**United States Department of Agriculture**

Marketing and Regulatory Programs

Animal and Plant Health Inspection Service


# Field Release of *Melittia oedipus* (Lepidoptera: Sessidae), a Non-indigenous Moth for Control of Ivy Gourd, *Coccinia grandis* (Cucurbitaceae), in Guam and the Northern Mariana Islands

## Draft Environmental Assessment, April 2006

# Field Release of *Melittia oedipus* (Lepidoptera: Sessidae), a Non-indigenous Moth for Control of Ivy Gourd, *Coccinia grandis* (Cucurbitaceae), in Guam and the Northern Mariana Islands

## Draft Environmental Assessment
## April 2006

**Agency Contact:**
Joseph Vorgetts
Pest Permit Evaluations Branch
Plant Protection and Quarantine
Animal and Plant Health Inspection Service
U.S. Department of Agriculture
4700 River Road, Unit 133
Riverdale, MD 20737–1236
Telephone: 301–734–8758

# Table of Contents

# I. Introduction and Need for the Proposed Action

## A. Introduction

The University of Guam and the Department of Land and Natural Resources of the Northern Mariana Islands propose to release a non-indigenous moth, *Melittia oedipus* (Lepidoptera: Sessidae), under permit from the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), for the biological control of ivy gourd, *Coccinia grandis* (L.) Voigt (Cucurbitaceae) in Guam and the Northern Mariana Islands. The larvae bore into vines of the ivy gourd, *Coccinia grandis,* a noxious invasive weed in the plant family Cucurbitaceae.

Guam is located approximately 3,700 miles west-southwest of Honolulu, Hawaii. It belongs to a chain of islands located in the western Pacific Ocean called the Mariana Islands. The Northern Mariana Islands are a chain of islands that lie north of Guam but do not include the island of Guam. Rota (50 miles north of Guam), Tinian (140 miles north of Guam), and Saipan (150 miles north of Guam) are the three most populated islands in the Northern Marianas chain. In 1898, Guam was ceded to the United States, following the Spanish defeat in the Spanish-American War. The Northern Mariana Islands became part of the U.S. Trust Territory of the Pacific after World War II.

Ivy gourd is a perennial vine native to East Africa (Murai *et al.,* 1998) that thrives in warm, humid, tropical regions. It is a common weed in its native habitat but is not a serious pest. However, in Hawaii, Guam, Saipan, and Rota it is invasive. Vines form thick mats over trees and shrubs, covering vegetation on roadsides, forests, residential yards, pastures, gardens, and natural reserves.

Ivy gourd is a dioecious plant. One variety of ivy gourd is a cultivar grown as a vegetable crop. It readily roots if nodes touch the soil. Slashed vines left in the ground readily regrow. Birds feeding on ripe fruit serve as a seed dispersal mechanism.

Ivy gourd is a host of most of the common pests of the cucurbitaceous crops such as *Diaphania indica, Aulacophora foveicollis, Bactrocera cucurbitae, Aphis gossypii, Liriomyza* spp., *Leptoglossus australis, Bemisia* spp. and others. Ivy gourd harbors these pests, so it serves as a refuge that promotes population explosions of these species.

*M. oedipus* is a stem and root-boring caterpillar. Adult moths live 5-7 days and feed on flower nectar, honey, and sugar water. Eggs are laid individually on tendrils, leaves, and stems. Eggs hatch 10-12 days after they are laid. Larvae bore into the stem and pupation takes place beneath the thin bark. Larval tunneling causes the stems to weaken and break (Chun, 2001).

Voucher specimens of *M. oedipus* have been deposited in the collections of the University of Guam and the U.S. National Museum of Natural History–Smithsonian Institution, Washington, DC.

## B. Purpose and Need

### 1. Background

The purpose of the proposed release of *M. oedipus* is to reduce the severity and extent of infestation of ivy gourd on Guam and the Northern Mariana Islands. Native to Africa but naturalized in Asia, Fiji, and northern (tropical) Australia (Jeffrey 1967, Murai *et al*. 1998), ivy gourd (a member of the plant family Cucurbitaceae in the order Violales) is a rapidly growing, climbing or trailing vine. In its native habitat it is a common, but not a serious weed, because it is kept in check by competing plants and natural enemies. In recent years, however, ivy gourd has become an invasive weed (HDOA 1994) in Hawaii, Guam, Saipan, and Rota typified by the thick mats of vegetation described previously.

Ivy gourd is also a host for most of the pests of the cucurbitaceous crops such as pumpkin caterpillar *(Diaphania indica),* red pumpkin beetle *(Aulacophora foveicollis),* melon fly *(Bactrocera cucurbitae),* melon aphid *(Aphis gossypii),* leafminers *(Liriomyza* spp.), black leaf footed bug *(Leptoglossus australis),* whiteflies *(Bemisia* spp.), and others. Rapid spread of ivy gourd, after introduction into a new area, is attributable to vigorous growth, easy reproduction from stem fragments, and prolific seed production.

It has been estimated that over 15,000 acres in Saipan, 500 acres in Guam, and five acres in Rota are now infested with ivy gourd and infestations continue to spread. Successful control of this weed has occurred in the Hawaiian Islands by releasing *Acythopeus cocciniae* and *Acythopeus burkhartorum* (Coleoptera: Curculionidae), in addition to M. oedipus (Teramoto, pers. comm.). *A. cocciniae* and *A. burkhartorum* have been released in the Northern Mariana Islands (Horner, 2003, Muniappan and Horner, 2004).

The pending application for release of this biological control agent into the environment was submitted in accordance with the provisions of the Plant Protection Act of 2000 as codified in 7 Code of Federal Regulations

(CFR) 330. This environmental assessment (EA) was prepared by APHIS in compliance with the National Environmental Policy Act (NEPA) (42 United States Code (U.S.C.) 4321 *et seq*.) as prescribed in implementing regulations adopted by the Council on Environmental Quality (40 CFR 1500–1509), by USDA (7 CFR lb), and by APHIS (7 CFR 372).

## 2. Efficacy and Host Specificity

Evidence of host specificity from laboratory tests:

**Hawaii:** "Choice" (test plant and *C. grandis* exposed to *M. oedipus*) and "no-choice" (only the test plant exposed *to M. oedipus)* tests were conducted on the 30 species of plants belonging to nine families that are listed in Appendix 1. *M. oedipus* laid very few eggs on non-target test plants. In contrast, high rates of egg laying on *Coccinia grandis* (Chun 1996, 2001; Hennessey, 1996) were observed. Based on these results, APHIS prepared an EA and issued a permit to release *M. oedipus* in the field in Hawaii. In 1996, *M. oedipus* was released and has become established in Oahu and on other Hawaiian Islands.

In Hawaii, plants for host specificity testing were selected based on the centrifugal phylogenetic method advocated by Washer (1974). Under the protocol, all species commercially grown, naturalized, and endemic to Hawaii in the family Cucurbitaceae were tested. Additional plants belonging to the order Violales, which includes the family Cucurbitaceae, as well as several plants in other orders, were also tested (Appendix 1). Adult moths laid very few eggs on test plants as compared to ivy gourd. Since the release of *M. oedipus* in 1996 on the Hawaiian Islands, there have been no reports of attack on non-target species (Chun 2001).

**Guam:** In March 2005, a culture of *M. oedipus* was brought from Hilo, Hawaii, to the Containment Laboratory at the University of Guam. Consultation between the University of Guam, Department of Land and Natural Resources of the Northern Marianas, the U.S. Fish and Wildlife Service, and APHIS resulted in the selection of the endemic plant species, *Zehneria guamensis,* (Cucurbitaceae), for host specificity testing since it occurs within the same family as ivy gourd and is the only cucurbit endemic to the region (Stone 1979). Both "choice" and "no choice" tests were conducted. Inconsequential egg laying on Z. *guamensis* was observed in the "choice" tests and "no choice" tests (of a total of 785, only four eggs were laid on Z. guamensis).

Host specificity tests conducted in Guam on the endemic species *Z. guamensis* (Cucurbitaceae) is given in Appendix 2. In the “choice” test, only four eggs were found on *Z. guamensis* as compared to 534 eggs on *C. grandis* and 247 eggs on the sides of the cages. In the “no choice” tests, no

eggs were laid on *Z. guamensis,* but 324 eggs were found on the sides of the cages. There were 356 eggs on *C. grandis* out of a total of 455 eggs laid in "no choice" tests. Based on these results, the environmental release of *M. oedipus* is not expected to have any negative off-target effects.

# II. Alternatives Including the Proposed Action

This chapter will explain the alternatives available for the control of ivy gourd and summarize the potential environmental consequences of the alternatives. However, the alternatives listed under "no action" are not provided as alternatives for APHIS and may continue whether or not a permit is issued for environmental release of *M. oedipus.* These are methods presently being used to control ivy gourd by public and private concerns and are presented to provide information to the reader.

## A. No Action

Under this alternative, APHIS would not issue permits to any applicant for the release of *M. Oedipus* for the control of ivy gourd on Guam and the Northern Mariana Islands. The release of the biological control agent would not take place.

The following are not alternatives subject to APHIS decision-making authority. However, they are currently being used to control ivy gourd by public and private interest groups, and there use is likely to remain the same or increase if a "no action" decision is made by APHIS.

**1. Chemical Control**

The herbicide triclopyr (Garlon®) has been used to control ivy gourd in Saipan, Rota, and Hawaii by dipping cut stem ends, but the treatment is expensive and results are temporary. On Guam, spraying glyphosate (Roundup®) on ivy gourd foliage had no effect.

**2. Mechanical Control**

Mechanical removal using a bulldozer has been used in clearing areas of ivy gourd and is temporarily effective. Hand weeding and cutting of stems is done only in yards or farm hedges. Because the cut stems of ivy gourd readily root and sprout, effective practices must be implemented. Poor disposal of the cut stems in vacant lots or roadsides aids in spreading this weed.

**3. Biological Control**

Three biological control agents have been released for ivy gourd in Hawaii. The moth, *Melittia oedipus,* was released on the island of Oahu in 1996. In

1999, both weevils *(A. burkhartorum* and *A. cocciniae)* were released on Oahu. Successful control of ivy gourd has been observed in the Hawaiian Islands by these organisms (Teramoto, pers. comm.).

If *M. oedipus* becomes established on Guam and the Northern Mariana Islands, it will be the third agent to become established there for the control of ivy gourd. The other two agents, *A. cocciniae* and *A. burkhartorum,* were permitted for release in Guam and Saipan in 2003 and 2004, respectively.

### B. Issue the Permit

Under this alternative, APHIS would issue a permit to any qualified applicant for the release of *M. oedipus* for the control of ivy gourd on Guam and the Northern Mariana Islands. These permits would contain no special provisions or requirements concerning release procedures or mitigating measures.

### C. Issue the Permit with Specific Management Constraints and Mitigating Measures (Preferred Alternative)

Under this alternative, APHIS would issue permits to any qualified applicant to implement field release of *M. oedipus* for the control of ivy gourd on Guam and the Northern Mariana Islands. However, the permits would contain special provisions or requirements concerning release procedures, mitigation measures and/or post-release environmental monitoring.

## III. Environmental Impacts of the Proposed Action and Alternatives

### A. No Action

The continued use of chemical herbicides, mechanical controls, and biological control at current levels would result if the "no action" alternative is chosen. In the absence of successful control agents, ivy gourd will continue to expand its range, displacing native flora, increasing pest infestations of cucurbitaceous crops. Chemical control is expensive, temporary and often ineffective. It poses some environmental concerns, such as soil contamination, impacts on non-target species, and health hazards.

Mechanical control practiced in residential yards, along fence rows, and in cropped lands can be incomplete when slashing results in cuttings that are

not properly removed. This may cause an increase in ivy gourd populations, if the cuttings are not properly and fully removed. Likewise, bulldozing has been used in clearing large areas of ivy gourd and is temporarily effective, but does not result in long-term suppression.

### B. Issue Permit

Under this option, a permit would be issued allowing release *M. oedipus* without restrictions, constraints or mitigations. This alternative is supported by current evidence that indicates that *M. oedipus* is highly host-specific and will not have direct or indirect negative impacts on native plant species

### C. Issue Permit with Specific Management Constraints (Proposed Action)

Once released into a new environment, a biological control agent that becomes established, as is anticipated if *M. oedipus* is released, has a slight potential to move from the target plant to non-target species, and itself become a pest. Such host shifts to unrelated plant species by introduced weed biological control agents are rare (Pemberton, 2000). However, if a host shift were to take place, the resulting effects could be unanticipated environmental impacts that may not be easily reversed. Therefore, to confirm predictions of no significant impact, permit conditions should include a requirement for preparing and implementing a post-release environmental monitoring plan.

## IV. Other Environmental Issues

### A. Non-target Organisms

Available evidence indicates that *M. oedipus* is highly host-specific and will not have any direct or indirect negative impacts on native plant species.

### B. Threatened or Endangered Species

Threatened and endangered (T&E) species are a special concern and are protected by the Endangered Species Act. One endangered plant *(Serianthes nelsonii* Fabaceae) and three plants proposed for endangered listing occur on Guam and the Northern Mariana Islands *(Tabernaemontana rotensis* Apocynaceae, *Nesogenes rotensis* Verbenaceae and *Osmoxylon mariannense* Araliaceae). However, none of these plants are related to ivy gourd, so the

proposed field release of *M. Oedipus* does not present a perceptible risk to these species.

Also, there is no indication that any listed T&E species, or candidate species proposed for listing, utilize ivy gourd as a host or are otherwise dependent on it for their survival. Therefore, there is no indication of any risk that release of *M. oedipus* could indirectly cause adverse effects on T&E species.

## C. Executive Orders

Executive Order (E.O.) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," focuses Federal attention on the environmental and human health conditions of minority and low-income communities and promotes community access to public information and public participation in matters relating to human health or the environment. The E.O. requires Federal agencies to conduct their programs, policies, and activities that substantially affect human health or the environment in a manner so as not to exclude persons and populations from participation in or benefitting from such programs. It also enforces existing statutes to prevent minority and low-income communities from being subjected to disproportionately high and adverse human health or environmental effects. Neither alternative poses disproportionately high or adverse human health or environmental effects to any specific minority or low-income group.

E.O. 13045, “Protection of Children from Environmental Health Risks and Safety Risks,” acknowledges that children may suffer disproportionately from environmental health and safety risks because of their developmental stage, greater metabolic activity levels, and behavior patterns, as compared to adults. The E.O., (to the extent permitted by law and appropriate, and consistent with the agency’s mission) requires each Federal agency to consider environmental health risks and safety risks that may disproportionately affect children. Neither alternative is expected to have disproportionately high or adverse human health or environmental effects to children.

# V. List of Preparers

**Dr. R. Muniappan**
Agricultural Experiment Station
University of Guam
Mangilao, Guam

**Dr. Joseph Vorgetts**
Pest Permit Evaluations Branch
Permits, Registrations, Imports and Manuals
Plant Protection and Quarantine
USDA, APHIS
Riverdale, MD 20737

# VI. List of Reviewers

**Dr. Robert Flanders**
Chief, Pest Permit Evaluations Branch
Permits, Registrations, Imports and Manuals
USDA, APHIS, Plant Protection and Quarantine
Riverdale, MD 20737

**Dr. Michael J. Firko**
Director, Permits, Registrations, Imports and Manuals
USDA, APHIS, Plant Protection and Quarantine
Riverdale, MD 20737

# VII. References Cited


Chun, M.E. 1996. Host range studies of the moth *Melittia oedipus* (Lepidoptera: Sesiidae), a potential biocontrol agent for ivy gourd, *Coccinia grandis* (Cucurbitaceae), Report, Plant Pest Control Branch, Hawaii Department of Agriculture, 17 p.

Chun, M.E. 2001. Biology and host specificity of *Melittia oedipus* (Lepidoptera: Sessidae), a biological control agent of *Coccinia grandis* (Cucurbitaceae). Proc. Hawaiian Entomol. Soc. 35: 85–93.

Hawaii Department of Agriculture (HDOA). 1994. Report to the eighteenth legislature 1995 regular session in response to I-louse Resolution no. 221 HD2 of the seventeenth legislature 1994 regular session, requesting the Department of Agriculture to submit recommendation for the undertaking of biological research which would lead to the elimination of ivy gourd, Coccinia grandis.

Hennessey, R.D. 1996. Field release of Melittia oedipus (Lepidoptera: Sesiidae) for biological control of ivy gourd, Coccinia grandis (Cucurbitaceae), in Hawaii. Environmental Assessment USDA, APHIS, Riverdale, MD.

Horner, T.A. 2003. Field release of *Acythopeus cocciniae* (Coleoptera: Curculionidae), a nonindigenous leaf-mining weevil for control of ivy gourd, *Coccinia grandis* (Cucurbitaceae), in Guam and Saipan. Environmental Assessment, Policy and program Development, USDA-APHIS, Riverdale, MD. 13 p.

Jeffrey, C. 1967. Cucurbitaceae, in Milne Redhead, E. and Polhill, R. M. (eds.), Flora of Tropical East Africa. Crown Agents, London.

McGregor, A. and R. Vargas. 2002. The eradication of melon fly from Guam and the Commonwealth of the Northern Mariana Islands: a benefit-cost analysis. 41 pp.

Muniappan, R. and T. Horner 2004. Field release of *Acythopeus burkhartorum* (Coleoptera: Curculionidae), a non-indigenous weevil for control of ivy gourd, *Coccina grandis* (Cucurbitaceae) in Guam and Northern Mariana Islands. Environmental Assessment, APHIS USDA.10 pp.

Murai, K., M. Chan, and T. Culliney. 1998. Host range studies of two African *Acythopeus* spp. (Coleoptera: Curculionidae), potential biocontrol agents for ivy gourd, *Coccinia grandis* (Cucurbitaceae). Plant Pest Control Branch, Hawaii Department of Agriculture. 19 pp.

Pemberton, R. W. 2000. Predictable risk to native plants in weed biological control. Oecologia 125:489–494.

Stone, B.C. 1979. The flora of Guam. Micronesia 6:1–659.

Wapshere, A.J. 1974. A strategy for evaluating the safety of organisms for biological weed control. Annals of Applied Biology. 77: 201–211.

**Appendix 1. Plants tested for host specificity of *Melittia oedipus* at the Hawaiian Department of Agriculture (Chun, 2001)**

| Family | Species |
|---|---|
| Apiaceae | *Centella asiatica* |
| | *Daucus carota* |
| Aristolochiaceae | *Aristolochia littoralis* |
| Brassicaceae | *Brassica oleracea* |
| Begoniaceae | *Begonia hirtella* |
| Apocynaceae | *Alyxia oliviformis* |
| Convolvulaceae | *Ipomoea obscura* |
| | *Merremia tuberosa* |
| Caricaceae | *Carica papaya* |
| Cucurbitaceae | *Benincasa hispida* |
| | *Citrullus lanatus* |
| | *Lagenaria siceraria* |
| | *Luffa acutangula* |
| | *Luffa aegyptiaca* |
| | *Cucurbita maxima* |
| | *Cucurbita moschata* |
| | *Cucurbita maxima x C. moschata* |
| | *Cucurbita pepo* |
| | *Momordica charantia* |
| | *Cucumis dipsaceus* |
| | *Cucumis melo v. common* |
| | *Cucumis melo v. inodorus* |
| | *Cucumis melo v. reticulatus* |
| | *Cucumis sativus* |
| | *Sechium edule* |
| | *Sicyos erostratus* |
| | *Sicyos hispidis* |
| | *Sicyos pachycarpus* |
| | *Sicyos waimanaloensis* |
| | *Trichosanthes anguina* |
| Fabaceae | *Phaseolus vulgaris* |
| Flacourtiaceae | *Xylosma hawaiiense* |
| Passifloraceae | *Passiflora edulis* |
| Solanaceae | *Lycopersicon esculentum* |
| | *Solanum melongena* |
| Turneraceae | *Turnera ulmifolia* |
| Violaceae | *Isodendrion laurifolium* |
| | *Viola chamissoniana subsp. Tracheliifolia* |

**Appendix 2. Host specificity conducted on the non-target species *Zehneria guamensis***

| Replication | Test | # Melittia Adults | # Eggs Laid on Coccinia | # Eggs Laid on Zehneria | # Eggs Lain on Cage |
|---|---|---|---|---|---|
| I | Choice | 5 ♂ + 6 ♀ | 167 | 3 | 49 |
| | No choice (Zehneria) | 7 ♂ + 10 ♀ | n/a | 0 | 51 |
| | No choice (Coccinia) | 22♂ + 16♀ | 50 | n/a | 10 |
| II | Choice | 22♂ + 20♀ | 250 | 0 | 59 |
| | No choice (Zehneria) | 8 ♂ + 4 ♀ | n/a | 0 | 155 |
| | No choice (Coccinia) | 5 ♂ + 7 ♀ | 213 | n/a | 45 |
| III | Choice | 4 ♂ + 6 ♀ | 31 | 0 | 121 |
| | No choice (Zehneria) | 7 ♂ + 8 ♀ | n/a | 0 | 13 |
| | No choice (Coccinia) | 8 ♂ + 8 ♀ | 60 | n/a | 38 |
| IV | Choice | 4 ♂ + 9 ♀ | 86 | 1 | 18 |
| | No choice (Zehneria) | 5 ♂ + 8 ♀ | n/a | 0 | 105 |
| | No choice (Coccinia) | 2♂ + 5 ♀ | 33 | n/a | 6 |