

## BOOK REVIEW

MUNIAPPAN R., REDDY G.V.P. & RAMAN A.: BIOLOGICAL CONTROL OF TROPICAL WEEDS USING ARTHROPODS. Cambridge University Press, Cambridge, New York, Melbourne, Madrid, Cape Town, Singapore, São Paulo, Delhi, 2009, 495 pp. ISBN 978-0-521-87791-6. Price: GBP 75.00.

Weeds are a major constraint of agricultural production, particularly in the developing world. Cost-efficient biological control is a self-sustaining way of reducing the abundance of weeds and has fewer non-target effects than chemical methods, which can cause serious damage to the environment. The aim of this book is to consolidate and present the past and current research and implementation in the biological control of tropical weeds. Alien plants cause serious economic losses by competing for natural resources, reducing yield and quality of various products, endangering native vegetation, and have other negative effects on agriculture and the economy.

Three outstanding researchers, R. Muniappan, the Program Director of the Integrated Pest Management Collaborative Research Program at the Office of International Research, Education and Development, Virginia Polytechnic Institute and State University, USA; G. Reddy, entomologist at the Agricultural Experiment Station, University of Guam, USA and A. Raman, senior lecturer in Ecological Agriculture at the Charles Sturt University, Orange, New South Wales and the E.H. Graham Centre for Agricultural Innovation, Orange, New South Wales, Australia, have combined their experience of biological weed control in the tropics and called on thirty five researchers from different countries to write chapters on various kinds of invasive weeds and the options of controlling them using various arthropods in different parts of the tropics.

This book is divided into 24 chapters. Four of them are devoted to general problems of biological control of weeds in the tropics and twenty to individual invasive weed plants currently causing serious problems in tropical and subtropical parts of the world. The first chapter is devoted to the biological control of weeds in the tropics and the problem of sustainability. It includes short descriptions of management strategies, biological control, technology transfer and economics of biological control of weeds. Three chapters at the end of the book provide overviews of activities pertaining to the biological control of tropical weeds in India, the important role of the International Institute of Tropical Agriculture in the biological control of weeds and the role of the Secretariat of the Pacific Community in the biological control of weeds in the Pacific Islands.

Further chapters deal with biological, ecological and economic management of twenty invasive weeds, of which nineteen have been introduced mainly from South America to other parts of the tropical world, causing serious ecological damage to the local environment and economic problems for the people. Only parasitic herbs of the genus *Striga* are of Euro-Asian origin. Sustainable biological control of each weed species using one or more arthropods is discussed. The aim is to provide ecological management models for use across the tropical world and assist in the assessment of potential risks to native and economic plant species. This is a valuable resource for scientists and policy makers concerned with the biological control of invasive tropical plants.

There is a chapter devoted to each of the following weed species and their arthropods: *Acacia nilotica* ssp. *indica*, Australian *Acacia* species (Mimosaceae) in South Africa, *Ageratina adenophora* (Asteraceae), *Azolla filiculoides* (Azollaceae), *Cabomba caroliniana* (Cabombaceae), invasive *Cactus* species (Cactaceae), *Chromolaena odorata* (Asteraceae), *Clidemia hirta* (Melastomataceae), *Coccinia grandis* (Cucurbitaceae), *Eichhornia crassipes* (Pontederiaceae), *Lantana camara* (Verbenaceae), *Mimosa diplotricha* and *Mimosa pigra* (Mimosaceae), *Parthenium hysterophorus* (Asteraceae), *Passiflora mollissima* (Passifloraceae), *Pistia stratiotes* (Araceae), *Prosopis* species (Leguminosae), *Salvinia molesta* (Salviniaceae), *Solanum mauritianum* (Solanaceae) and *Striga* (Orbanchaceae).

All of these species are weeds that have either already invaded or have the potential to invade tropical countries.

Sixteen of them have been introduced from America into tropical and subtropical parts of Africa and Asia, one each from Australia into Africa, from Asia into Australia and from Africa into the Pacific. Of twenty weed species, fifteen are terrestrial and five aquatic (*Azolla filiculoides*, *Cabomba caroliniana*, *Eichhornia crassipes*, *Pistia stratiotes* and *Salvinia molesta*). The weeds considered include the following life forms: trees, shrubs, vines and herbaceous plants. Their habitats vary from arid tropical (*Parthenium hysterophorus*, *Cactus* spp., *Acacia*, *Striga*) to humid tropical (*Chromolaena odorata*, *Clidemia hirta*, *Coccinia grandis*, *Mimosa diplotricha*, *M. pigra*). *Lantana camara* is a cosmopolitan species whereas *Passiflora mollissima* and *Solanum mauritianum* are subtropical and tropical, and *Ageratina adenophora* a temperate species.

Some of these plants occur in Europe where they are considered to be ornamental plants. *Lantana camara* is native to the American tropics. It was introduced into other parts of the world as an ornamental plant. It spread quickly in other countries and is now an invasive weed in many tropical and sub-tropical areas. *Cabomba caroliniana*, a submerged aquatic plant, because of its delicate appearance is a desirable aquarium plant in Europe. It was introduced via the aquarium trade into many countries throughout the world where it causes problems in slowly moving or permanent standing water bodies. An ornamental plant, *Eichhornia crassipes*, commonly known as “water hyacinth”, native to the Amazonian basin, was introduced into Africa, where it is an invasive weed. It affects water-resource utilization and resulted in widespread environmental degradation. It had a major negative economic and ecological effect on Lake Victoria.

Usually several arthropod species are tested and released for the biological control of each species of weed but only one or two become established in the infested area. *Chromolaena odorata* (Asteraceae), formerly known as *Eupatorium odoratum*, is one of the worst weeds in the world, affecting agriculture and biodiversity in tropical and subtropical regions. Only a few of the 225 species of phytophagous insect associated with this weed are successful biological control agents. *Acacia nilotica*, the gum arabic tree, native to the tropics and subtropics of Africa and the Indian subcontinent, is an invasive weed in Australia. Of 71 phytophagous insect species associated with this weed, only six have been released of which only two became established in Australia. Many of the species of arthropods released fail to become established.

The phytophagous insects used as biological control agents of invasive weeds damage various parts of plants including roots, stems, leaves, flower and leaf buds and fruit. Usually the larvae, but also adults of various insect groups, mainly of Coleoptera, Lepidoptera, Diptera, Heteroptera and Hemiptera, which feed on weeds may cause serious damage and suppress their development. Insects may be stem-borers, root or leaf feeders, gall-forming, leaf-mining, leaf-chewing, seed-feeding, flower and flowerbud feeders, defoliators or sap-sucking. In addition some species of mites (Acari) are used as biological control agents of weeds, for example *Tetranychus opuntiae* to control the weed *Opuntia stricta* and *Acalitus adoratus* (Eriophyidae) to control *Chromolaena odorata*, and some fungi that cause plant diseases have also been used. Their efficacy in suppressing weeds is very low and, therefore, they are not now used for biological control.

Some of the authors use terms „the Old World“ and „the New World“. The use of these terms in scientific literature is both unsuitable and incorrect as they are mainly historical terms. It would be better to use geographical terms like Afro-Eurasia, or Africa, Asia and Europe (instead the Old World) and North America and South America (the “New World”).

It would improve the book for general readers if the introductory part of each chapter included a drawing or photograph of the habitus of the weed species and a map of its native and invaded distribution in the world. Only a few of the chapters include such illustrations.

The references associated with each chapter reflect to a certain extent how much effort has gone into finding arthropod biological control agents of weeds in countries in the tropical and subtropical parts of the world. In total there are one thousand and eight hundred citations in this book. The detailed Index at the end of the book is well and carefully presented and includes about two thousands terms, which greatly facilitates the finding of information on any of the twenty invasive weeds included in this book.

This book is a very important summary of the knowledge on tropical weeds and the possibilities of biological control using arthropods. It will undoubtedly be an important source of information for studies on these problems for many years to come not only for researchers in the tropical and subtropical parts of the world but also for people studying similar problems in temperate parts of Europe, Asia and North America.

*M. Skuhrová*