 12448                      | 0              | Adults<br>& Late<br>Instars | Trees &<br>Saplings                               | 3,4,5                             |
| 4                           | ~ 1/4 mile from<br>P238                   | N 25° 39'<br>34.6" | W 80°<br>30'<br>46.3" | 4070                       | 0              | Adults<br>& Late<br>Instars | Saplings  | 2,3,4,5                           |
| 5                           | ~ 1/4 mile from<br>P244                   | N 25° 40'<br>44.3" | W 80°<br>29'<br>55.9" | 19418                      | 0              | Adults<br>& Late<br>Instars | Trees &<br>Saplings                               | 3,4,5                             |
| 6                           | ~ 1/4 mile<br>from P248                   | N 25° 39'<br>29.9" | W 80°<br>31'<br>43.8" | 968                        | 0              | Adults<br>& Late<br>Instars | Saplings  | 3,4,5                             |
| 7                           | ~ 1/4 mile<br>from P249                   | N 25° 39'<br>20.7" | W 80°<br>31'<br>57.0" | 4237                       | 65             | Adults<br>& Late<br>Instars | Trees &<br>Saplings                               | 3,4,5                             |
| 8                           | ~ 2.5 miles<br>from P245                  | N 25° 44'<br>00.0" | W 80°<br>29'<br>50.5" | 17006                      | 115            | Adults<br>& Late<br>Instars | Saplings  | 2,3,4                             |
| 9                           | ~ 3/4 mile<br>from P241                   | N 25° 37'<br>38.4" | W 80°<br>32'<br>07.3" | 13013                      | 64             | Adults<br>& Late<br>Instars | Trees &<br>Saplings                               | 2,3,4                             |
| 10                          | Behind<br>Homestead-<br>Miami<br>Speedway | N 25° 25'<br>26.1" | W 80°<br>24'<br>56.9" | 0                          | 826            | Adults<br>& Late<br>Instars | Trees &<br>Saplings                               | 2,3,4,5                           |

|    |   |                 |                 |       |     |                       |                  |         |
|----|---|-----------------|-----------------|-------|-----|-----------------------|------------------|---------|
| 11 | Behind Homestead-Miami Speedway   | N 25° 25' 26.1" | W 80° 24' 56.9" | 47794 | 387 | Adults & Late Instars | Trees & Saplings | 2,3,4,5 |
| 12 | Behind Homestead-Miami Speedway   | N 25° 25' 26.1" | W 80° 24' 56.9" | 51281 | 429 | Adults & Late Instars | Trees & Saplings | 2,3,4,5 |
| 13 | Behind Homestead-Miami Speedway   | N 25° 25' 26.1" | W 80° 24' 56.9" | 69112 | 338 | Adults & Late Instars | Trees & Saplings | 2,3,4,5 |
| 14 | ENP (narrow dirt road off main levy road)                                     | N 25° 39' 20.3" | W 80° 31' 43.5" | 2307  | 84  | Adults & Late Instars | Trees & Saplings | 3,4,5   |
| 15 | ENP (Tamiami Trail & Krome)   | N 25° 40' 33.5" | W 80° 29' 55.6" | 23002 | 0   | Adults & Late Instars | Trees & Saplings | 2,3,4   |
| 16 | Krome to 168 <sup>th</sup> st. Right into SW 213 <sup>th</sup> Av.            | N 25° 37' 12.1" | W 80° 32' 14.9" | 868   | 70  | Adults & Late Instars | Trees & Saplings | 2,3,4,5 |
| 17 | Krome to 168 <sup>th</sup> st. Right into SW 213 <sup>th</sup> Av. + 1/2 mile | N 25° 37' 02.9" | W 80° 32' 14.6" | 389   | 149 | Adults & Late Instars | Trees & Saplings | 2,3,4,5 |
| 18 | Near ENP. Krome to 136 <sup>th</sup> st. 2 miles from P236                    | N 25° 39' 17.6" | W 80° 30' 47.1" | 20036 | 158 | Adults & Late Instars | Trees & Saplings | 2,3,4   |
| 19 | Near ENP. Krome to 136 <sup>th</sup> st. All the way to gate then R to curve  | N 25° 39' 09.2" | W 80° 31' 28.9" | 9950  | 164 | Adults & Late Instars | Trees & Saplings | 2,3,4   |
| 20 | Near ENP. Krome to 136 <sup>th</sup> st. All the way to gate. L all the way.  | N 25° 37' 03.0" | W 80° 32' 16.1" | 6533  | 117 | Adults & Late Instars | Trees & Saplings | 2,3,4   |
| 21 | Near ENP. Krome to 136 <sup>th</sup> st. By gate                              | N 25° 38' 16.5" | W 80° 31' 50.1" | 22638 | 188 | Adults & Late Instars | Trees & Saplings | 2,3,4   |
| 22 | Near ENP. Krome to 136 <sup>th</sup> st. L. 1/4 mile.                         | N 25° 38' 24.6" | W 80° 31' 50.4" | 18455 | 0   | Adults & Late Instars | Trees & Saplings | 3,4,5   |

|  |  |                    |                       |                |              |                             |                     |           |
|--|--|--------------------|-----------------------|----------------|--------------|-----------------------------|---------------------|-----------|
| 23   | Near ENP.<br>Krome to 136 <sup>th</sup><br>st. L. Off of<br>dirt road.                 | N 25° 38'<br>54.7" | W 80°<br>31'<br>56.9" | 30259          | 0            | Adults<br>& Late<br>Instars | Trees &<br>Saplings | 3,4,5     |
| 24   | Near ENP.<br>Krome to 136 <sup>th</sup><br>st. L. Stand<br>1/4 m. in from<br>dirt road | N 25° 39'<br>12.7" | W 80°<br>31'<br>32.8" | 17094          | 0            | Adults<br>& Late<br>Instars | Trees &<br>Saplings | 3,4,5     |
| 25   | Near ENP.<br>Krome to 136 <sup>th</sup><br>st. R then on L<br>side.                    | N 25° 38'<br>53.7" | W 80°<br>31'<br>29.7" | 60978          | 152          | Adults<br>& Late<br>Instars | Trees &<br>Saplings | 2,3,4     |
| 26   | Off Card Sound<br>(Homestead/Key<br>Largo)   | N 25° 22'<br>54.1" | W 80°<br>25'<br>44.8" | 109308         | 67           | Adults<br>& Late<br>Instars | Trees &<br>Saplings | 4,5       |
| 27   | Off Card Sound<br>(Homestead/Key<br>Largo)   | N 25° 22'<br>54.1" | W 80°<br>25'<br>44.8" | 61936          | 0            | Adults<br>& Late<br>Instars | Trees &<br>Saplings | 4,5       |
| 28   | Off Card Sound<br>(Homestead/Key<br>Largo)   | N 25° 22'<br>54.1" | W 80°<br>25'<br>44.8" | 23057          | 6            | Adults<br>& Late<br>Instars | Trees &<br>Saplings | 4,5       |
| 29   | Off Card Sound<br>(Homestead/Key<br>Largo)   | N 25° 22'<br>54.1" | W 80°<br>25'<br>44.8" | 0              | 423          | Adults<br>& Late<br>Instars | Trees &<br>Saplings | 1,2,3,4,5 |
| 30   | Off Card Sound<br>(Homestead/Key<br>Largo)   | N 25° 22'<br>54.1" | W 80°<br>25'<br>44.8" | 0              | 217          | Adults<br>& Late<br>Instars | Trees &<br>Saplings | 1,2,3,4,5 |
| 31   | Off Card Sound<br>(Homestead/Key<br>Largo)   | N 25° 22'<br>54.1" | W 80°<br>25'<br>44.8" | 16484          | 0            | Adults<br>& Late<br>Instars | Trees &<br>Saplings | 1,2,3,4,5 |
| 32   | Off Card Sound<br>(Homestead/Key<br>Largo)   | N 25° 22'<br>54.1" | W 80°<br>25'<br>44.8" | 26135          | 226          | Adults<br>& Late<br>Instars | Trees &<br>Saplings | 1,2,3,4,5 |
| 33   | Off Card Sound<br>(Homestead/Key<br>Largo)   | N 25° 22'<br>54.1" | W 80°<br>25'<br>44.8" | 49916          | 0            | Adults<br>& Late<br>Instars | Trees &<br>Saplings | 3,4,5     |
| 34   | Tamiami Trail<br>(SW 8 <sup>th</sup> St.) &<br>SW 153 <sup>rd</sup> pl.                | N 25° 49'<br>55.3" | W 80°<br>23'<br>14.7" | 13313          | 85           | Adults<br>& Late<br>Instars | Trees &<br>Saplings | 2,3,4     |
| <b>Total number of biocontrol insects released:</b>  |  |                    |                       | <b>799,494</b> | <b>4,422</b> |                             |                     |           |
| <p>*=Predominant growth stages in the psyllid release sites; 2=recently open vegetative buds, 3=up to 10 cm long new tip with immature leaves, 3= &gt;10 cm long immature leaves, 4=Fully expanded tips with immature leaves, 5=Tips with mature old leaves.</p> |  |                    |                       |                |              |                             |                     |           |

## **Impact Evaluation**

Released biological control agents cause chronic damage to melaleuca trees and result in negative impacts such as defoliation, stem dieback and mortality of trees of various dimensions and ages. At the initial stage of the past 10-year project period, damage assessments and overall impact evaluations were often limited to individual trees or a small population levels. We have been monitoring 12-yr plus long-term field studies as part of impact evaluation of this project and documenting such impacts in larger populations. Such evaluations included melaleuca seedling regenerating potential through seed production, seed-retention in the canopies, seed-rain from canopies and the germinability of these seeds compared with level prior to the release of biocontrol agents. Also, scheduled monitoring and results documentation of biological control impact on melaleuca infestations and ultimate changes in plant species diversity, as well as abundance and co-sharing of dominance by non-melaleuca plants in once melaleuca monocultures, is in progress. Results of these findings will be included in future reports as the studies are concluded.