United States Department of Agriculture

Marketing and Regulatory Programs

Animal and Plant Health Inspection Service

Field Release of *Puccinia spegazzinii* for Biological Control of *Mikania micrantha* in Guam and the Commonwealth of the Northern Mariana Islands

Environmental Assessment, October 2011

Field Release of *Puccinia spegazzinii* for Biological Control of *Mikania micrantha* in Guam and the Commonwealth of the Northern Mariana Islands

Environmental Assessment, October 2011

Agency Contact:
Shirley Wager-Page, Branch Chief
Pest Permitting
Plant Protection and Quarantine
Animal and Plant Health Inspection Service
U.S. Department of Agriculture
4700 River Road, Unit 133
Riverdale, MD 20737–1236

Table of Contents

I. Purpose and Need for the Proposed Action

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ), Pest Permitting Branch (PPB), is proposing to issue permits for release of a plant pathogenic fungus, *Puccinia spegazzinii* De Toni (Basidiomycetes: Uredinales). The agent would be used by the applicant for the biological control of *Mikania micrantha* (mile-a-minute, bittervine) in Guam. Before permits are issued for release of *P. spegazzinii*, the APHIS–PPQ, PPB must analyze the potential impacts of the release of this agent into Guam as well as the Commonwealth of the Northern Mariana Islands (CNMI) because of its proximity to Guam. In addition, applicants may request to release *P. spegazzinii* into the CNMI in the future.

This environmental assessment[1] (EA) has been prepared, consistent with USDA, APHIS' National Environmental Policy Act of 1969 (NEPA) implementing procedures (Title 7 of the Code of Federal Regulations (CFR), part 372). It examines the potential effects on the quality of the human environment that may be associated with the release of *P. spegazzinii* to control infestations of *M. micrantha* within Guam and the CNMI. This EA considers the potential effects of the proposed action and its alternatives, including no action.

The applicant's purpose for releasing *P. spegazzinii* is to reduce the severity of infestations of *M. micrantha* within Guam. *Mikania micrantha* is a smothering vine that grows in disturbed forests, stream banks, roadsides, pastures, plantations and cultivated crops. It rapidly overgrows abandoned areas. *Mikania micrantha* is estimated to cover 2,581 acres of Guam, 1.93 percent of the country (Reddy, 2011)

Current control methods of *M. micrantha* focus on slashing and herbicides, but are expensive, ineffective, not sustainable, and can be environmentally damaging (Sankaran et al., 2001). For these reasons, the applicant has a need to release *P. spegazzinii*, a host- specific, biological control organism for the control of *M. micrantha* into the environment of Guam and the CNMI.

[1] Regulations implementing the National Environmental Policy Act of 1969 (42 United States Code 4321 et seq.) provide that an environmental assessment "shall include brief discussions of the need for the proposal, of alternatives as required by section 102(2)(E), of the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted." 40 CFR § 1508.9.

II. Alternatives

This section will explain the two alternatives available to the PPB—no action and issuance of permits for environmental release of *P. spegazzinii*. Although the PPB's alternatives are limited to a decision on whether to issue permits for release of *P. spegazzinii*, other methods available for control of *M. micrantha* are also described. These control methods are not decisions to be made by the PPB, and their use is likely to continue whether or not permits are issued for environmental release of *P. spegazzinii*, depending on the efficacy of *P. spegazzinii* to control *M. micrantha*. These are methods presently being used to control *M. micrantha* by public and private concerns.

A third alternative was considered, but will not be analyzed further. Under this third alternative, the PPB would have issued permits for the field release of *P. spegazzinii*; however, the permits would contain special provisions or requirements concerning release procedures or mitigating measures. No issues have been raised that would indicate special provisions or requirements are necessary.

A. No Action

Under the no action alternative, the PPB would not issue permits for the field release of *P. spegazzinii* for the control of *M. micrantha*. The release of this biological control agent would not take place. The following methods are presently being used to control *M. micrantha*; these methods will continue under the "No Action" alternative and will likely continue even if permits are issued for release of *P. spegazzinii*, depending on the efficacy of the organism to control *M. micrantha*.

1. Chemical Control

In Fiji, chemical control of *M. micrantha* includes application of the herbicides 2,4-D, 2,4,5-T, or a combination of 2,4-D and picloram (Orapa and Pene, undated). In Guam, the herbicides glyphosate and triclopyr are used to kill *M. micrantha*.

2. Mechanical Control

Mikania micrantha may be killed by repeated cutting and/or uprooting, although plants regrow rapidly (Orapa and Pene, undated).

3. Biological Control

Other biological control organisms for *M. micrantha* have been released in the Pacific. *Liothrips mikaniae*, a thrips, was released into the Solomon Islands and Papua New Guinea in 1988, and later in Malaysia (Orapa and Pene, undated). The insect failed to establish in any location. Two butterfly species, *Actinote anteas* and *A. thalia pyrrha*, have been released in Indonesia and have been evaluated for release in Fiji and Papua New

Guinea. These insects have not been released in Guam or the CNMI. *Mikania micrantha* biological control efforts are now focused on *P. spegazzinii* in Fiji and Papua New Guinea.

B. Issue Permits for Environmental Release of *A. subterminalis*

Under this alternative, the PPB would issue permits for the field release of the rust fungus *P. spegazzinii* for the control of *M. micrantha*. A rust fungus is any of various fungi of the order Uredinales that are injurious to a wide variety of plants. Permits for environmental release of *P. spegazzinii* would contain no special provisions or requirements concerning release procedures or mitigating measures in Guam and the CNMI.

Biological Control Agent Information

1. Taxonomy

Phylum: Basidiomycota
Class: Urediniomycetes
Order: Uredinales
Family: Pucciniaceae
Genus: *Puccinia*
Species: *P. spegazzinii* DeToni

2. Geographical Range of *P. spegazzinii*

a. Native Range

Puccinia spegazzinii has only been recorded from the Neotropics (Orapa and Pene, undated) (the biogeographic region that includes southern Mexico and Central America, the Caribbean, southern Florida, and South America). It has been recorded on various *Mikania* species throughout the range of the genus, from the southern United States to northern Argentina (Orapa and Pene, undated). The specific strain of *P. spegazzinii* selected for release in Guam is the same strain that has been released in Fiji and Papua New Guinea, Isolate W1960 (IMI 393075), an isolate originally collected from eastern Ecuador. Laboratory testing conducted at CABI Bioscience in the United Kingdom demonstrated that this strain is very effective against *M. micrantha* in Fiji and Papua New Guinea (Ellison, 2006b), and is expected be the most effective for Guam.

b. Other Areas of Introduction

Puccinia spegazzinii was released in India in 2005 to 2007, but the rust failed to establish persistent populations in the field (Ellison and Day, 2010). It was released in China in 2006 and Taiwan in 2008. Status of the release in China is unknown but establishment and spread of the rust has

occurred in Taiwan (Ellison and Day, 2010). Most recently, *P. spegazzinii* has been released in Papua New Guinea and Fiji in 2009.

3. Life History of *P. spegazzinii*

Orapa and Pene (undated) describe *Puccinia spegazzinii* as an obligate parasitic rust fungus which completes all stages of its lifecycle on a single host species (autoecious). It is also microcyclic, with only two spore-producing stages (basidiospores and teliospores), instead of the usual five stages. The teliospores embed in host tissue, forming distinct, raised sori (masses of spores bursting through the plant epidermis), 2 to 6 centimeters in diameter, on the underside of leaves and over the entire area of petioles and stems. Under high humidity, basidiospores are released and it is these that spread the infection to young, growing tissue on the same host. Older plant tissue is less susceptible to infection. During unfavorable conditions, the rust is able to survive in stem cankers for long periods.

III. Affected Environment

A. Target Weed

Order: Asterales
Family: Asteraceae
Tribe: Eupatoriae
Genus: *Mikana*
Species: *M. micrantha* Kunth. Ex H.B.C.

Synonym: *Mikania scandens*

Zhang et al., (2004) describe *M. micrantha* as a many-branched scrambling perennial vine that can reproduce easily through both sexual and vegetative reproduction. This vine can produce a large number of seeds that are small and light. Dispersal takes place by wind and is the main source of invasion into disturbed environments. *Mikania micrantha* can also reproduce from stem fragments which root easily at the nodes and from vegetative ramets arising from rosettes. Most local spread results from vegetative propagation (Swamy and Ramakrishnan, 1987).

B. Areas Affected by *Mikania micrantha*

1. Native and Introduced Range of *M. micrantha*

The native range of *M. micrantha* is the tropical and subtropical zones of North, Central, and South America, from sea level up to 2,000 meters (Holm et al., 1977). *Mikania micrantha* is now an important weed in a number of countries within the moist tropical zones of southeast Asia and the Pacific, and is still expanding its exotic range. In the Pacific, it is present in American Samoa, CNMI, Cook Islands, Fiji, French Polynesia,

Guam, New Caledonia, Niue, Palau, Papua New Guinea, Federated States of Micronesia, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu, and Wallis and Futuna (Orapa and Pene, undated). It is widespread on Rota (Space et al., 2000). *Mikania micrantha* appears to grow best where annual average temperature is usually higher than 21°C and soil moisture is over 15 percent (Huang et al., 2000, as cited in Zhang, 2004).

C. Plants Related to *Mikania micrantha* and Their Distribution

Plants related taxonomically to *M. micrantha* would be the most likely to be attacked by the proposed biological control organism, *P. spegazzinii*. Plants in the same genus as *M. micrantha* (*Mikania*) are the most closely related to it. There are approximately 250 species in the genus *Mikania*, the majority of which have a Neotropical center of origin. There are only seven species of *Mikania* native to Africa. In Asia, there is only one native species, *Mikania cordata* (Burm. F.) Robinson, which occurs from southern Myanmar (Burma) through to tropical and sub-tropical China (Holmes, 1982). In the Pacific Islands, *M. cordata* has been recorded in Papua New Guinea, the Philippines, Samoa, and the Solomon Islands (PIER, 2007).

IV. Environmental Consequences

A. No Action

Mikania micrantha grows in orchards, forests, along rivers and streams in disturbed areas, and along roadsides. It can smother both agro-forestry and natural forest ecosystems, and many crops within smallholder and plantation production systems in the tropical moist forest zones of Asia and the Pacific Region. In the Zhujian Delta of China, *M. micrantha* has caused forests to degenerate because it forms a heavy mat that smothers the forest canopy, and in aquatic habitats, *M. micrantha* can spread onto ponds to cover or kill aquatic plants (Zhang et al., 2004).

Orapa and Pene (undated) describe the negative effects of *M. micrantha* in the Fiji Islands. *M. micrantha* is an aggressive competitor for nutrients, light, and water in cropping systems and forests. In subsistence food gardens and plantations of sugarcane, coffee, cocoa, taro, oilpalm, nonu, kava, bananas, etc., *M. micrantha* grows rapidly, smothering crops, and interferes with harvesting. *Mikania micrantha* has also been shown to

have allelopathic[2] properties.

However, Ellison et al., (2008) describe the beneficial uses of *M. micrantha* as follows: Cattle will eat it if nothing else is available, but its nutritional value is considered to be inferior to that of the pasture plants it is able to smother. It has been used to prevent soil erosion and also to serve as mulch. On some islands in the Pacific, leaves are used to stop the flow of blood from fresh wounds. In its native range, there are unsubstantiated reports of *M. micrantha* use in folk medicine as a cure for snakebites.

1. Impact from Use of Other Control Methods

The continued use of chemical, mechanical and biological controls at current levels would be a result if the "no action" alternative is chosen. These environmental consequences may occur even with the implementation of the biological control alternative, depending on the efficacy of *P. spegazzinii* to reduce *M. micrantha* in Guam and the CNMI.

a. Chemical Control

Herbicide applications can control *M. micrantha* but can also harm food crops and cause undesirable human and environmental consequences.

b. Mechanical Control

Mechanical methods of controlling *M. micrantha* are time consuming, labour intensive and generally inefficient due to its ability to grow back quickly. The climbing habit of *M. micrantha* enables it to penetrate into the crowns of bushes or trees where it is difficult to apply mechanical methods without damage to the crops (Cock et al., 2000).

c. Biological Control

No organisms for the biological control of *M. micrantha* have been released in Guam or the CNMI. *Puccinia spegazzinii* infects all aerial parts of *M. micrantha*, causing leaf, petiole, and stem cankering, often leading to the death of the entire plant (Orapa and Pene, undated).

B. Issue Permits for Environmental Release of *P. spegazzinii*

1. Impact of *P. spegazzinii* on Nontarget Plants

Host specificity of *P. spegazzinii* has been demonstrated through laboratory testing. If the biological control organism only attacks one or a few closely related plant species, the organism is considered to be very

[2] The inhibition of growth in plants by chemicals produced by another plant species.

host-specific. Host specificity is an essential trait for a biological control organism proposed for environmental release.

a. Host Specificity Testing

Published research of host specificity study results indicate *P. spegazzinii* has a very narrow host range, limited to species of *Mikania*, and in particular to *M. micrantha*. Variability in susceptibility within the species of *M. micrantha* has been reported (Ellison et al., 2008). Within the *Mikania* genus, only *M. natalensis*, *M. capensis*, *M. microptera*, and *M. cordata* became infected. Only *M. cordata* had a fully compatible response; the other species developed only small pustules that produced very limited numbers of teliospores. Thus, based upon greenhouse evaluations, only *M. cordata* might be at risk (Ellison et al., 2008). Ellison and Day (2010) report that *M. cordata* was found to be infected by *P. spegazzinii* in the field in Papua New Guinea. However, neither Guam nor the CNMI are within the distribution of *M. cordata* (PIER, 2007).

In host specificity tests using an isolate of *P. spegazzinii* collected from Trinidad (W1761) were conducted in India on 74 plants in the family Asteraceae and selected crop species (Ellison, 2006a) (appendix 1). In these studies, minor chlorotic spots were observed on *Helianthus annuus* (sunflower) and *Eupatorium cannabinum*, and in most cases, faded and disappeared as the leaves aged (Ellison et al., 2008). These plants occur in the family Asteraceae, the same family to which *Mikania* belongs. Microscopic analysis was undertaken for species that exhibited chlorotic spots, and in all cases, basiospore germination and/or penetration were inhibited by the non-host (Ellison et al., 2008). In host specificity tests conducted in China (Fu et al., 2006) (appendix 1) using 72 plant species in 29 families, chlorotic spots appeared on *Asparagus cochinchinensis*, *Eupatorium adenophorum*, *Elephantopus scaber*, and *Helianthus annuus*. However, no infection was found (Fu et al., 2006). Additional non-target plants were tested prior to release of *P. spegazzinii* (eastern Ecuador, W1960) in Fiji (appendix 2) with no infection of any of these plants (Ellison, 2006b).

2. Impact of *P. spegazzinii* on *M. micrantha*

Ellison and Day (2010) have provided an update regarding releases of *P. spegazzinii*. *Puccinia spegazzinii* failed to establish at one location in India, but successful establishment has been documented in Taiwan, Fiji, and Papua New Guinea. The current status of *P. spegazzinii* in China is unknown (Ellison and Day, 2010). There is evidence that *P. spegazzinii* is beginning to affect populations of *M. micrantha* in Papua New Guinea where it has been released. It establishes best in the wet tropics and does not establish well in drier areas (Ellison and Day, 2010).

Researchers anticipate that *P. spegazzinii* will spread rapidly, and in the

long term, will reduce the growth and fecundity of *M. micrantha* so that it will no longer pose a threat to agriculture or natural forest ecosystems. However, *P. spegazzinii* is not expected to eradicate *M. micrantha* from Guam or the CNMI.

3. Uncertainties Regarding the Environmental Release of *P. spegazzinii*

Once a biological control agent such as *P. spegazzinii* is released into the environment and becomes established, there is a slight possibility that it could move from the target plant (*M. micrantha*) to attack nontarget plants. Host shifts by introduced weed biological control agents to unrelated plants are rare (Pemberton, 2000). Native species that are closely related to the target species are the most likely to be attacked (Louda et al., 2003). If other plant species were to be attacked by *P. spegazzinii*, the resulting effects could be environmental impacts that may not be easily reversed. Biological control agents such as *P. spegazzinii* generally spread without intervention by man. In principle, therefore, release of this biological control agent at even one site must be considered equivalent to release over the entire area in which potential hosts occur, and in which the climate is suitable for reproduction and survival.

In addition, this agent may not be successful in reducing *M. micrantha* populations in Guam and the CNMI. Worldwide, biological weed control programs have had an overall success rate of 33 percent; success rates have been considerably higher for programs in individual countries (Culliney, 2005). Actual impacts on *M. micrantha* by *P. spegazzinii* will not be known until after release occurs and post-release monitoring has been conducted. It is expected that *P. spegazzinii* will reduce *M. micrantha* populations by infecting all aerial parts of *M. micrantha*, causing leaf, petiole, and stem cankering that will lead to the death of the entire plant (Orapa and Pene, undated).

4. Human Health

Puccinia spegazzinii is a pathogen that only infects plants, not humans. It is not expected to pose any risk to humans or other animals.

5. Cumulative Impacts

"Cumulative impacts are defined as the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agencies or person undertakes such other actions" (40 CFR 1508.7).

Several weed biological control programs are occurring on Guam and the CNMI using arthropods, including control of *Chromolaena odorata* (Siamweed) with *Pareuchaetes pseudoinsulata* (Lepidoptera: Arctiidae) and *Cecidochares connexa* (Diptera: Tephritidae); control of *Coccinia grandis* (ivy gourd) with the curculionid weevils *Acythopeus cocciniae* and *Acythopeus burkhartorum*, and *Melittia oedipus* (Lepidoptera: Sessidae); and, control of *Lantana camara* using the lantana leaf beetle *Octotoma scabripennis* (Coleoptera: Chrysomelidae).

Release of *P. spegazzinii* is not expected to have any negative cumulative impacts in Guam or the CNMI because of its host specificity to *M. micrantha*. Effective biological control of *M. micrantha* will have beneficial effects for weed management programs, and may result in a long-term, non-damaging method to assist in the control of of *M. micrantha*. In addition, *Puccinia spegazzinii* is a plant pathogen and will not infect arthropods released for biological control in Guam or the CNMI.

6. Endangered Species Act

Section 7 of the Endangered Species Act (ESA) and ESA's implementing regulations require Federal agencies to ensure that their actions are not likely to jeopardize the continued existence of federally listed threatened and endangered species or result in the destruction or adverse modification of critical habitat.

There are three endangered plants in Guam and the CNMI: Hayun Iagu (*Serianthes nelsonii*) (family Fabaceae), *Nesogenes rotensis* (family Verbenaceae), and *Osmoxylon mariannense* (family Araliaceae). These plants are not in the same family as *M. micrantha* (family Asteraceae) and are not closely related; thus, these plants would not serve as hosts of *P. spegazzinii*. From field observations and host specificity testing, it has been determined that *P. spegazzinii* is specific to species in the genus *Mikania* (Ellison, 2006a, b; Orapa and Pene, undated). There are no *Mikania* species federally listed as threatened or endangered. *Osmoxylon mariannense* is threatened by competition from invasive, nonnative plant species including *M. scandens* (=*M. micrantha*) (FWS, 2007).

No federally listed animal species are known to use *M. micrantha*. *Mikania scandens* (=*M. micrantha*) contributes to the alteration of native forests by overgrowing vegetation, a factor in the decline of threatened and endangered species such as the Mariana fruit bat (*Pteropus mariannus mariannus*) and little Mariana fruit bat (*Pteropus tokudae*) (FWS, 1990).

For these reasons, APHIS has determined that environmental release of *P. spegazzinii* will have no effect, or a potentially beneficial effect, depending on the efficacy of the organism, on threatened and endangered species.

V. Other Issues

Consistent with Executive Order (EO) 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations," APHIS considered the potential for disproportionately high and adverse human health or environmental effects on any minority populations and low-income populations. There are no adverse environmental or human health effects from the field release of *P.*

spegazzinii and it will not have disproportionate adverse effects to any minority or low-income populations.

Consistent with EO 13045, "Protection of Children From Environmental Health Risks and Safety Risks," APHIS considered the potential for disproportionately high and adverse environmental health and safety risks to children. No circumstances that would trigger the need for special environmental reviews are involved in implementing the preferred alternative. Therefore, it is expected that no disproportionate effects on children are anticipated as a consequence of the field release of *P. spegazzinii*.

VI. Agencies, Organizations, and Individuals Consulted

This EA was prepared and reviewed by APHIS. The addresses of participating APHIS units, cooperators, and consultants (as applicable) follow.

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Policy and Program Development
Environmental and Risk Analysis Services
4700 River Road, Unit 149
Riverdale, MD 20737

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
Pest Permitting
4700 River Road, Unit 133
Riverdale, MD 20737

U.S. Department of Agriculture
Agricultural Research Service
Foreign Disease-Weed Science Research Unit
Ft. Detrick, MD 21702

Western Pacific Tropical Research Center
College of Natural and Applied Sciences
University of Guam
Mangilao, GU 96923

VII. References

Cock, M.J.W., Ellison, C.A., Evans, H.C., and Ooi, P.A. 2000. Can failure be turned into success for biological control of mile-a-minute weed (*Mikania micrantha*)? pp. 155-167. *In:* Neal R. Spencer [ed.]. Proceedings of the X International Symposium on Biological Control of Weeds. 4-14 July 1999, Montana State University, Bozeman, Montana.

Culliney, T.W., 2005. Benefits of classical biological control for managing invasive plants. Critical Reviews in Plant Sciences. 24: 131−150.

Ellison, C.A. 2006a. Classical Biological Control of *Mikania micrantha* with *Puccinia spegazzinii*: Implementation Phase R8228 (ZA0539) Final Technical Report. CABI Bioscience, Ascot, UK Centre. 65 pp. Available http://www.dfid.gov.uk/r4d/PDF/Outputs/CropProtection/R8228_FTR.pdf. *last accessed* August 5, 2011.

Ellison, C.A. 2006b. *Puccinia spegazzinii* a biological control agent for the invasive alien weed *Mikania micrantha*: pathotype selection and host specificity testing for Fiji and Papua New Guinea. CABI Bioscience, Ascot, UK Centre. 10 pp.

Ellison C.A., Evans, H. C., Djeddour, D. H., and Thomas, S.E., 2008. Biology and host range of the rust fungus *Puccinia spegazzinii*: A new classical biological control agent for the invasive, alien weed *Mikania micrantha* in Asia. Biological Control. 45: 133–145.

Ellison, C.A., and Day, M. 2010. Current status of releases of *Puccinia spegazzinii* for *Mikania micrantha* control. Biocontrol News and Information. 32(1): 1–2.

Evans, H.C. and Ellison, C.A., 2005. The biology and taxonomy of rust fungi associated with the neotropical vine *Mikania micrantha*, a major invasive weed in Asia. Mycologia. 97: 935–947.

Fu, W.-d., Yang, M.-l., and Ding, J.-q., 2006. Biology and host specificity of *Puccinia spegazzinii*, a potential biocontrol agent for *Mikania micrantha*. Chinese Journal of Biological Control. 22: 67–72.

Holm, L.G., Plucknett, D.L., Pancho, J.V., and Herberger, J.P. 1977. The World's Worst Weeds: Distribution and Biology. University Press of Hawaii, Honolulu, Hawaii.

Holmes, W.C., 1982. Revision of the Old World *Mikania* (Compositae). Botanische Jahres beitraegefuer Systematik. 103: 211–246.

Huang, Z.L., Cao, H.L., Liang, X.D., Ye, W.H., Feng, H.L., and Cai, C.X. 2000. The growth and damaging effect of *Mikania micrantha* in different habitats. Journal of Tropical and Subtropical Botany. 8: 131–138 (in Chinese).

Louda, S.M., Pemberton, R.W., Johnson, M.T., and Follett, P.A., 2003. Nontarget effects−The Achilles' heel of biological control? Retrospective analyses to reduce risk associated with biological control introductions. Annual Review of Entomology. 48: 365–396.

Orapa, W., and S. Pene. Undated. Import Risk Analysis for the Importation of a Biological Control Agent, the Mikana Rust *Puccinia spegazzinii* DeToni (Basidiomycetes: Uredinales) for the Management of Mile-a-minute (*Mikania micrantha*) in the Fiji Islands. Plant Protection Service, Land Resources Division, Secretariat of the Pacific Community, Suva.

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

PIER—see U.S. Forest Service, Pacific Island Ecosystems at Risk.

Reddy, G.V.P. 2011. Survey of invasive plants on Guam and identification of the 20 most widespread. Micronesica. 41: 263–274.

Sankaran, K.V., Muraleedharan, P.K., and Anitha, V. 2001. Integrated Management of the Alien Invasive Weed *Mikania micrantha* in the Western Ghats. Kerala Forestry Research Institute, Peechi, India, 51 pp.

Space, J.C., Waterhouse, B., Denslow, J.S., and Nelson, D. 2000. Invasive Plant Species on Rota, Commonwealth of the Northern Mariana Islands. U.S.D.A. Forest Service, Pacific Southwest Research Station, Institute of Pacific Islands Forestry, Honolulu, Hawai'i, USA. 31 pp. http://sprep.org/att/IRC/eCOPIES/INVASIVE%20SPECIES/CMI_rota.pdf *last accessed* August 5, 2011.

Swamy, P.S., and Ramakrishnan P.S., 1987. Weed potential of *Mikania micrantha* H. B. K., and its control in fallows after shifting agriculture (Jhum) in North-East India. Agriculture, Ecosystems and Environment. 18: 195–204.

U.S. Fish and Wildlife Service. 1990. Guam Mariana Fruit Bat and Little

Mariana Fruit Bat Recovery Plan. Portland, Oregon. 63 pp.

U.S. Fish and Wildlife Service. 2007. Recovery Plan for Two Plants from Rota (*Nesogenes rotensis* and *Osmoxylon mariannense*). Portland, Oregon. 86 pp.

U.S. Forest Service, Pacific Island Ecosystems at Risk. Online resource at http://www.hear.org/pier/ *last accessed* August 3, 2011.

Zhang, L.Y., Ye, W.H., Cao, H.L, and Feng, H.L. 2004. *Mikania micrantha* H.B.K.—an overview. Weed Research. 44: 42−49.

Appendix 1. Test plant list used for host specificity testing of *Puccinia spegazzinii* in India, United Kingdom, and/or China (Ellison, 2006a; Fu et al., 2006; Ellison, 2008)

Scientific Name	Common Name	Family
Ageratum conyzoides	Billy-goat weed, chick weed	Asteraceae (Tribe: Eupatorieae)
Ageratum houstonianum	Floss flower, mist flower	Asteraceae (Tribe: Eupatorieae)
Ageratina riparia	Mist flower	Asteraceae (Tribe: Eupatorieae)
Ageratum F1hybrid "Adriatic"		Asteraceae (Tribe: Eupatorieae)
Chromolaena odorata	Siamweed	Asteraceae (Tribe: Eupatorieae)
Eupatorium adenophorum	Crofton weed	Asteraceae (Tribe: Eupatorieae)
Eupatorium cannabinum	Hemp-agrimony	Asteraceae (Tribe: Eupatorieae)
Eupatorium coelestinum	Mist flower, hardy ageratum	Asteraceae (Tribe: Eupatorieae)
Liatris pycnostachya	Prairie blazing star	Asteraceae (Tribe: Eupatorieae)
Mikania cordata	Heartleaf hempvine	Asteraceae (Tribe: Eupatorieae)
Mikania guaco	Guaco	Asteraceae (Tribe: Eupatorieae)
Mikania vitifolia		Asteraceae (Tribe: Eupatorieae)
Mikania micrantha	Mile-a-minute	Asteraceae (Tribe: Eupatorieae)
Stevia rebaudiana	sweetleaf	Asteraceae (Tribe: Eupatorieae)
Artemisia annua	Sweet sagewort, wormwood	Asteraceae (Tribe: Anthemideae)
Matricaria aurea	Golden chamomile, golden mayweed	Asteraceae (Tribe: Anthemideae)
Chrysanthemum carinatum	Tricolor chrysanthemum	Asteraceae (Tribe: Anthemideae)
Chrysanthemum coronarium	Garland chrysanthemum	Asteraceae (Tribe: Anthemideae)
Dendranthema indicum		Asteraceae (Tribe: Anthemideae)
Tagetes erecta	Mexican marigold	Asteraceae (Tribe: Anthemideae)
Pyrethrum roseum	Painted daisy	Asteraceae (Tribe: Anthemideae)
Aster chinensis.	Chinese aster	Asteraceae (Tribe:Astereae)
Aster alpinus	Alpine aster	Asteraceae (Tribe: Astereae)
Bellis perennis	Daisy	Asteraceae (Tribe: Astereae)
Solidago canadensis	Golden rod	Asteraceae

Appendix 1. Test plant list used for host specificity testing of *Puccinia spegazzinii* in India, United Kingdom, and/or China (Ellison, 2006a; Fu et al., 2006; Ellison, 2008)

		(Tribe: Astereae)
Solidago decurrens	Golden rod	Asteraceae (Tribe: Astereae)
Conyza japonica		Asteraceae (Tribe: Astereae)
Brachycome iberidifolia	Swan River daisy	Asteraceae (Tribe: Astereae)
Erigeron annuus	Eastern daisy fleabane	Asteraceae (Tribe: Astereae)
Lactuca sativa vars. "All the year round" and "Unrivaled"	Lettuce	Asteraceae (Tribe: Lactuceae)
Sonchus arvensis	Field sowthistle	Asteraceae (Tribe: Lactuceae)
Taraxacum officinale	Common dandelion	Asteraceae (Tribe: Lactuceae)
Gerbera jamsoni	Gerbera daisy, Transvaal daisy, Berberton daisy	Asteraceae (Tribe: Mutisieae)
Calendula officinalis	Calendula	Asteraceae (Tribe: Calenduleae)
Dimorphotheca sinuata	Cape marigold	Asteraceae (Tribe: Calenduleae)
Arctotis spp. var. Harlequin"	African daisy	Asteraceae (Tribe: Arctotideae)
Gazania spp.	Treasure flower	Asteraceae (Tribe: Arctotideae)
Gazania rigens		Asteraceae (Tribe: Arctotideae)
Carthamus tinctorus var. "goldtuft"	Safflower	Asteraceae (Tribe: Cynareae)
Cyanara cardunculus	Globe artichoke	Asteraceae (Tribe: Cynareae)
Centaurea cyanus	Cornflower, bachelor's button	Asteraceae (Tribe: Cynareae)
Stokesia laevis	Stokes aster, cornflower aster	Asteraceae (Tribe: Vernonieae)
Elephantopus scaber		Asteraceae (Tribe: Vernonieae)
Elephantopus tomentosus	Devil's grandmother	Asteraceae (Tribe: Vernonieae)
Vernonia cinerea	Little ironwed, Ash colored fleabane	Asteraceae (Tribe: Vernonieae)
Vernonia noveboracensis	New York ironweed	Asteraceae (Tribe: Vernonieae)
Vernonia anthelmintica	ironweed	Asteraceae (Tribe: Vernonieae)
Senecio cruentus	cineraria	Asteraceae (Tribe: Senecioneae)
Senecio cineraria var. silverdust	Dusty miller	Asteraceae (Tribe: Senecioneae)
Senecio scandens		Asteraceae (Tribe: Senecioneae)
Helianthus annuus vars. AHT-16, AHT-17, IH-673, IH-662, CO-2,	Sunflower	Asteraceae (Tribe: Heliantheae)

Appendix 1. Test plant list used for host specificity testing of *Puccinia spegazzinii* in India, United Kingdom, and/or China (Ellison, 2006a; Fu et al., 2006; Ellison, 2008)

Morden, Swarna hybrid, CO-4, and TCSH-1		
Parthenium hysterophorus	Santa Maria feverfew, Congress weed	Asteraceae (Tribe: Heliantheae)
Dahlia pinnata	Pinnate dahlia	Asteraceae (Tribe: Heliantheae)
Rudbeckia laciniata	Cutleaf coneflower	Asteraceae (Tribe: Heliantheae)
Rudbeckia hirta	Blackeyed Susan	Asteraceae (Tribe: Heliantheae)
Galinsoga parviflora	Gallant soldier	Asteraceae (Tribe: Heliantheae)
Wedelia trilobata	Creeping oxeye	Asteraceae (Tribe: Heliantheae)
Cosmos bipinnatus	Cosmos	Asteraceae (Tribe: Heliantheae)
Guizotia abyssinica	Niger-seed, rantil	Asteraceae (Tribe: Heliantheae)
Tithonia diversifolia	Mexican sunflower, tree marigold	Asteraceae (Tribe: Heliantheae)
Inula ensifolia	Swordleaf inula	Asteraceae (Tribe: Inuleae)
Tagetes erecta	Big marigold, Aztec marigold	Asteraceae (Tribe: Helenieae)
Tagetes tenuifolia	Striped marigold	Asteraceae (Tribe: Helenieae)
Amaranthus retroflexus	Redroot pigweed	Amaranthaceae
Amaranthus lividus		Amaranthaceae
Celosia cristata	Cockscomb	Amaranthaceae
Mangifera indica	Mango	Anacardiaceae
Anacardium occidentale	Cashew	Anacardiaceae
Alocasia macrorrhiza	Upright elephant ears	Araceae
Epipremnum aureum	Pothos, devil's ivy	Araceae
Cocos nucifera	Coconut	Arecaceae
Areca catechu	Betel-nut palm, arecanut	Arecaceae
Trachycarpus fortunei	Windmill palm	Arecaceae
Chamaedorea elegans	Bamboo palm, parlor palm	Arecaceae
Caryota ochlandra	Chinese fishtail palm	Arecaceae
Elaeis olifera	Oil palm	Arecaceae
Bambusa arundinacea	Thorny bamboo, spiny bamboo	Bambusaceae
Brassica nigra	Black mustard	Brassicaceae
Brassica juncea	Mustard	Brassicaceae
Brassica oleracea	Wild cabbage	Brassicaceae
Brassica campestris	Field mustard	Brassicaceae
Coronopus didymus	Lesser swinecress	Brassicaceae
Matthiola incana	Tenweeks stock, gilli flower	Brassicaceae
Raphanus sativus	Radish	Brassicaceae
Ananas comosus	Pineapple	Bromeliaceae
Lobelia erinus	Garden lobelia, trailing lobelia	Campanulaceae
Dianthus sp.	Dianthus	Caryophyllaceae
Ipomoea batatas	Sweet potato	Convolulaceae
Cucumis sativus	Cucumber	Cucurbitaceae

Appendix 1. Test plant list used for host specificity testing of *Puccinia spegazzinii* in India, United Kingdom, and/or China (Ellison, 2006a; Fu et al., 2006; Ellison, 2008)

Cucumis melo	Cantaloupe	Cucurbitaceae
Dioscorea bulbifera	Potato yam	Dioscoreaceae
Ricinus communis	Castor	Euphorbiaceae
Hevea brasiliensis	rubber	Euphorbiaceae
Manihot esculentus	Cassava	Euphorbiaceae
Vigna unguiculata	Cow pea	Fabaceae
Acacia confusa	Small Philippine acacia	Fabaceae
Cajanus cajan	Pigeon pea	Fabaceae
Cicer arietinum	Chick pea	Fabaceae
Glycine max	Soybean	Fabaceae
Pueraria lobata	Kudzu vine	Fabaceae
Pueraria thomsonii	Kudzu vine	Fabaceae
Lens esculenta	Lentil	Fabaceae
Phaseolus aureus	Mung bean	Fabaceae
Phaseolus vulgaris	Common bean	Fabaceae
Pisum sativum	pea	Fabaceae
Iris tectorum	Japanese roof iris	Iridaceae
Coleus scutellarioides	Common coleus	Lamiaceae
Cinnamomum zeylanicum	Cinnamon	Lauraceae
Allium tuberosum	Garlic chives	Liliaceae
Rohdea japonica	Sacred lily	Liliaceae
Chlorophytum comosum	Spider plant	Liliaceae
Asparagus cochinchinensis	Chinese asparagus	Liliaceae
Linum usitatissimum	Linseed, flax	Linaceae
Gossypium hirsutum	Upland cotton	Malvaceae
Gossypium aboreum	Desi cotton	Malvaceae
Artocarpus heterophyllus	Jack tree, Jack fruit	Moraceae
Musa paradisiaca	Banana	Musaceae
Musa coccinea	Red torch banana	Musaceae
Myristica fragrans	Nutmeg	Myristicaceae
Syzygium aromaticum	Clove	Myrtaceae
Eucalyptus bridgesiana		Myrtaceae
Eucalyptus cypellocarpa	Mountain gray gum	Myrtaceae
Syzygium jambos	Malabar plum	Myrtaceae
Cymbidium goeringii	Noble orchid	Orchidaceae
Averrhoa carambola	Carambola, starfruit	Oxalidaceae
Arachis hypogaea	Peanut	Papilioaceae
Sesamum indicum	Sesame	Pedaliaceae
Piper betle	Betel-pepper, betel vine	Piperaceae
Piper nigrum	Black pepper	Piperaceae
Plantago depressa	Asian plantain	Plantaginaceae
Ochlandra travancorica	Elephant grass, reed	Poaceae
Oryza sativa	Paddy rice	Poaceae
Pennisetum typhoides	Pearl millet	Poaceae
Tritcum aestivum	Wheat	Poaceae
Sorghum vulgare	Sorghum	Poaceae
Sorgum bicolor	Sorghum	Poaceae
Saccharum officinarum	Sugarcane	Poaceae
Zea mays	Maize, corn	Poaceae e
Phlox drummondii	Drummond phlox, annual phlox	Polemoniaceae
Rumex patientia	Patience dock	Polygonaceae
Polygonum perfoliatum	Mile-a-minute vine	Polygonaceae

Appendix 1. Test plant list used for host specificity testing of *Puccinia spegazzinii* in India, United Kingdom, and/or China (Ellison, 2006a; Fu et al., 2006; Ellison, 2008)

Polygonum coriaceum		Polygonaceae
Malus spectabilis	Asiatic apple	Rosaceae
Coffea arabica	Arabian coffee	Rubiaceae
Citrus grandis	pomelo	Rutaceae
Citrus deliciosa	Italian tangerine	Rutaceae
Litchi chinensis	lychee	Sapindaceae
Dimocarpus longan	longan	Sapindaceae
Antirrhinum majus	Snapdragon	Scrophulariaceae
Linaria bipartite	Toad flax	Scrophulariaceae
Alianthus altissima	Tree-of-heaven	Simaroubaceae
Capsicum annuum	Chili, red pepper	Solanaceae
Nicotiana tabacum	Tobacco	Solanaceae
Solanum melongena	Brinjal	Solanaceae
Petunia hybrida	Petunia	Solanaceae
Lycopersicon esculentum	Tomato	Solanaceae
Theobroma cacao	Cocoa, cacao	Sterculiaceae
Camellia sinensis	Tea	Theaceae
Schima crenata		Theaceae
Corchorus capsularis	Jute, white jute	Tiliaceae
Tropaeolum majus	Garden nasturtium	Tropaeolaceae
Tectona grandis	Teak	Verbenaceae
Viola tricolor	Pansy	Violaceae
Zingiber officinale	Ginger	Zingiberaceae
Eanslettaria cardamomum	Cardamom	Zingiberaceae

Appendix 2. List of the test plant species from Fiji that were screened with the rust *Puccinia spegazzinii* (eastern Ecuador, W1960) to confirm its specificity to *Mikania* (From: Ellison, 2006b).

Scientific name	Common name	Classification* Subclass (Sc): Order (O): Family (F): Tribe (T):	Importance	Source / place of collection	[1]Reaction to Rust Inoculation
Zinnia	Zinnia	Sc: Asteridae Order: Asterales F: Asteraceae T: Heliantheae	Ornamental	UK (seed)	0
Bidens pilosa L.	Cobblers pegs	Sc: Asteridae Order: Asterales F: Asteraceae T: Heliantheae	Weed	Fiji (seed)	0
Morinda citrofolia L.	Noni, Nonu, (Indian mulberry)	Sc: Asteridae O: Rubiales F: Rubiaceae	Medicinal plant (source of dye)	Fiji (plants)	0
Anisomeles indica (L.) Kuntze	-	Sc Asteridae O:Lamiales F: Labiatae (Laminaceae)	Medicinal plant (eaten in sago cakes in Malaysia, important for bees)	Fiji (cuttings)	0
Hyptis pectinata	Ben Tulsi	Sc Asteridae O:Lamiales F: Labiatae (Laminaceae)	Medicinal weed	Fiji (cuttings)	0
Plectranthus (=*Solenostemon*) *scutellarioides* (L.) R. Br.	Coleus (E) Lata (F)	Sc Asteridae O:Lamiales F Labiatae (Laminaceae)	Garden ornamental	Fiji (cuttings)	0
Piper methysticum Foster f.	Kava, yagona	Sc Magnoliidae O: Piperales F: Piperaceae	Roots, source of narcotic sedative drink. Export crop.	Fiji (1 cutting survived)	0
Colocasia esculanta (L.) Schott	Taro, d(k?)alo	(Monocotyleonae) Sc: Arecidae O: Arales F: Araceae	Tubers food source. Export root crop	Fiji (plants)	0
Hippobroma longiflora (L.) G. Don f.	Star of Bethlehem	Sc: Asteridae O: Asterales F: Campanulaceae	Alien species, with invasive potential. Toxic latex.	Fiji (seed)	0
Scaevola sericea Vahl.	Beach naupaka, sea lettuce tree	Sc: Asteridae O: Asterales F: Goodeniaceae	Native to Pacific. Seeds survive in sea water –germinate in fresh water	Dueba, Fiji (seed)	0
Psidium guajava L.	Common guava	Sc: Rosidae Order Myrtales F: Myrtaceae	Cultivated for fruit, can be invasive	Fiji (seed)	0

* All Dicotyleonae unless otherwise stated. Based on Conquist's System of Classification

Decision and Finding of No Significant Impact
for
Field Release of *Puccinia spegazzinii* for Biological Control of *Mikania micrantha* in Guam and the Commonwealth of the Northern Mariana Islands
October 2011

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ) Pest Permitting Branch (PPB), is proposing to issue permits for release of a plant pathogenic fungus, *Puccinia spegazzinii* De Toni (Basidiomycetes: Uredinales). The agent would be used for the biological control of *Mikania micrantha* (mile-a-minute, bittervine) in Guam and the Commonwealth of the Northern Mariana Islands (CNMI). Before permits are issued for release of *P. spegazzinii*, APHIS must analyze the potential impacts of the release of this organism into Guam and the CNMI in accordance with USDA APHIS National Environmental Policy Act implementing regulations (7 Code of Federal Regulations Part 372). APHIS has prepared an environmental assessment (EA) that analyzes the potential environmental consequences of this action. The EA is available from:

U.S. Department of Agriculture
Animal and Plant Health inspection Service
Plant Protection and Quarantine
Registrations, Identification, Permits, and Plant Safeguarding
4700 River Road, Unit 133
Riverdale, MD 20737
http://www.aphis.usda.gov/plant_health/ea/index.shtml

The EA analyzed the following two alternatives in response to a request for permits authorizing environmental release of *P. spegazzinii*: (1) no action, and (2) issue permits for the release of *P. spegazzinii* for biological control of *M. micrantha*. A third alternative, to issue permits with special provisions or requirements concerning release procedures or mitigating measures, was considered. However, this alternative was dismissed because no issues were raised that indicated that special provisions or requirements were necessary. The No Action alternative, as described in the EA, would likely result in the continued use at the current level of chemical and mechanical control methods for the management of *M. micrantha*. These control methods described are not alternatives for decisions to be made by the PPB, but are presently being used to control *M. micrantha* in Guam and the CNMI and may continue regardless of permit issuance for field release of *P. spegazzinii*. Legal notice of the EA was made available in the Marianas Variety in Guam and Saipan and the Pacific Daily News for a 30-day public comment period that ended on October 10, 2011. One comment was received on the EA regarding concerns about the need for specificity testing of *P. spegazzinii* on plants that occur on Guam. The permit applicant in Guam responded directly to the commentor and clarified the host specificity testing process, explaining that even if not specifically tested, plants distantly related to the target weed (*M. micrantha*) would be at little risk of attack by *P. spegazzinii*. In addition, the permit applicant continues to involve the commentor in the research and potential release of *P. spegazzinii*.

I have decided to authorize the PPB to issue permits for the environmental release of *P. spegazzinii.* The reasons for my decision are:

- This biological control agent is sufficiently host specific and poses little, if any, threat to the biological resources, including non-target insect species of Guam and the CNMI.
- The release will have no effect on federally listed threatened and endangered species or their habitats in Guam and the CNMI.
- *P. spegazzinii* poses no threat to the health of humans.
- No negative cumulative impacts are expected from release of *P. spegazzinii.*
- There are no disproportionate adverse effects to minorities, low-income populations, or children in accordance with Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations" and Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks."
- While there is not total assurance that the release of *P. spegazzinii* into the environment will be reversible, there is no evidence that this organism will cause any adverse environmental effects.

I have determined that there would be no significant impact to the human environment from the implementation of the preferred alternative (issuance of permits for the release of *P. spegazzinii*) and, therefore, no Environmental Impact Statement needs to be prepared.

for Mary E Pak

Dr. Michael J. Firko
Director
Registrations, Identification, Permits, and Plant Safeguarding
Plant Health Programs
APHIS, Plant Protection and Quarantine

10/24/11

Date