

Field Release of a Nonindigenous Beetle, *Gratiana boliviana* (Coleoptera: Chrysomelidae), for Biological Control of Tropical Soda Apple, *Solanum viarum* (Solanaceae).

Environmental Assessment

April 2003

Agency Contact:

Tracy A. Horner, Ph.D.

Policy and Program Development

USDA - APHIS

4700 River Road, Unit 149

Riverdale, MD 20737-1236

Phone (301) 734-5213

Fax (301) 734-3640

email Tracy.A.Horner@aphis.usda.gov

Proposed Action: The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS) is proposing to issue a permit for the release of a nonindigenous beetle, *Gratiana boliviana* Spaeth (Coleoptera: Chrysomelidae). The agent would be used by the applicant for the biological control of tropical soda apple, *Solanum viarum* Dunal (Solanaceae) in the continental United States.

Type of statement: Environmental Assessment

For further information: Tracy A. Horner, Ph.D.

1. Purpose and Need for the Proposed Action

1.1 The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), is proposing to issue a permit to a researcher at the University of Florida for release of a nonindigenous, leaf-feeding beetle, *Gratiana boliviana* Spaeth (Coleoptera: Chrysomelidae). The agent would be used by the applicant for the biological control of tropical soda apple, *Solanum viarum* Dunal (Solanaceae). Before a permit is issued for release of *G. boliviana*, APHIS needs to analyze the potential effects of the release of this agent into the continental United States.

The proposed biological control (biocontrol) agent, *G. boliviana* is a tortoise beetle in the insect family Chrysomelidae and is native to South America. Adults and larvae feed on tropical soda apple leaves, restricting the vigor and growth rate of the plants potentially reducing the competitive advantage this invasive weed has over native vegetation. Females deposit eggs individually on tropical soda apple leaves and petioles. Females produce an average of 300 eggs. The egg stage lasts 5_6 days at 25°C. The larval stage is completed in 15_18 days, and there are five instars. The pupal stage usually lasts 6_7 days. In total, 26 to 31 days are required for the insect to develop from the egg to the adult stage.

1.2 The applicant's purpose for releasing *G. boliviana* is to reduce the severity of infestations of tropical soda apple in Florida and other infested States in the continental United States. Tropical soda apple is a perennial shrub that belongs to the plant family Solanaceae, section Acanthophora, genus *Solanum*, and subgenus *Leptostemonum*. It is native to Brazil and Argentina but has become a weed in other areas of South America and in Africa, India, Nepal, West Indies, Honduras, Mexico, and the United States. Earliest records indicate that this plant was initially detected in Glades county (southeast Florida) in 1988. The pasture-land infested in 1992 was estimated to be approximately 150,000 acres, and ten years later this infested area has increased to more than one million acres of improved pastures, citrus groves, sugar cane fields, ditches, vegetable crops, sod farms, forestlands (oak hammocks and cyprus heads), and natural areas. The plant has been reported in nine other States (Alabama, Georgia, Mississippi,

Louisiana, Texas, North Carolina, South Carolina, Tennessee, and Pennsylvania), and has the potential to expand its range even further in the United States, based on temperature and photoperiod threshold experiments conducted by Patterson (1996) in controlled environmental chambers.

The primary means of dispersal of tropical soda apple in the United States is livestock and wildlife feeding on fruits. However, contaminated equipment, hay, seed, composted manure and sod may also serve as a means of dispersal. Once established in an area, wildlife may continue the spread of tropical soda apple. Infestations are spreading rapidly mainly in the southeastern States in the proximity of Florida. This invasive exotic weed was placed on the Federal Noxious Weed List in 1995, and it is listed as one of the most invasive species in Florida by the Florida Exotic Pest Plant Council.

1.3 APHIS must decide among the following alternatives:

- A. To deny the permit application (no action),
- B. To issue the permit as submitted,
- C. To issue the permit with management constraints or mitigation measures.

1.4 Issues arising from the field release of *G. boliviana* are:

- A. Will *G. boliviana* attack non-target plants within and outside of the area infested with tropical soda apple?
- B. Will *G. boliviana* affect any federally listed threatened or endangered species or other species of special concern?

1.5 The pending application for release of this biocontrol agent into the environment was submitted in accordance with the provisions of the Plant Protection Act of 2000 (7 United States Code (U.S.C.) 7701 *et seq.*). This environmental assessment (EA) was prepared by APHIS in

compliance with the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 *et seq.*) as prescribed in implementing regulations adopted by the Council on Environmental Quality (40 Code of Federal Regulations (CFR) 1500-1509), by USDA (7 CFR 1b), and by APHIS (7 CFR 372).

2. Alternatives Including the Proposed Action

2.1 This chapter will explain the alternatives available to APHIS. Although APHIS' alternatives are limited to a decision on whether to issue a permit for release of *G. boliviana*, other methods available for control of tropical soda apple are also described. These control methods are not decisions to be made by APHIS and may continue whether or not a permit is issued for environmental release of *G. boliviana*. These are methods presently being used to control tropical soda apple by public and private concerns and are presented to provide information to the reader.

2.2 Description of APHIS' alternatives.

2.2.1 Alternative 1 - No Action: Under this alternative, APHIS would not issue a permit for the field release of *G. boliviana* for the control of tropical soda apple. The release of this biocontrol agent would not take place.

2.2.2 Alternative 2 - Issue the Permit: Under this alternative, APHIS would issue a permit for the field release of *G. boliviana* for the control of tropical soda apple. This permit would contain no special provisions or requirements concerning release procedures or mitigating measures.

2.2.3 Alternative 3 - Issue the Permit with Specific Management Constraints and Mitigating Measures: Under this alternative, APHIS would issue a permit for the field release of *G. boliviana* for the control of tropical soda apple. However, the permit would contain special provisions or requirements concerning release procedures or mitigating measures.

2.3 The following alternatives are presently being used to control tropical soda apple. These controls will continue under the “No Action” alternative but may continue even if a permit is issued for release of *G. boliviana*.

2.3.1 Chemical Control. Herbicides including triclopyr (Remedy®), glyphosate (Roundup®), dicamba (Banvel ®) , 2,4-D plus dicamba (Weedmaster ®), and picloram plus 2,4-D (Grazon P+D®) are used for control of tropical soda apple.

2.3.2 Mechanical Control. In dense infestations, mowing to a 3-4 inch height prevents plants from producing fruit and seeds. Repeated mowing will not completely control the weed but if used in combination with timely herbicide application will provide effective control. These control tactics provide only a temporary solution, and they are not always feasible in rough terrain or natural areas.

2.3.3 Regulatory Control. The Plant Protection Act of 2000 provides for the control and regulation of interstate movement of tropical soda apple. Several southern States are trying to implement ‘Prevention or Containment Strategies’ to prevent the spread of tropical soda apple by regulating the movement of cattle, hay, sod, manure, infested seeds, and soil from tropical soda apple infested areas to areas free of infestations. States have to certify that the regulated products indicated above are tropical soda apple free before shipping from the infested areas into other States.

3. Affected Environment

3.1 Evidence of host specificity of *G. boliviana*

In total, 141 plant species in 35 families were included in the host range specificity tests with *G. boliviana* in Argentina, and at the Florida and Mississippi quarantine-facilities (Medal *et al.*, 2000, 2001). The plants tested included 67 species (Appendix 1) in the family of the target

weed (Solanaceae) of which 35 were from the genus *Solanum* and 32 from 16 other genera. Sixteen native species of *Solanum*, 11 exotic species that occur in the United States, and 8 exotic species of *Solanum* that are not present in the United States, were included in the host-range tests. None of the native species tested showed any indication of being an alternative host of *G. boliviana*. Larval mortality under no-choice conditions was 100% for all U.S. native *Solanum* species tested. *G. boliviana* fed and developed only on a few members in the Acanthophora section of the genus *Solanum*.

Eggplant (*Solanum melongena*) was tested extensively in host specificity tests, including laboratory and field choice and no-choice tests (Medal 2000, 2001). Although some light feeding, oviposition, and development by *G. boliviana* occurred in no-choice laboratory feeding tests, in no-choice field tests, eggplant was not accepted as a host and no noticeable feeding occurred. In addition, this insect has never been recorded attacking eggplant in South America.

3.1.2 Threatened and Endangered Plant Species in the Tropical Soda Apple Infested Areas:

Three plants in the genus *Solanum* are listed as endangered in the United States: *S. drymophilum*, *S. incompletum*, and *S. sandwicense*. Another species, *S. nelsonii*, is a candidate for listing. However, none of these plants occur in the proposed release area (continental United States) for *G. boliviana*. *Solanum incompletum*, *S. nelsonii* and *S. sandwicense* occur only in Hawaii. *Solanum drymophilum* occurs only in Puerto Rico.

4. Environmental Consequences

4.1 This chapter will analyze the potential environmental consequences of each alternative on the resources described in Chapter 3.

4.2 Effects of Alternative 1 - No Action

4.2.1 Effects on Non-Target Organisms: The continued use of chemical herbicides and mechanical controls at current levels would be a result if the “no action” alternative is chosen. In addition to being expensive, control tactics based entirely on the use of herbicides can lead to negative environmental side effects including undesirable chemical residues both in the ecosystem (soil, water), and in commodities (milk, meat), as well as adverse effects on non-target organisms. Herbicides and mowing only provide temporary weed suppression, and in addition to being expensive, they are not always practical in inaccessible areas.

4.2.2 Effects on Threatened and Endangered: Impact on threatened and endangered species as a result of chemical and mechanical control would be similar to effects on non-target species and habitats described in section 4.2.1.

4.3 Effects of Alternative 2 - Issue Permit

4.3.1 Effects on Non-Target Organisms: None of the native *Solanum* species tested in host specificity tests showed any indication of being an alternative host of *G. boliviana*. The two known natural hosts of *G. boliviana* in South America are *Solanum viarum* (tropical soda apple), and *Solanum palinacanthum*, which does not occur in the United States. Results obtained from field surveys conducted during three-years in Argentina, Brazil, Paraguay, and Uruguay, open and caged-field experiments in Argentina, host-range specificity tests in Argentina, Florida, and Mississippi, and the lack of unfavorable host records in the scientific literature provide strong evidence that *G. boliviana* will be specific to tropical soda apple in the continental United States. In addition, from the host specificity testing conducted on eggplant, risk to this crop is extremely low.

4.3.2 Impact on Threatened and Endangered Species: *G. boliviana* has a narrow host range, restricted to the genus *Solanum*, subgenus *Leptostemonum*, and mainly, the section Acanthophora. Although all of the listed plant species in the genus *Solanum* belong to the subgenus *Leptostemonum*, none belong to the section Acanthophora. In addition, none of the listed species occur in the continental United States. *S. incompletum*, *S. nelsonii* and *S.*

sandwicense occur only in Hawaii. *S. drymophilum* occurs only in Puerto Rico. Releases of *G. boliviana* are not proposed for these locations and accidental introduction of this insect into these locations is unlikely.

A biological evaluation and request for concurrence with APHIS' finding that release of *G. boliviana* "is not likely to adversely affect threatened and endangered species or designated critical habitat" was submitted to the U.S. Fish and Wildlife Service (FWS), Arlington, VA, in compliance with Section 7 of the Endangered Species Act of 1973, as amended. On October 10, 2002, the FWS issued a concurrence letter stating that "releases of *Gratiana boliviana* for control of *Solanum viarum* on the North American mainland may affect, but are not likely to adversely affect, any threatened or endangered species. They are also not likely to destroy or adversely modify any designated critical habitat of such species and are not likely to jeopardize any species proposed to be listed as endangered or threatened or result in destruction or adverse modification of any area proposed to be designated as critical habitat".

4.4 Effects of Alternative 3 - Issue the Permit with Specific Management Constraints and Mitigating Measures

4.4.1 Effects on Non-Target Organisms: No specific management constraints or mitigating measures have been recommended for this species. Therefore, under this alternative, impacts on non-target organisms would be identical to those described in 4.3.1.

4.4.2 Effects on Threatened and Endangered Species: No specific management constraints or mitigating measures have been recommended for this species. Therefore, under this alternative, impacts on threatened and endangered organisms would be identical to those described in 4.3.2.

4.5 No disproportionate effects are expected for minority, low income populations, or children due to the release of *G. boliviana*. Potential reduction in herbicide usage to control tropical soda apple may result in beneficial effects to humans and the environment, decreasing health risks.

4.6 An unavoidable effect of the proposed action would be the lack of complete control of the target pest. Should the proposed action be unsuccessful, the present chemical and mechanical control activities would continue. Tropical soda apple would continue to expand into areas presently uninfested.

4.7 Once a biological control agent such as *G. boliviana* is released into the environment and it becomes established, there is a slight possibility it could move from the target plant to non-target plants and itself become a pest. Host shifts by introduced weed biocontrol agents to unrelated plants are uncommon (Pemberton 2000). However, if a host shift were to take place, the resulting effects could be environmental impacts that may not be easily reversed. Biological control agents such as *G. boliviana* generally spread even without the agency of man. In principle, therefore, release of these insects at even one site must be considered equivalent to release over the entire area in which potential host plants occur and in which the climate is suitable for reproduction and survival. However, post- release evaluations of the beetle populations and their effects on tropical soda apple plants will be conducted for several years after initial release in Florida. The negative effects, if any, on non-target plants also will be monitored during the post-release evaluations of the released biocontrol agent. A monitoring plan will be developed before any field release to detect early signs of adverse environmental impacts. Contingency plans to treat release sites with insecticides will be implemented if signs of adverse environmental impacts or non-target effects are detected.

http://plants.usda.gov/plantproj/plants/cgi_bin/fr_qurymen.cg.

5. List of Preparers

This environmental assessment was prepared by Dr. Julio C. Medal, Weed Biocontrol Researcher, and Dr. James P. Cuda, Assistant Professor, University of Florida- Entomology and Nematology Department, Gainesville, Florida, and Dr. Tracy Horner, Entomologist, USDA- APHIS - Policy and Program Development, Riverdale, Maryland.

6. List of Agencies Consulted

Dr. John Fay, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service was consulted under Section 7 of the Endangered Species Act.

The Technical Advisory Group for the Biological Control Agents of Weeds (TAG) recommended the release of *Gratiana boliviana* on April 22, 2002. TAG members that reviewed the release petition (Medal *et al.* 2001) included representatives from the United States Department of the Interior (National Park Service and Bureau of Land Management), USDA (Agricultural Research Service, APHIS, Cooperative State Research, Education, and Extension Service, and the U.S. Forest Service), the Environmental Protection Agency, the U.S. Army Corps of Engineers, the California Department of Food and Agriculture, Agriculture and Agri-Food Canada and the National Plant Board.

7. List of Reviewers

This document was reviewed by Dr. Robert Flanders, Pest Permit Evaluation Branch Chief and Dr. Michael Firko, Assistant Director of Plant Health Programs, USDA-APHIS-Plant Protection and Quarantine, Riverdale, MD.

8. References Cited

- Coile, N. C. 1998. Notes on Florida's endangered and threatened plants. Florida Department of Agriculture & Consumer Services, Bureau of Entomology, Nematology and Plant Pathology. Botany Section Contribution No. 38, 2nd edition. 119 p.
- Gandolfo, D. 1998. Tropical soda apple, pp. 59-74. In: Cordo, H. (ed.). USDA-ARS South American Biological Control Laboratory Annual Report. 1997-98. Hurlingham, Argentina.

- McGovern, R. J., Polston, J. E. & Mullahey, J. J. 1996. Tropical soda apple (*Solanum viarum* Dunal): Host of tomato, pepper, and tobacco viruses in Florida. In: Proceedings of tropical soda apple symposium, Bartow, Florida. 1996. University of Florida-IFAS, 31-34.
- McGovern, R. J., Polston, J. E., Danyluk, G. M., Heibert, E., Abouzid, A. M. & Stansly, P. A. 1994a. Identification of a natural weed host of tomato mottle geminivirus in Florida. *Plant Dis.* 78: 1102-1106.
- McGovern, R. J. Polston, J. E. & Mullahey, J. J. 1994b. *Solanum viarum*: weed reservoir of plant viruses in Florida. *Int. J. Pest Management.* 40: 270-273.
- Medal, J., D. Gandolfo, and J. Cuda. 2000. Petition to release the tortoise beetle *Gratiana boliviana* Spaeth (Coleoptera: Chrysomelidae), for classical biological control of tropical soda apple, *Solanum viarum* Dunal (Solanaceae), in the United States. University of Florida/USDA-ARS South American Biological Control Laboratory. 45 p.
- Medal, J., D. Gandolfo, J. Cuda, and S. Usnick. 2001. Additional host-specificity tests to support the petition to release *Gratiana boliviana* (Coleoptera: Chrysomelidae) for biocontrol of tropical soda apple. University of Florida/USDA-ARS. 41 p.
- Mislevy, P., Mullahey, J. J. & Colving, D. L. 1996. Management practices for tropical soda apple control: Update. In: Proceedings of tropical soda apple symposium, Bartow, Florida. 1996. University of Florida-IFAS, 61-67.
- Patterson, D. T. 1996. Effects of temperature and photoperiod on tropical soda apple (*Solanum viarum* Dunal) and its potential range in the United States. In: Proceedings of tropical soda apple symposium, Bartow, Florida. 1996. University of Florida-IFAS, 29-30.

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

U.S. Fish and Wildlife Service. 1997. Endangered and threatened wildlife and plants. U.S. Government Printing Office. 52 p.

Appendix 1: List of Solanaceae Species Tested with *Gratiana boliviana*

Tribe Solaneae

Status in the
United States

Genus *Solanum*

Subgenus *Leptostemonum*

Section *Acantophora*

<i>S. viarum</i> (TSA)	exotic
<i>S. aculeatissimum</i>	-----
<i>S. atropurpureum</i>	-----
<i>S. capsicoides</i>	exotic
<i>S. mammosum</i>	exotic
<i>S. palinacanthum</i>	-----

Section *Lasiocarpa*

<i>S. pseudohulo</i>	exotic
<i>S. quitoense</i>	-----

Section *Micrantha*

<i>S. jamaicense</i>	exotic
<i>S. tampicense</i>	exotic

Section *Melongena*

Subsection *Androceras*

<i>S. citrullifolium</i>	native
<i>S. rostratum</i>	native

Subsection *Cryptocarpum*

<i>S. sisymbriifolium</i>	exotic
---------------------------	--------

Subsection *Lathyrocarpum*

<i>S. carolinense</i>	native
<i>S. dimidiatum</i>	native
<i>S. elaeagnifolium</i>	native
<i>S. pumilium</i>	native

Subsection *Melongena*

<i>S. melongena</i> (eggplant)	exotic
--------------------------------	--------

Section *Torva*

<i>S. bonariensis</i>	-----
<i>S. donianum</i>	native
<i>S. torvum</i>	exotic
<i>S. verbascifolium</i>	native

Subgenus *Solanum*

<i>S. americanum</i>	native
<i>S. diphyllum</i>	native
<i>S. erianthum</i>	native
<i>S. jasminoides</i>	exotic
<i>S. mauritianum</i>	
<i>S. nigrum</i>	native
<i>S. parishii</i>	

	<i>S. retroflexum</i>	native
	<i>S. seafortianum</i>	
	<i>S. scabrum</i>	native
	<i>S. tuberosum</i> (potato)	exotic
Genus <i>Acnistus</i>		
	<i>A. australe</i>	
Genus <i>Capsicum</i>		
	<i>C. annum</i>	
	<i>C. frutescens</i>	
Genus <i>Cyphomandra</i>		
	<i>C. betacea</i>	
Genus <i>Iochroma</i>		
	<i>Iochroma. sp.</i>	
Genus <i>Lycopersicon</i>		
	<i>L. esculentum</i>	
Genus <i>Physalis</i>		
	<i>P. angulata</i>	
	<i>P. arenicola</i>	
	<i>P. crassifolia</i>	
	<i>P. gigantea</i>	
	<i>P. pubescens</i>	
	<i>P. viscosa</i>	
	<i>P. walteri</i>	
Tribe <i>Daturae</i>		
Genus <i>Brugmansia</i>		
	<i>B. sanguinea</i>	
Genus <i>Datura</i>		
	<i>D. discolor</i>	
	<i>D. metel</i>	
	<i>D. meteloides</i>	
	<i>D. stramonium</i>	
	<i>D. ferox</i>	
Tribe <i>Lycieae</i>		
Genus <i>Lycium</i>		
	<i>L. carolinianum</i>	
	<i>L. fremontii</i>	
Tribe <i>Nicotianeae</i>		
Genus <i>Nicotiana</i>		
	<i>N. glauca</i>	
	<i>N. rustica</i>	
	<i>N. sylvestris</i>	
	<i>N. tabacum</i>	
Genus <i>Nierembergia</i>		
	<i>N. scoparia</i>	
Genus <i>Petunia</i>		

Tribe Jaborasae

Genus *Salpichroa*

P. axilaris

Petunia. sp. (ornamental hybrid)

Tribe Salpiglossidae

Genus *Salpiglossis*

S. organifolia

Genus *Schizanthus*

S. sinuata

Tribe Solandreae

Genus *Solandra*

Schizanthus. sp.

S. glandiflora

**Decision and Finding of No Significant Impact
for
Field Release of *Gratiana boliviana* (Coleoptera: Chrysomelidae), for
Biological Control of Tropical Soda Apple, *Solanum viarum*
(Solanaceae)
Environmental Assessment
April 2003**

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), is proposing to issue permits for release of a nonindigenous, leaf-feeding beetle, *Gratiana boliviana* Spaeth (Coleoptera: Chrysomelidae). The agent would be used for the biological control of tropical soda apple, *Solanum viarum* Dunal (Solanaceae) in the continental United States.

The alternatives available to APHIS are No Action (no permits), Issue Permit, and Issue Permit with Management Constraints or Mitigating Measures. Because of the action being proposed by APHIS, the Issue Permit and the Issue Permit with Management Constraints or Mitigating Measures alternatives will result in the release of the biological control agent into the environment. APHIS has therefore analyzed the potential effects of the release of the agent into the environment. The No Action alternative, as described in the environmental assessment (EA), would likely result in the continued use at the current level of chemical, mechanical, and regulatory control methods for the management of tropical soda apple. These control methods described are not alternatives for decisions to be made by APHIS, but are presently being used to control tropical soda apple in the United States and may continue regardless of permit issuance for field release for *G. boliviana*.

I have decided to issue permits for the field release of *G. boliviana* without management constraints or mitigating measures. The reasons for my decision are:

- This biological control agent is sufficiently host specific and poses little, if any, threat to the biological resources of the United States
- This species will not disproportionately affect minority or low- income populations, nor will they disproportionately affect children or result in any environmental health risks or safety risks to children.
- *G. boliviana* poses no threat to the health of humans or wild or domestic animals.
- *G. boliviana* is not likely to adversely affect endangered or threatened species or their habitat.

- While there is not total assurance that the release of *G. boliviana* into the environment will be reversible, there is no evidence that this organism will cause any adverse environmental effects.

Based on the analysis found in the EA, I find that issuance of permits for the field release of *G. boliviana* without management constraints or mitigating measures will not have a significant impact on the quality of the human environment.

/s/

Michael J. Firko
Assistant Director
APHIS Plant Health Programs
Plant Protection and Quarantine

March 14, 2003