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Biological Control of Tropical Weeds Using Arthropods

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MUNIAPPAN, R., REDDY, G. V. P., AND RAMAN, A. (EDS.) 2009. Biological Control of Tropical Weeds Using Arthropods. Cambridge University Press, Cambridge, UK. x + 495 pp. ISBN 978-0-521-87791-6, US$126.00 (hardback), US$112.00 (eBook).

Nonnative invasive weeds are considered to be one of the most important threats to biodiversity, second only to habitat destruction (Randall 1996). Globalization and expansion of international trade have contributed to weed problems worldwide. Tropical and subtropical countries are particularly prone to the establishment of nonnative invasive plants. The explosive growth of these plants is due in part to the favorable climates in the invaded areas and the absence of the natural enemies that normally limit the reproduction and spread of these plants in their native ranges. Classical biological control, which seeks to reunite an invasive weed with one or more of its coevolved natural enemies, can provide an environmentally sustainable, cost effective, and permanent solution to most invasive weed problems.

The focus of this new book is the biological control of invasive tropical weeds with arthropods. The editors have done an excellent job of providing the rationale for the book in Chapter 1. Not surprisingly, the benefits of biological control relative to other control technologies are highlighted. However, what makes this book unique is that the editors emphasize the importance of implementing effective weed biological control programs in developing countries where the expertise and resources are either limited or unavailable. The 20 weed biological projects that are reviewed in Chapters 2 through 22 include aquatic weeds (e.g., *Azolla filiculoides*, *Cabomba caroliniana*, *Eichhornia crassipes*, *Pistia stratiotes*, and *Salvinia molesta*), humid terrestrial weeds (*Ageratina adenophora*, *Chromolaena odorata*, *Clidemia hirta*, *Coccinia grandis*, *Cyperus rotundus*, *Ipomea carnea*, *Lantana camara*, *Mikania micrantha*, *Mimosa* spp., *Parthenium hysterophorus*, *Passiflora mollissima*, *Portulaca oleracea*, *Sida* spp., and *Solanum mauritianum*), weeds of xeric environments (e.g., *Acacia* spp., *Prosopis* spp. and invasive cacti), and even parasitic weeds (*Orobanche* spp., and *Striga* spp.). Key aspects of the target weeds (e.g., origin, distribution, genotype differences, beneficial and negative impacts, and conflicts of interest) as well as their biological control agents (e.g., biology, host specificity, establishment, efficacy, and abiotic/biotic mortality factors) are included in each chapter. The sections on mortality of the biological control agents from local parasitoids/predators should be well received because biotic mortality from indigenous natural enemies is underreported yet often influences the success and/or failure of a weed biological control project. Benefit-cost analyses resulting from the adoption of biological control, which are extremely important to policymakers but are often lacking, have been included for most of the projects.

The book even contains some new information that most biological control practitioners probably are not aware of. For instance, this reviewer was astonished to learn that the well known aquatic weed Carolina mosquitofern, *Azolla caroliniana*, which is found throughout the eastern United States was recently synonymized with its western congener *A. filiculoides*. What was even more surprising was to learn that based on recent chloroplast- and mitochondrial- DNA analyses and fossil records, the origin of the water lettuce genus *Pistia* was probably western Europe (Germany), and not the Americas as previously thought.

Except for some typographical errors, one of the few criticisms of the book from this reviewer's perspective is the omission of several tropical weed projects of global importance that have a long history and are still on-going (e.g., *Hydrilla verticillata*, *Schinus terebinthifolius*) or are recent examples of successful biological control (e.g., *Melaleuca quinquenervia*, *Solanum viarum*). Another topic that could have been addressed given the emphasis on developing countries is capacity building, and the international efforts to address this need. For instance, short courses on biological control of tropical weeds were conducted in the Asia-Pacific Region for several years (Julien & White 1997) and have been on-going in Latin America since 2002 (Medal et al. 2003).

The weed biological control programs reviewed in this book should at the very least provide the impetus for initiating biological control projects in developing countries experiencing these weed problems via the 'Fast Track' or 'Short Route' (Harley & Forno 1992). Transfer of biological control technology is more likely to be adopted by underdeveloped and developing countries because the high costs often associated with exploratory surveys, risk assessments and development of mass rearing procedures for the biological control agents discussed in each Chapter have been borne by other countries. However, recent biodiversity laws that have been adopted by some tropical countries have become an impediment to the open exchange of candidate weed and insect biological control agents. This issue will have to be addressed if developing countries are to reap the full benefits from these projects. It is encouraging that India, Africa, and the Secretariat of the Pacific Community have recognized this problem in Chapters 22-24 and are taking leadership roles in facilitating the exchange of natural enemies.

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