# Field Release of *Oxyops vitiosa* (Coleoptera: Curculionidae), a Nonindigenous Weevil, for Biological Control of Melaleuca, *Melaleuca quinquenervia* (Myrtaceae)

## Environmental Assessment

**February 1997**

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# I. Description of the Proposed Action

The Animal and Plant Health Inspection Service (APHIS) of the United States Department of Agriculture (USDA) has received an application from the U. S. Agricultural Research Service (ARS) for a permit to release an exotic weevil, *Oxyops vitiosa* Pascoe (Coleoptera: Curculionidae), in Florida (Appendix 1). Both larvae and adults feed on young leaves of the melaleuca (or "paperbark") tree, *Melaleuca quinquenervia* (Cav.), a noxious weed in the family Myrtaceae. (Note: In common usage the name "melaleuca" denotes *Melaleuca quinquenervia* whereas the genus name "*Melaleuca*" refers to the genus in which melaleuca and its close relatives are placed.)

Preparatory to field releases, the applicant proposes to import *O. vitiosa* from Australia into the USDA-certified quarantine facility of the Florida Division of Plant Industry in Gainesville, Florida. Any parasitoids will be screened out in quarantine. The weevils also will be examined for disease agents such as *Beauveria bassiana.* As a precaution, adult weevils not showing signs of this disease will be dipped in Benomyl [R] fungicide.

Initially, ARS will introduce weevils into field cages for multiplication on the grounds of the University of Florida's IFAS Research and Education Center at Fort Lauderdale. Additional weevils will be released concurrently at certain sites in southern Florida. Later, weevils multiplied in cages will be released into the environment south of Lake Okeechobee in Broward, Collier, Dade, Lee, and Palm Beach Counties; a few releases may be made in other localities. Exact sites for the open releases will be selected in consultation with various State, Federal, and other cooperators. Up to 1,000 weevils may be released at each site. The timing of the releases is still uncertain, but results of initial studies indicate that all seasons might be suitable.

Voucher specimens have been deposited in the collections of Dr. Charles O'Brien, Tallahassee, Florida and the Florida State Collection of Arthropods, Gainesville. Additional specimens will be deposited in the U.S. National Museum of Natural History, Washington, DC; the Canadian National Collection, Ottawa, Canada; and the California Department of Food and Agriculture, Sacramento, California. Dr. Charles W. O'Brien, Florida A & M University, Tallahassee, Florida, made the initial species determination. He or Dr. Michael Thomas, Florida Division of Plant Industry, will check the identity of specimens in future shipments.

The pending application was submitted in accordance with the Federal Plant Pest Act (7 USC 150aa *et seq.*) and the Plant Quarantine Act (7 USC 151aa *et seq.*). This environmental assessment (EA) was prepared in compliance with the National Environmental Policy Act (NEPA) (42 USC 4321 *et seq.*) as described in the

implementing regulations adopted by the Council on Environmental Quality (40 CFR 1500-1509), by the USDA (7 CFR 1b), and by APHIS (7 CFR 372).

## II. Purpose of and Need for the Proposed Action

The purpose of the proposed releases of *O. vitiosa* is to reduce the severity of infestations of melaleuca in central Florida. After melaleuca was introduced into Florida as an ornamental at the beginning of the 20th century, it escaped from cultivation. Over the past three or four decades it has moved into wetlands, urban areas, and rural settings.

The melaleuca tree

--crowds out native vegetation and deprives wildlife of habitat.

--wastes water by transpiring six times faster than native grass species that it replaces in some areas.

--creates hazards for boats and water control structures by dropping broken limbs into the water.

--provokes allergic responses in one in five people living in Palm Beach County, Florida (LaRoche, 1994).

--burns at high temperatures creating a threat to nearby developments (LaRoche, 1994).

The U. S. Army Corps of Engineers (1996) estimated that at least 450,000acres of the Everglades and South Florida wetlands are now infested, an area that includes Everglades National Park and Big Cypress Wildlife Preserve (Cost and Craver, 1981). Infestations are continuing to spread. Melaleuca was listed by the Federal government as a noxious weed in 1992.

## III. Alternative to the Proposed Action

The no-action alternative to issuing a permit for the release of *O. vitiosa* is to deny the permit. If the permit is denied, attempts will continue in some areas to control melaleuca by mechanical and herbicidal means.

# IV. Environmental Impacts of the Proposed Action and Alternative

The intended environmental impact of the proposed action is a reduction in the severity of melaleuca infestations with consequent regrowth and reestablishment of native vegetation.

In the absence of successful biological control agents, melaleuca will continue to expand its range, displacing the native flora and harming the fauna. Mechanical and chemical control measures kill mature trees but often exacerbate the problem by stimulating the plants to produce numerous seeds that quickly grow into vigorous saplings (*O. vitiosa* is expected to attack saplings with particular intensity). Control with chemical herbicides would add to the pesticide load of the environment, threatening wildlife and possibly increasing contamination of groundwater supplies.

Biological control agents such as *O. vitiosa* generally spread even without the agency of man. In principle, therefore, release of this species at a few sites in Florida must be considered equivalent to release over the entire area of the United States in which potential host plants occur and in which the climate is suitable. In Australia, *O. vitiosa* has been collected only in subtropical regions resembling southern Florida and southern California (*O. vitiosa* is not known to occur outside of Australia). Hence, the weevil is not expected to spread into temperate zones in California even in the presence of suitable alternate hosts.

The proposed introductions of *O. vitiosa* into Florida raise the question of environmental safety since the weevils might conceivably cause feeding damage to nontarget species of plants. Evidence for the host specificity of *O. vitiosa* comes from the scientific literature, from field and laboratory studies conducted in Australia, and from laboratory studies conducted in Florida.

The family Myrtaceae is represented in Florida by eight native species in four genera (*Calyptranthes, Eugenia, Myrcianthes*, and *Psidium*) and by melaleuca and several introduced species of *Callistemon* (i.e., bottlebrush) and *Eucalyptus*. The native species are placed in the Subfamily Myrtoideae, while melaleuca and the other introduced species belong to the Subfamily Leptospermoideae. Bottlebrush and several native species are being commercialized by the nursery industry. Experiments are underway in California to determine whether or not *M. alternifolia* (Maiden & Betche) Cheel, a narrow-leaved species, would be useful as an oil source (Sachs *et al.*, 1990). Both native and introduced species of Myrtaceae were subjected to host-specificity testing (details follow).

The genus *Oxyops* includes about 65 known species, all native to Australia. *O. vitiosa* and one other species have been recorded from broad-leaved *Melaleuca* species (Jones and Elliot, 1986). *Eucalyptus* species are the only other known host plants of *Oxyops* weevils (Froggatt, 1907; Tillyard, 1926).

Field studies

An ARS entomologist, Dr. J. C. Balciunas,, determined the host range of *O. vitiosa* in the insect's native home in Queensland and New South Wales (Balciunas and Buckingham, 1996). Over an eight-year period, approximately 1,300 kg of leaves and stems were collected--700 kg from melaleuca, 400 kg from 13 *Melaleuca* species other than *M. quinquenervia*, and 240 kg from various trees (including 29 species of myrtaceous trees in genera other than *Melaleuca*). One thousand, seventy-seven weevils (total of eggs, larvae, and adults) were found on melaleuca compared to only 60 on eight other species of plants (Appendix 2). Additional visual searches for *O. vitiosa* on myrtaceous trees revealed the weevil's strong preference for melaleuca over other plants, some of which were closely related to melaleuca.

Laboratory tests

In Australia, 28 species of Myrtaceae (including melaleuca) and 11 cultivated species in other families were subjected to larval and/or adult feeding and oviposition tests (Appendix 3). Adult weevils caused considerable damage to melaleuca and most other tested members of the genus *Melaleuca* as well as to certain other Myrtaceae in the genera *Callistemon*, *Eucalyptus*, *Myrciaria*, *Myrica*, *Syzygium*, and *Psidium*. Certain species of *Accera* and *Myrcianthes* (both Myrtaceae), and *Lagerstroemia* (Lythraceae) sustained lesser but still significant damage. However, few eggs were deposited on plants other than melaleuca, and no larvae completed development on plants other than melaleuca. Adult and larval damage to nonmyrtaceous plants was nil.

In Florida, the tested plants were (1) 35 species of Myrtaceae (all eight species native to Florida and 27 introduced species), (2) 12 species of Myrtales in families other than Myrtaceae, (3) 21 species in the Superorder Rosaflorae, related to the superorder in which the order Myrtales (and hence melaleuca) is placed, and (4) 34 species or varieties of trees, fruits, and cultivated plants in taxa unrelated to melaleuca. Among the tested fruit trees were guava (*Psidium*), rose-apple (*Syzygium jambos*), jaboticaba (*Myrciaria cauliflora*), Surinam cherry (*Eugenia uniflora*), and oil of bay or bay-rum tree (*Pimenta racemosa*). The genus *Eucalyptus* is often cultivated for timber, but only in experimental plantings in Florida.

General results of the tests conducted in Florida on plants other than *Calyptranthes* spp. and *Eugenia* spp. are reported here, and details are presented in Appendix 4. Detailed

results on tested species of *Calyptranthes* and *Eugenia* are presented in tabular form in Appendix 4 (these species are closely related to endangered species in Hawaii, Puerto Rico, and the Virgin Islands).

*Feeding tests of adults.* In initial multiple-choice screening tests, only one non-myrtaceous species, *Myrica cerifera* (wax myrtle), sustained significant damage; in the presence of melaleuca it showed less than 25% of the damage apparent on melaleuca (this damage was comparable to that sustained by various Myrtaceae). In the second series of tests, all no-choice, certain species of *Eucalyptus*, *Myrciaria*, *Myrica*, *Psidium*, *Pseudanamomis*, and *Syzygium* sustained from 75% to 100% of the damage apparent on melaleuca. Lesser damage (25% to 75% that of the melaleuca controls) was sustained by some species of *Accera*, *Myrcianthes*, and *Lagerstroemia.*

*Adult longevity.* In the third series of tests, all no-choice, newly emerged adult weevils survived an average of 29 days on *M. simpsonii* , and 128 days on *Myrica cerifera*. Survival on the remaining plants (except *Calyptranthes* spp. and *Eugenia* spp.) was highly variable.

*Oviposition tests.* When three species of *Callistemon*, *Myrica cerifera*, and melaleuca were exposed to weevils in a large cage (360 $ft^3$), no *Callistemon* species received more than 5% of the number of eggs on melaleuca, and *M. cerifera* received no eggs at all.

*Larval feeding and survival tests.* Twenty-four species of Myrtaceae and *M. cerifera* were exposed to feeding by very young weevil larvae. Feeding on certain species of *Callistemon*, *Eucalyptus*, *Myrcianthes*, and *Myrica* was generally less than 25% of that on melaleuca, and on all test plants weevil mortality at the prepupal stage was at least 95% compared with 4%-57% on the melaleuca controls. Seventeen species of Myrtaceae and *M. cerifera* were exposed to feeding by larvae reared to medium or large size on melaleuca. Feeding was moderate on certain species of *Eucalyptus*, *Myrica*, and *Psidium guajava* but light to nil on the other 13 species tested. Weevil mortality at the prepupal stage was much higher on *Eucalyptus camaldulensis, Myrica cerifera,* and *Psidium guajava* than on the melaleuca controls.

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Threatened and endangered species

In 1995 the U.S. Army Corp of Engineers consulted the U. S. Fish and Wildlife Service (FWS) concerning possible effects of melaleuca control on endangered and threatened species in Florida's Okeechobee Waterway and the Central and Southern Florida Flood Control Project area. Results of this consultation (termed a "section-7" consultation) were reported in an EA (U. S. Army Corps of Engineers, 1996). FWS found that

melaleuca control, including control by biological agents, was unlikely adversely to affect endangered or threatened species. If, during the course of the ARS biological control project against melaleuca, new evidence of possible impacts on threatened and endangered species comes to light, ARS and APHIS will engage in further consultation with FWS.

Nonendangered plants and wildlife

The host range tests have indicated that there should be no critical, permanent, direct effects on nontarget species of plants although young leaves of introduced relatives of melaleuca (e.g., bottle brushes, eucalyptus, guava) might sustain transitory damage. Wax myrtle, a native species, also might be attacked in the spring, but damage would quickly diminish as the leaves aged. In any case, nontarget species probably would suffer less damage from *O. vitiosa* than from native insects.

The net effect of melaleuca control on Florida's native fauna is expected to be positive. Common passarine birds usually associated with dryland habitats extensively utilize melaleuca until the melaleuca canopy closes, but in wetland areas where melaleuca is prevalent this utilization takes place at the expense of less widely distributed wetland birds (U. S. Army Corps of Engineers, 1996). Invasion of natural habitats by melaleuca diminishes ecological diversity, and a reduction of melaleuca would promote the reestablishment of diversity. As in the case of birds, the control of melaleuca might cause certain species of small mammals to decline in favor of those utilizing saw grass and other native wetland habitats (Ostrenko and Mazzotti, 1981).

The control of melaleuca may have a negative impact on honey bees which use the trees as a source of nectar and pollen. However, honey bees do not extensively use melaleuca stands located in remote areas of the Everglades (i.e., the principal targets of control), and in any case honey produced from melaleuca is an inferior grade.

Human health

Releases of *O. vitiosa* are expected to enhance human health by controlling melaleuca trees which produce allergy-causing pollen.

Noise

Although tree removal could lead to increased noise in developed areas, it is expected that the weevils will kill few mature trees (saplings are the main target).

Nuisance

Enormous numbers of weevils might be produced temporarily during a successful biological control program, and they would be a nuisance to people who dislike insects. However, the densest concentrations of melaleuca (especially saplings) occur in undeveloped wetlands where few people would encounter the weevils. Also, the extremely small number of *Oxyops vitiosa* specimens (22) encountered in Australian collections suggests that this species is not readily attracted to lights (species attracted to lights are often abundant in collections). An effective

public education program should greatly reduce the importance of a nuisance impact.

Private property

If the weevils kill trees on private property, some property values might be reduced and landowners might bear the cost of tree removal. The State of Florida has not yet required private tree removal even though possession of melaleuca is prohibited. Some localities require developers to remove melaleuca and other exotics on private land during development. This weevil would have a beneficial impact in those areas by reducing the amount and size of melaleuca requiring removal.

Air and water impacts

The mechanical removal of dead trees might have small, transitory effects on air quality. However, a successful biological control program would decrease long-term impacts by decreasing the need for tree removal. Water supplies might increase in some areas as native plants replace killed melaleuca trees. A successful program would also mitigate the fire hazard posed by melaleuca.

Prevention of undesired environmental effects

No undesired environmental effects were identified during field and laboratory studies conducted since 1988 in Australia and the United States. Weevil populations in Florida and their effects on melaleuca and nontarget plant species will no doubt be monitored for many years partly because of the high intrinsic scientific interest and partly because of the because the project has extremely high public visibility.

In summary, Australian field surveys and laboratory tests of host-specificity in Australia and Florida have established that *O. vitiosa* is sufficiently specific to *M. quinquenervia* to be safe for release. It is expected that adult weevils occasionally will cause feeding damage to young foliage of certain nontarget plants growing near melaleuca. Also, dispersing adults occasionally may damage certain more distant plants. More rarely, wax myrtle and native and introduced Myrtaceae may support oviposition and sustain minor damage from larval feeding. However, attacks on all nontarget plants will be too transitory to threaten entire populations. The minuscule risks of releasing *O. vitiosa* are far outweighed by the large potential benefits.

# V. References

**Balciunas, J.K., and G.R. Buckingham.** 1996. Release of the Australian weevil, *Oxyops vitiosa* for control of melaleuca, *Melaleuca quinquenervia*. 24 pp. plus tables and appendices. (Petition submitted to the Technical Advisory Group, March, 1996.)

**Cost, N. D., and G. C. Craver.** 1981. Distribution of *Melaleuca* in south Florida measured from the air. Pp. 1-8 in Geiger, R. K. (ed.), *Proceedings of Melaleuca Symposium*, Fort Myers, Florida, Sept. 23-24, 1980, Florida Department of Agriculture and Consumer Services, Division of Forestry, 140 pp.

**Froggatt, W. W.** 1907. Coleoptera. Pp. 121-211 in *Australian Insects*. William Brooks & Company, Ltd., Sydney, 449 pp.

**Jones, D. L., and W.R. Elliot.** 1986. *Pests, Diseases and Ailments of Australian Plants.* Lothian Publishing, Melbourne, 333 pp.

**LaRoche, F.** 1994. Melaleuca management plan for Florida. Exotic Pest Plant Council, 88 pp.

**Ostrenko, W., and F. Mazzotti.** 1981. Small mammal populations in *Melaleuca quinquenervia* communities in the eastern Florida Everglades. Pp. 91-98 in R. K. Geiger (ed.), Proceedings of *Melaleuca* Symposium. September 23-24, 1980, Florida Division of Forestry, Tallahassee, Florida.

**Sachs, R. M., C. I. Lee, S.A. Cartwright, M.S. Reid, and C. Smith.** 1990. *Melaleuca alternifolia*: a new crop for California? Calif. Agr. 44: 27-29.

**Tillyard, R. J.** 1926. Coleoptera. Pp. 176-248 in *The Insects of Australia and New Zealand.* Angus and Robertson, Ltd., Sydney, 560 pp.

**U. S. Army Corps of Engineers.** 1996. Integrative Approach to Melaleuca Management in the State of Florida. Environmental Assessment and Draft Finding of No Significant Impact. U.S. Army Corps of Engineers, South Atlantic Division, Jacksonville District, 43 pp. plus appendix.

# VI. Preparators, Consultants, and Reviewers

This document was prepared by **Gary R. Buckingham**, ARS, Gainesville, FL, and **Ronald D. Hennessey**, APHIS, Riverdale, MD. It is based largely on a petition submitted by **J. K. Balciunas** (ARS, Gainesville, FL) and **G. R. Buckingham** to the Technical Advisory Group (TAG) on the biological control of weeds. Subsequently, TAG officially recommended that APHIS issue a permit for the release of *O. vitiosa* from quarantine into the environment. The TAG members were **Thomas A. Bewick**, Ph.D., University of Florida, Gainesville, FL; **Harold W. Browning**, Ph.D., University of Florida, Lake Alfred, FL; **David Sisneros**, Ph.D., U. S. Bureau of Reclamation, Denver, CO; **Alfred F. Cofrancesco**, Ph.D., U. S. Army Corps of Engineers, Vicksburg, MS; **Jack R. Coulson**, ARS, Belltsville, MD; **George P. Markin**, Ph.D., U. S. Forest Service, Bozeman, MT; **Dale Meyerdirk**, Ph.D., APHIS, Riverdale, MD; **Thomas C. Robert, Jr.**, Bureau of Land Management, Washington, DC; **James G. Saulmon**, Ph.D., U. S. Environmental Protection Agency, Washington, DC. The U. S. Fish and Wildlife Service endorsed the TAG recommendation. The Florida Arthropod Introduction Committee issued a separate approval for release of the *Oxyops* weevil.

This manuscript was reviewed by **Carl Bausch**, J.D., **Robert V. Flanders**, Ph.D., **Dale Meyerdirk**, Ph.D., and **Nancy Sweeney** (all at APHIS, Riverdale, MD); **Jerome Grant**, Ph.D., University of Tennessee; and **David C. Thompson**, Ph.D., New Mexico State University.

# VII. Appendices

**Appendix 1.** Application for a permit to release *Oxyops vitiosa* in the United States.

**Appendix 2.** Host specificity of *O. vitiosa*: Field investigation in Australia.

**Appendix 3.** Host specificity of *O. vitiosa*: Laboratory investigation in Australia.

**Appendix 4.** Host specificity of *O. vitiosa*: Laboratory investigation in Florida.

# Appendix 1: Application for a permit to release *Oxyops vitiosa* in the United States.

PLETED BY THE APPLICANT

BIOLOGICAL ASSESSMENT AND TAXONOMIC SUPPORT
HYATTSVILLE, MARYLAND 20782

## APPLICATION AND PERMIT TO MOVE LIVE PLANT PESTS OR NOXIOUS WEEDS
BC AGENTS

G. R. Buckingham
USDA-ARS-SAA
c/o Biological Control
P.O. Box 147100
Gainesville, FL 32614-7100

1. TYPE OF PEST TO BE MOVED

[X] Arthropods [ ] Noxious Weeds ** [ ] Genetically Engineered
* [ ] Pathogens [ ] Other (Specify)

2. TELEPHONE NO. ( 352 ) 372 3505

| A. SCIENTIFIC NAMES OF PESTS TO BE MOVED | B. CLASSIFICATION (Orders, Families, Races, or Strains) | C. LIFE STAGES, IF APPLICABLE | D. NUMBER OF SPECIMENS OR UNITS | E. SHIPPED FROM (Country or State) | F. BC Agents ARE PESTS ESTABLISHED IN U.S. | G. MAJOR HOST(S) OF THE PEST |
|---|---|---|---|---|---|---|
| 4. Oxyops vitiosa Pascoe | Coleoptera | All stages | 2000 | Australia | No | Melaleuca |
| 5. | Curculionidae | | | FLDPI | | quinquenervia |
| 6. | | | | | | |

7. WHAT HOST MATERIAL OR SUBSTITUTES WILL ACCOMPANY WHICH PESTS (Indicate by line number)
Florida melaleuca leaves or plants

| 8. DESTINATION | 9. PORT OF ARRIVAL | 10. APPROXIMATE DATE OF ARRIVAL OR INTERSTATE MOVEMENT |
|---|---|---|
| Ft. Lauderdale and surroundings | Shipped from DPI Quarantine | As soon as possible |

| 11. NO. OF SHIPMENTS | 12. SUPPLIER | 13. METHOD OF SHIPMENT |
|---|---|---|
| 10 | C. Turner-Australia; G. Buckingham | [ ] Air Mail [ ] Air Freight [ ] Baggage [X] Auto |

14. INTENDED USE (Be specific, attach outline of intended research)
To be field released for control of melaleuca trees; some will be used to begin colony at USDA/ARS lab

| 15. METHODS TO BE USED TO PREVENT PLANT PEST ESCAPE | 16. METHOD OF FINAL DISPOSITION |
|---|---|
| Field collected Australian weevils will be examined by Mike Thomas and/or Charles O'Brien for ID. Samples will be examined for pathogens. | Field release in melaleuca infestations |

17. *Applicant must be a resident of the U.S.A. I/We agree to comply with the safeguards printed on the reverse of this form, and understand that a permit may be subject to other conditions specified in Sections B and C.*

SIGNATURE OF APPLICANT (Must be person named in Item 1) Molly Buckingham

18. DATE Oct. 4, 1996

## SECTION B - TO BE COMPLETED BY STATE OFFICIAL

19. RECOMMENDATION
[X] Concur (Approve) [ ] Comments (Disapprove)
[ ] (Accept USDA Decision)

20. CONDITIONS RECOMMENDED

| 21. SIGNATURE | 22. TITLE | STATE | 23. DATE |
|---|---|---|---|
| Connie Rikard | Assistant Director | Florida | 10-23-96 |

## SECTION C - TO BE COMPLETED BY FEDERAL OFFICIAL

96-102E

## PERMIT

24. PERMIT NO. 32259

**(Permit not valid unless signed by an authorized official of the Animal and Plant Health Inspection Service)**

**Under authority of the Federal Plant Pest Act of May 23, 1957 or the Federal Noxious Weed Act of 1974, permission is hereby granted to the applicant named above to move the pests described, except as deleted, subject to the conditions stated on, or attached to this application. (See standard conditions on reverse side).**

The Florida Department of Agriculture & Consumer Services requires a sample of all organisms being introduced into the State of Florida to be submitted to the Bureau of Entomology, Nematology, and Plant Pathology for verification of organism identity. Arthropod samples must be adults.

*If this request is for plant pathogens, please complete this form and PPQ Form 526-1. For biological control pathogens (entomopaths, weeds, etc.) complete this form only.
**Complete APHIS Form 2000 for moving genetically engineered organisms or products.

| 25. SIGNATURE OF PLANT PROTECTION AND QUARANTINE OFFICIAL | 26. DATE | 27. LABELS ISSUED | 28. VALID UNTIL | 29. PEST CATEGORY |
|---|---|---|---|---|
| | | | | |

PPQ FORM 526 *Previous edition obsolete.*

**Appendix 2.** Host specificity of *O. vitiosa*: Field investigation in Australia.

No. *O. vitiosa* found during searches of myrtaceous trees in Queensland and New South Wales, Australia.

| Tree species examined | No. *O. vitiosa* found eggs | larvae | adults | Total |
|---|---|---|---|---|
| Quantitative searches on: | | | | |
| *M. quinquenervia* | -- | -- | -- | 1,077 |
| *M. viridifolia* | 2 | 1 | 2 | 5 |
| *M. nervosa* | 0 | 1 | 2 | 3 |
| *M. fluviatilis* | 1 | 0 | 0 | 1 |
| Qualitative searches on: | | | | |
| *Melaleuca* spp. 1 and 2[1] | 0 | 1 | 6 | 7 |
| *M. diosmatifolia* | 0 | 0 | 1 | 1 |
| *Callistemon viminalis* | 0 | 6 | 0 | 6 |
| *Eucalyptus robusta* | 1 | 6 | 0 | 7 |

[1] both species in *M. quinquenervia* complex

**Appendix 3.** Host specificity of *O. vitiosa*: Laboratory investigation in Australia.

Plants tested.
Melaleuca complex: *Melaleuca argentea, M. dealbata, M. leucadendra, M. viridifolia.*
Other Myrtaceae: *Accera sellowiana, Callistemon pachyphyllus, C. saligmus, C. viminalis, Eucalyptus citriodora, E. gummifera, E. ptychocarpa, E. robusta, E. tereticornis, Eugenia brasiliensis, E. uniflora, Leptospermum polygalifolium, Leptospermum* sp., *Lophostemon confertus, L. grandiflora, Myrciaria cauliflora, Psidium littorale, P. guajava, Syzygium jambos, S. luehmanni, S. tierneyanum,* and *Xanthostemon chrysanthus.*

Experimental methods.
All tests were of the no-choice type. Tests of larvae: Ten 3rd- or 4th-instar larvae were placed on potted or garden plants of 24 species (one larva/plant, ten plants of each species). Ten additional larvae were placed on two species. Amount of feeding was recorded after 24 hours. Tests of adults: Male /female pairs of weevils were placed on potted plants of 29 species (one pair/plant, one to nine plants of each species). Amount of feeding was recorded after 24 hours. Results of tests of both larvae and adults are presented in tabular form.

Results of no-choice tests of larvae and adults of *Oxyops vitiosa* on Myrtaceae in Australia.

| Plant species tested | Member of melaleuca complex | Amount of feeding | Total No. eggs deposited | No. larvae eclosed | No. larvae completing development |
|---|---|---|---|---|---|
| Larval weevils tested on: | | | | | |
| *Melaleuca quinquenervia* | Yes | High | -- | -- | -- |
| *M. dealbata* | Yes | Mod.-high | -- | -- | -- |
| *M. leucadendra* | Yes | Moderate | -- | -- | -- |
| *M. viridifolia* | Yes | Mod.-high | -- | -- | -- |
| *Psidium guajava* | No | Moderate | -- | -- | -- |
| Adult weevils tested on: | | | | | |
| *Melaleuca quinquenervia* | Yes | High | 199 | -- | 50 |
| *M. argentea* | Yes | High | 3 | 0 | -- |
| *M. viridiflora* | Yes | Low | 2 | 2 | 0 |
| *Callistemon pachyphyllus* | No | High | 0 | 0 | -- |
| *C. viminalis* | No | High | 24 | -- | 0 |
| *Lophostemon confertus* | No | Low | 0 | 4 | 0 |
| *Syzygium luemanni* | No | High | 0 | 0 | -- |
| *S. tierneyanum* | No | Moderate | 3 | 0 | 0 |
| Other Myrtaceae (10 spp.) | No | Low | 0 | -- | -- |
| Non-Myrtaceae (15 spp.) | No | None | 0 | -- | -- |

**Appendix 4.** Host specificity of *O. vitiosa*: Laboratory investigation in Florida.

Plants tested.

Order Myrtales, Family Myrtaceae

Native species: *Calyptranthes pallens*, *C. zuzygium*, *Eugenia axillaris*, *E. confusa*, *E. foetida*, *E. rhombea*, *Myrcianthes simpsonii*, *Psidium longipes*.

Introduced specialty fruits: *Accera sellowiana*, *Eugenia brasiliensis*, *E. reinwardtiana*, *E. uniflora*, *E. uvalha*, *Myrciaria cauliflora*, *M. glomerator*, *M. vexator*, *Pimenta racemosa*, *Pseudanamomis umbellulifera*, *Psidium friedrichsthalianum*, *P. guajava*, *P. littorale longipes*, *Syzygium cumini*, S. *jambos*, *S. paniculatum*, *S. samarangense*.

Introduced shrubs and trees other than fruit trees: *Eucalyptus alba*, *E. argillacea*, *E. camaldulensis*, *E. cinerea*, *E. citiriodora*, *E. deglupta*, *E. globulus compacta*, *E. grandis*, *Leptospermum scoparium*, *Melaleuca decora*.

Order Myrtales

Families other than Myrtaceae (numbers of species tested indicated in parentheses): Combretaceae (3), Lyrthracae (2), Melastomataceae (3), Onagraceae (4).

Superorder Rosaflorae: Buxaceae (1), Pittosporaceae (1), Rosaceae (11), Saxifragaceae (3), Juglandaceae (1), Myricaceae (*Myrica cerifera* or wax myrtle), Ulmaceae (1).

Unrelated, mostly economic plants: Anacardiaceae (1), Steraceae (2), Brassicaceae (3), Bromeliaceae (1), Caricaceae (1), Cucurbitaceae (2), Ebenaceae (1), Ericaceae (1), Fabaceae (1), Illiciaceae (1), Lauraceae (1), Malvaceae (1), Moraceae (1), Musaceae (1), Oxalidaceae (1), Palmae (2), Pinnaceae (2), Poaceae (1), Podocarpaceae (1), Polygonaceae (2), Rutaceae (3), Solanaceae (3), Taxodiaceae (1).

**Appendix 4** (Cont.). Host specificity of *O. vitiosa*: Laboratory investigation in Florida.

Tests of plants other than *Calyptranthes* and *Eugenia*: Methods and Results

Feeding tests of adults

In initial multiple-choice screening tests, 1-12 plants of each species (except melaleuca) were exposed to feeding by a total of 12-36 adult weevils per species. After three days, amounts of weevil feeding were recorded. Damaged plants were then replaced with fresh bouquets of the same species, all melaleuca plants were replaced, and the tests were repeated. Only one non-myrtaceous species, *Myrica cerifera* (wax myrtle), sustained significant damage; in the presence of melaleuca it showed less than 25% of the damage apparent on melaleuca (this damage was comparable to that sustained by various Myrtaceae).

Feeding tests of adults (cont.)

In the second series of tests, all no-choice, 15 species of Myrtaceae and four species (*Lagerstroemia indica, Liquidamber styraciflua, M. cerifera,* and *Prunus serotina*) in other families were exposed to feeding by adult weevils (15-60 adults per plant species). In some experimental replicates the following species sustained from 75% to 100% of the damage apparent on melaleuca: *Eucalyptus citriodora, Myrciaria cauliflora, Myrica cerifera, Psidium guajava, P. longipes, Pseudanamomis ubellulifera,* and *Syzygium cumini.* Lesser damage (25% to 75% that of the melaleuca controls) was sustained by *Accera sellowiana, Myrcianthes simpsonii,* and *Lagerstroemia indica.*

Adult longevity

In the third series of tests, all no-choice, newly emerged adult weevils were placed on potted plants and bouquets of 17 species of native and introduced Myrtaceae and *M. cerifera.* Nine to 10 adults were placed per plant of native myrtaceous species except *M. simpsonii* which received 4 weevils, 3-11 adults per plant of introduced myrtaceous species, and 6 adults per plant of *M. cerifera.* The longevity of each adult was recorded (about 40 days are needed to produce eggs). Adults on *M. simpsonii* survived an average of 29 days, and adults on *Myrica cerifera* survived for 128 days. Survival on the remaining plants (except *Calyptranthes* spp. and *Eugenia* spp.) was highly variable.

Oviposition tests

Potted plants and bouquets of 26 species of Myrtaceae and *M. cerifera* were exposed to feeding and oviposition by female weevils (20-129 females/plant species) in both choice and no-choice tests. Results are indicated here by plant species as percentages of the

number of eggs deposited on the melaleuca controls: *Callistemon rigidus* 73%, *C. viminalis* 60%, *M. cerifera* 15%, *C. citrinus* 8%. Not all results of these tests are strictly comparable since melaleuca had been tethered to certain plants of *C. rigidus* and *C. citrinus* in order to stimulate oviposition for a subsequent test. When all three species of *Callistemon*, *M. cerifera*, and melaleuca were exposed to weevils in a large cage (360 $ft^3$), no *Callistemon* species received more than 5% of the number of eggs on melaleuca, and *M. cerifera* received no eggs at all.

Larval feeding and survival tests

*Tests with newly emerged larvae.* Potted plants and/or bouquets of 24 species of Myrtaceae and *M. cerifera* were exposed to feeding by newly eclosed larval weevils. All plant species except *Eucalyptus citriodora*, *Eugenia brasiliensis*, and *Syzygium cumini* received from 18 to 101 larvae (these three species were tested with only four to eight larvae each because of the limited insect and plant material available for testing). Feeding on the following species was generally <25% of that on melaleuca: *Callistemon rigidus*, *C. viminalis*, *Eucalyptus camaldulensis*, *E. globulus compacta*, *Myrcianthes simpsonii*, and *Myrica cerifera* (feeding was 85% in one exceptional test). On all test plants weevil mortality at the prepupal stage was at least 95% compared with 4%-57% on the melaleuca controls.

*Tests with medium-to-large larvae reared on melaleuca.* Potted plants or bouquets of 17 species of Myrtaceae and *M. cerifera* were exposed to feeding by larvae reared to medium or large size on melaleuca (17 to 179 larvae/plant species). Feeding was moderate on *Eucalyptus camaldulensis*, *M. cerifera*, *Psidium guajava*, and *P. littorale longipes* and light to nil on the other 13 species tested. Weevil mortality at the prepupal stage was as follows: Test #1: 100% on *E. camaldulensis* and *P. guajava*, 84% on *P. littorale longipes*, 0-56% on the melaleuca controls. Test #2: 33% on *M. cerifera*, 16% on melaleuca controls.

**Appendix 4** (Cont.). Host specificity of *O. vitiosa*: Laboratory investigation in Florida

Results of tests using *Calyptranthes* and *Eugenia*[1]

| | Adult feeding | | Adult longevity (days) | Oviposition[2] | Larval feeding | |
|---|---|---|---|---|---|---|
| | Choice[2] | No-choice[3] | | | Neonates[2] | Med.-to-large[2] |
| Native species: | | | | | | |
| *Calyptranthes pallens* | N[4] | 0 | <10 | 1% | -- | N |
| *C. zuzygium* | <25% | 0-100% | <10 | <1% | <2% | <3% |
| *Eugenia axillaris* | <25% | 0 | -- | 3% | -- | <3% |
| *E. confusa* | N | 0-100% | <10 | <1% | <2% | <3% |
| *E. foetida* | <25% | 0-100% | <10 | 1% | <2% | <3% |
| *E. rhombea* | <50% | 0- 75% | <10 | <1% | <2% | <3% |
| Introduced species: | | | | | | |
| *E. brasiliensis* | <25% | 0 | -- | 0 | <2% | -- |
| *E. reinwardtiana* | <25% | 10- 50% | -- | 0 | <2% | <3% |
| *E. uniflora* | <25% | 0-100% | <10 | 2% | <2% | <3% |
| *E. uvalha* | <50% | 0-100% | -- | 0 | -- | -- |

[1] All relatives of endangered species in Hawaii, Puerto Rico and the Virgin Islands.
[2] Numbers indicate percentages (mean of several replicates) of the amount observed on melaleuca control plants.
[3] Amount of defoliation in individual replicates, minimum and maximum figures.
[4] Nibbling only.

# FINDING OF NO SIGNIFICANT IMPACT

USDA--APHIS--PPQ is reviewing an application for a permit to release *Oxyops vitiosa* (Coleoptera: Curculionidae) in Florida. This nonindigenous weevil is potentially useful for the biological control of melaleuca tree, *Melaleuca quinquinervia* (Myrtaceae), an important weed in certain Florida wetlands. Releases of *O. vitiosa* are expected to have no significant adverse impact on the quality of the human environment in the United States. This finding in based on the following considerations:

--Both field surveys and laboratory tests indicate that larvae of *O. vitiosa* can complete development only on melaleuca.

--Adults of *O. vitiosa* may feed on young foliage of wax myrtle and certain plants related to melaleuca (e.g., bottle brush), but populations of the weevil will not be able to sustain themselves on these hosts, and the damage, if any, caused by adult feeding will be transitory.

--Releases of *O. vitiosa* would pose no risk to threatened and endangered species. This conclusion was reached by the U. S. Fish and Wildlife Service following a section-7 consultation with the U. S. Army Corps of Engineers.

--The biological characteristics of *O. vitiosa* preclude any harmful effects on human health.

--To the extent that *O. vitiosa* suppresses melaleuca, native plants will benefit from reduced competition with the weed, and wildlife including certain endangered species such as the Everglades snail kite will benefit from a reestablishment of the natural ecosystem.

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3/5/97

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Date