CROP PROTECTION PROGRAMME

Promotion of Weed Biocontrol in Asia: the *Mikania micrantha* Experience

R8502 (ZA0705)

FINAL TECHNICAL REPORT

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Project Leader: Dr. Carol A. Ellison

CABI Bioscience (A Division of CAB International)

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R8502 Crop Protection Programme

Executive Summary

Mikania micrantha H.B. K. (Asteraceae), or mile-a-minute weed, is a neotropical invasive plant in many countries within the tropical moist forest zones of Southeast Asia. This perennial vine can smother agro-forestry and natural forest ecosystems, as well as many crops within homegarden and plantation production systems. Under the CPP *Mikania* programme (Projects R6735 / ZA0026 and R8228 / ZA0539), classical biological control (CBC) had been implemented against this weed in Assam and Kerala in India. The purpose of this short project was to enhance and increase the dissemination outputs from the programme by the production of user-friendly publications and an awareness raising media production with a regional perspective.

The main outputs of the project are given below:

1. *Policy Level Support*. Production of a book; 'Invasive Alien Plants in Asia: Problems and Solutions': This book is written in popular scientific language, to enable wide non-specialists interest and aimed at policy makers and appropriate institutions in the target countries (India, Nepal, Indonesia, Fiji, Malaysia, and China). The focus is on *Mikania* and the lessons learned during the implementation of *Mikania* project in India.

2. *Guidance for Researchers and Extension Services*. Production of a Training Manual; 'Best management practices for *Mikania micrantha*'. It contains information on cultural, biological and chemical control methods for *Mikania* and other serious invasive alien weeds in the region. The manual is aimed at agricultural extension workers, forestry and plantation managers, and conservationists. It is produced in English and the Kerala local language of Malayan.

3. *Awareness Raising*. Video programme on invasive alien weeds and their control for National TV broadcast and for use by extension services. The programme focuses on creating awareness in the farming communities of the problems posed by invasive alien weeds.

Classical biological control (through the introduction of exotic fungal pathogens) is a self-perpetuating and thus long-term and sustainable management option for the *Mikania* problem in Asia. This technology is appropriate for resource poor farmers, since it require no financial or time inputs from them in order to be implemented. The short project has supported this approach to the management of invasive alien plant species by providing user targeted information at three levels:

- Increasing awareness at the government policy level, on the impact of invasive alien species;
- Providing a manual to aid people working in the field with farmers and forestry workers to understand and implement the best management techniques in the short term, and understand the principles of CBC as a long-term management option;
- Raising of public awareness by the broadcast of the information film, supporting and explaining at the appropriate level, CBC technologies.

CONTENTS

ACRONYMS

AAU – Assam Agricultural University

AVCRC - Audiovisual Research Centre, University of Calicut.

BIOTROP - The Southeast Asian Regional Centre for Tropical Biology.

CBC – Classical biological control

KFRI – Kerala Forest Research Institute

NBPGR – National Bureau of Plant Genetic Resources

SEAMEO - Southeast Asian Ministers of Education Organization

PROJECT STAFF* AND CONTRIBUTING AUTHORS

Dr. V. Anitha (Socio-economist),
Forestry and Human Dimensions Programme Division,
Kerala Forest Research Institute,
Peechi – 680 653, Kerala, India.

Dr. Hem Saggar Barral (Chief Executive. Bird Conservation),
Bird Conservation Nepal,
PO Box 12465, Lazimpat, Kathmandu, Nepal.

Mr. R. P. Bhuyan (Associate Professor, Weed Scientist)
Dept. of Tea Husbandry & Technology,
AAU, Jorhat, India.

*Dr. Carol A. Ellison (Principal Scientist, Plant Pathology and Weed Biocontrol)
Invasive Species Management, CABI Bioscience UK Centre (Ascot),
Silwood Park, Ascot, Berks., SL5 7TA, UK.

Dr. Ding Jianqing (Entomologist and Biocontrol)
Inst. of Agro-Environment and Sustainable Development,
Chinese Academy of Agricultural Sciences,
12 Zhongguancun Nandajie,
Beijing, 100081, P. R. China

Dr. R.K. Khetarpal (Quarantine and Genetics)
National Bureau for Plant Genetic Resources,
Pusa Campus,
New Delhi, 110 012, India

*Dr. Sean T. Murphy (Research Group Leader, Ecology and Weed Biocontrol),
Invasive Species Management, CABI Bioscience UK Centre (Ascot),
Silwood Park, Ascot, Berks., SL5 7TA, UK.

Mr. Warea Orapa (Weed Scientist)
Secretariat of the Pacific Community,
PMB Suva, Fiji.

Prof. Jebomani Rabindra (Director, Insect Biocontrol)
Project Directorate of Biological Control,
P.B. No. 2491, H.A. Farm Post,
Bellary Road, Hebbal,
Bangalore 560024. India

Prof. P.S. Ramakrishnan (Senior Professor, Traditional Ecological Knowledge)
School of Environmental Sciences, Jawaharlal Nehru University,
New Delhi 110067, India

*Dr. K.V. Sankaran (Senior Pathologist and Weed Scientist)
Division of Pathology,
Kerala Forest Research Institute,
Peechi – 680 653, Kerala, India.

Dr. K.V. Santheep (Socio-economist),

Forestry and Human Dimensions Programme Division,
Kerala Forest Research Institute,
Peechi – 680 653, Kerala, India.

Dr. Soetikno S. Sastroutomo (Biocontrol, Farmer Participatory Training & Information Technology)
CAB International Southeast Asia Regional Centre,
P.O. Box 210, 43400 UPM Serdang,
Selangor, Malaysia

Dr. Soekisman Tjitrosemito (Weed Scientist)
SEAMEO-BIOTROP,
Bogor, Indonesia

Background

Mikania micrantha (Asteraceae), or mile-a-minute weed, is a major invasive alien weed in many regions throughout Asia, and is still invading new areas. It affects agricultural ecosystems, native vegetation and agroforestry. Under the CPP a two Phase project was funded to investigate control options for this weed: R6735 / ZA0026 (Phase 1) and R8228 / ZA0539 (Phase II). The key findings of the research have been:

- the development of impact assessment methodology and a sampling survey scheme for *Mikania* in two regions of India (Kerala and Assam);
- the development and implementation of a classical biological control (CBC) strategy for this weed using a selected pathotype of the neotropical, co-evolved rust pathogen, *Puccinia spegazzinii*.

Capacity building and promotion have been key components of the project, and this has included the training of scientists in the UK, in-country workshops, the production of a DVD about invasive weeds, press releases, radio and TV items and a number of scientific and popular publications. During the project CABI Bioscience and collaborating Indian Institutions, had requests from many countries within the Asian Pacific Region for information concerning the sustainable management of invasive alien weeds in the short and long-term, and particularly the biological control of *Mikania.* Information relating to the political, economic, social and scientific processes involved in the implementation of CBC using pathogens, was not available in a format aimed at the non-CBC specialist working in agricultural and environmental focused departments of government. In addition, there was no comprehensive publication available, aimed at the foresters and farmers, on best management practices for invasive plants in the short-term, in a user-friendly format in Kerala and probably most of the target countries in the region. Finally, the need for public' buy-in' to CBC, provoked the idea of producing an educational information video for TV broadcast and extension service use, on the concepts behind this technology.

Note: The start of this project was delayed for 2 months, due to the necessity to redraft the Project Memorandum Form, just after the work was funded. The original Short Project, which involved CBC of *Mikania* awareness raising in Nepal, could not be implemented, due to the February 2005 coup in Kathmandu.

Project Purpose

The overall purpose of the *Mikania* Programme, based on the CPP purpose is:

> 'Implementation of a classical biological control strategy using a rust fungus (*Puccinia spegazzinii*) for the invasive alien, perennial weed *Mikania micrantha,* in tree crop, ago-forestry and small-holder farming systems in the moist tropical regions of southwest and northeast India.'

The aim of this short project is to enhance and increase the dissemination outputs from the *Mikania* Programme, by the production of user-friendly publications and an awareness raising media production, for key sectors within the Pacific Asia Region. These outputs will be contributed to by nationals from the target countries (India, Nepal, Indonesia, Fiji, Malaysia, and China), and will be available regionally to appropriate government and research organisations, and extension services, free of charge: all who will benefit from these activities. The need for these types of products was identified through many requests, from stakeholders in the region invaded by *Mikania*, for information on implementation of a CBC strategy for invasive alien weeds.

Activities and Outputs

1. Policy level support:

1.1 Commissioning of book chapters: The authors for the book were chosen from known CABI collaborators working in the field of invasive plant impact, monitoring and control, within the tropical Asia and Pacific region: focussing on those with experience of *Mikania*. The book aims to increase awareness at the government policy level on the impact of invasive alien species, which will: a) help focus government support for the development of appropriate techniques for their management; b) aid the development of government policies that enable these technologies to be implemented.

First drafts of (almost) all the Chapters were received within the time frame of the project. Details of the book are given below:

Invasive Alien Plants in Asia: Problems and Solutions

Edited by ST Murphy, CA Ellison, PS Ramnakrishnan and R Murphy

Preface I: *Dr. Monkombu S Swaminathan*
Preface II: *Dr. Frances Kimmins (NRInt')*

Section I: Introduction

CHAPTER 1. Invasive alien plants as a developmental constraint: some regional perspectives. *Dr. Sean T. Murphy (CABI Bioscience, Ascot, UK)*

CHAPTER 2. What makes a plant invasive? *Mikania micrantha* as a case study*. Prof. PS Ramnakrishnan (Jawaharlal Nehru University, New Delhi) and Dr. Sean T. Murphy*

Section II: Socioeconomic impact of invasive alien plants

CHAPTER 2. Social and economic implications of *Mikania micrantha* in the Kerala Western Ghats: smallholder perspective. *Dr. V. Anitha (Division of Economics, Kerala Forestry Research Institute)*

CHAPTER 3. *Mikania micrantha* in plantation crop: problems and management. *Dr. S. Soetikno (CABI Malaysia) and Dr. T. Sokisman (BIOTROP)*

CHAPTER 4. Impact of invasive alien plants on wildlife conservation. *Dr. Hem Sagar Baral (Bird Conservation Nepal) and Dr. Buyan (Assam Agricultural University)*

CHAPTER 5. Impact of invasive alien plants on Pacific island communities. *Dr. Warea Orapa (Secretariat of the Pacific Community, Suva, Fiji)*

Section III: Challenges and solutions for control

CHAPTER 6. Understanding the impact of invasive *Mikania micrantha* and its management through traditional ecological knowledge *Prof. PS Ramnakrishnan.*

CHAPTER 7. Preventing invasive alien plants: is the framework in place? *Dr. Ravi Khetarpal (National Bureau of Plant Genetic Resources, New Delhi)*

CHAPTER 8. Control options for invasive alien plants in agroforestry. *Dr. KV Sankaran (Kerala Forest Research Institute)*

CHAPTER 9. Natural control: the sustainable solution. *Dr. Carol A. Ellison (CABI Bioscience, Ascot, UK)* and *Dr. Matthew Cock (CABI Bioscience, Delémont, Switzerland)*

CHAPTER 10. Policy frameworks for the implementation of a classical biological control strategy: the Indian experience. *Prof. Jebomani Rabindra (Project Directorate of Biological Control, Bangalore)*

CHAPTER 11. Policy frameworks for the implementation of a classical biological control strategy: the Chinese experience. *Dr. Ding Jianqing* (*Inst. of Agro-Environment and Sustainable Development, Chinese Academy of Agricultural Sciences)*

Section IV: Conclusions

CHAPTER 12. Drawing on the collective experience for future country responses to the threat from invasive alien plants. *Dr. Sean Murphy, Prof. Jebomani Rabindra, Dr. Carol Ellison, Dr. Ding Jianqing.*

1.2 Editing of manuscripts. Within the time frame of this short project, the editing of the first drafts of all the received manuscripts have been completed by CABI personnel, and most have now been returned to the authors for their approval.

During the consultancy visit to KFRI (see 2, below) and the linked visits to AAU (workshop) and NBPGR (project meeting), the progress of the production of the chapters for the book were discussed with Sankaran, Buyan, Kheterpal and Rabindra.

1.3 Publication and distribution of book. As anticipate, delays in the original start date of the project (see background, above), has meant that the book was not published within the frame of the short project, but excellent progress has been made towards this end. It is expected that the book will have gone to press within the time frame of the CPP.

2. Guidance for researchers and extension Services:

2.1 CABI consultancy to KFRI to discuss the production of the manual and collect images. S. T. Murphy and C.A. Ellison visited KFRI in November 2005 (linked with the Workshops under R8228) to discuss the contents of the manual and video. Images were taken of weed invasions in Kerala and Assam for illustrations in the book and manual. The manual is simply written with lots of images and easy to follow procedures. It includes information on the major invasive alien species in Kerala (which are common to most of the target regions): *M. micrantha, Mimosa spp., Parthenium hysterophous, Chromolaena ordorata* and *Lantana camara.* Best short-term control measures (eg herbicides and cultural control) are clearly provided, and the concepts and potential for CBC for each species given.

2.2 Production, publishing and distribution of manual: S.T. Murphy will visit KFRI again in February 2006 to finalise the manual, and return with a mock-up for C.A. Ellison to edit before being translated in the Kerala local language of Malayan, and then going to print in both languages. It is fully expected that the manual will be ready for distribution within the time frame of the CPP.

3. Awareness raising:

3.1 CABI consultancy to KFRI to discuss and advise on production of video. (see 2.1). KFRI have lead on the production of this video, following on from their previous production; 'Weeds, The Biological Invaders, Part 1', produced by the Audiovisual Research Centre (AVCRC), University of Calicut, in collaboration with KFRI. K.V. Sankaran has travelled around Kerala with the AVCRC Production Team, getting footage for the video, a rough cut of which is now ready. The video includes interviews with farmers on their experiences and introduces the concepts of different management options including biological control. It is being translated into local languages, for used by extension workers.

3.2 Production of copies of video. During the February 2006 visit (see 2.2) to KFRI, S.T. Murphy will also view and advise on the editing of the rough cut of the video.

Dissemination

Murphy, ST, CA Ellison, PS Ramnakrishnan and R Murphy (eds.) 2006. Invasive Alien Plants in Asia: Problems and Solutions. (In preparation, draft chapters in various stages of completion, draft of almost all currently available.)

Sankaran, KV and CA Ellison 2006. Invasive Alien Weeds: Best Management Practices. (In preparation, draft available)

Weeds, The biological Invaders, Part II 2006. Video film produced by the Audiovisual Research Centre (AVCRC), University of Calicut, in collaboration with KFRI. (In preparation, first cut available)

Contribution of Outputs to developmental impact

The overall contribution of the *Mikania* CBC programme (through the introduction of the rust fungus) is the provision of a self-perpetuating and thus long-term and sustainable management option for the *Mikania* problem in India (and all affected region in Asia). This technology is appropriate for resource poor farmers, since it require no financial or time inputs from them in order to be implemented.

The specific contribution of the outputs from this short project are given below:

- The project has successfully drawn together a regional knowledge base into an accessible book publication, of value to policy makers, who influence the implementation of sustainable management approaches, to the control of invasive alien plant species. The work has drawn together much previously unpublished country experience within the Asia Pacific Region on invasive alien weed issues and management, providing a valuable reference to build future actions.
- The best practices manual has drawn together a disparate set of information on weed control specifically aimed at invasive alien species, into a user-friendly publication.
- The video will be a novel tool for use in providing information to the general public, and raising awareness of issues and solutions concerning invasive alien weed management.
- The collaborating institution of KFRI has benefited from developing and having access to targeted information for farmers and foresters and extension services on invasive alien plant management.

All contributors to the project are committed to achieving the outputs within the timeframe of the CPP, and hence to achieve the developmental benefits of providing the target audience with the publications and video.

The book will be widely distributed free of charge to relevant government departments (quarantine and agriculture) and research organisations in India, Nepal, Malaysia, Indonesia, China and Fiji (countries of contributing authors).

The manual will initially be used in Kerala and then other English-speaking countries in the region. It can also be translated into other languages, which will enable it to have a wider regional impact. Although this will require additional financial support, the investment should not be considered excessive for the potential stakeholders. The template in English will be provided (free of charge) to all those who have contacted project collaborators concerning invasive alien plant management.

The video will initially target India, but regional use is anticipated, with local language translation.

Biometricians Signature

The projects named biometrician must sign off the Final Technical Report before it is submitted to CPP. This can either be done by the projects named biometrician signing in the space provided below, or by a letter or email from the named biometrician accompanying the Final Technical Report submitted to CPP. (Please note that NR International reserves the right to retain the final quarter's payment pending NR International's receipt and approval of the Final Technical Report, duly signed by the project's biometrician)

I confirm that the biometric issues have been adequately addressed in the Final Technical Report:

Signature:

Name (typed): DR S T MURPHY
Position: Research Group Leader, Invasive Species Management, CABI Bioscience, UK Centre
Date: 30th January 2006