

Book Review: Trichoderma

Book Review. *Trichoderma: Identification and Agricultural Applications* by Gary J. Samuels and Prakash K. Hebbar. 2015. 8.5" × 11" spiral-bound softcover; 204 pages; 55 images; 2 pounds; ISBN 978-0-89054-484-6, American Phytopathological Society, St. Paul, Minnesota, www.apsnet.org/apsstore/shopapspress, \$185.00.

represents the culmination of systematics research by Gary Samuels on the difficult but important genus *Trichoderma* combined with the practical expertise in the use of these fungi in the biological control of fungal plant diseases by Prakash Hebbar. The combination provides a fantastic resource for anyone interested in these fungi. As mentioned in the preface this book grew out of the experience of these two scientists in working with small farmers growing cacao in West and Central Africa to control of cacao black pod disease caused by *Phytophthora megakarya*.

This book is intended as a practical guide to the use of *Trichoderma* in biocontrol including "where to look for *Trichoderma* cultures, how to isolate them, how to narrow the field to one or a few cultures through laboratory and controlled field experiments, and how to prepare inoculum and finally, examples for the application of *Trichoderma* cultures." *Trichoderma* is known to be useful not only in biological control of pathogenic fungi but also in promotion of plant health for improved crop production through the complex interaction of microorganisms.

Following the Introduction, two chapters address "Developing *Trichoderma*-based products for application in agriculture" and "Applications of *Trichoderma* species in the field and greenhouse". The chapter on developing products starts with a table of the products already in existence of which there are over fifty including their reported function, crop and manufacturer. The section on "Interactions among *Trichoderma* species, plants and their pathogens: a primer" should be required reading for anyone dealing with soil just to appreciate the complexity of this medium as well as the considerable effort that involved in understanding the interactions between soil microorganisms and plants. "A practical guide to the use of *Trichoderma* in agriculture" follows with reference to the many approaches that have been tried. This section leads logically into the "Assay for biological activity" or is my fungus working? and the techniques for measuring success. Finally sections to "Determine methods of formulation and shelf-life studies" and "Preserve cultures" are useful to those who have success and wish to scale-up their product for use. The final warning concerning good agricultural practices of crop rotation, fertilization, and sanitation confirms the need to use *Trichoderma* as part of a sound integrated pest management program.

A practical account of the application of *Trichoderma* in the field and greenhouse follows based on decades of experience. One realizes that what works in the lab may not be so useful in the field! And attempts to understand why an approach may or may not work reveal the complexity of each unique agricultural situation. The basis of suppressive soils and composts are reviewed and another section addresses "The use of *Trichoderma* species in soilless and hydroponic systems". Each section includes the

specifics of an approach on how to prepare conidial suspensions and required conidial concentrations. One of the most successful uses of *Trichoderma* has been in association with seeds; applying conidia to seeds may result in increased plant growth as well as giving this beneficial microorganism a head start in the soil environment. Finally “Topical applications” are reviewed in which the “*Trichoderma*-based products can be formulated in water...with conidial concentrations of 10⁸-10¹⁰.” These have been particularly successful in controlling diseases of cacao but many examples are summarized here.

The next three chapters emphasize the systematics and identification of species of *Trichoderma*. One chapter provides an overview of the “Systematics of the genus *Trichoderma*” addressing the morphology of the asexual and sexual morphs and their diverse habitats. With the move to one scientific name for fungi, the generic name *Trichoderma* has priority over the name for the sexual morph, *Hypocrea*, thus *Trichoderma* now is applied to both morphs. The asexual morph is most commonly encountered especially as a biological control agent, thus this book is useful in identifying the trichoderma morph. The basic morphology of *Trichoderma* is described along with a summary of the extensive recent literature. A phylogram illustrates the major groups recognized within *Trichoderma* with a summary table to the species in each group. One provocative section addresses the question “Are there biocontrol species of *Trichoderma*?” with insight into their function in plants especially as “the dominant component of the endophytic mycota of some trees” of which the isolates tend to show promise in biocontrol applications. These authors suggest that genomics may provide the tools to “discover relevant genes” from well-defined strains that may be biologically useful. The chapter ends with several sections on identification techniques using DNA sequences and chemical methods as well as cultures and morphology including media used in isolating and cultivating *Trichoderma* species. A synopsis follows of techniques and colony and micromorphological characters ranging from preparing mounts for microscopy (very important!) to variability in conidia, conidiophores, phialides and chlamydospores. Chapter five provides a synoptic key to forty-five species of *Trichoderma* using those characteristics described in the previous chapter.

About half of the book consists of descriptions and illustrations of the most commonly encountered and potentially useful species of *Trichoderma*. Each species occupies two pages, one with the scientific name and synonyms and the other with nine or more illustrations showing the conidiophore branching pattern, phialides, and conidia. To quote a mycology professor who used the book in his class: “Thanks a million for letting me use the book. It was very useful in class; students isolated several *Trichoderma* from different substrates and were able to identify them using the keys. The descriptions and illustrations are both excellent...this is a much needed and very useful guide for *Trichoderma* identification.”

This book summarizes decades of research on *Trichoderma* combining practical aspects and experience about its use in agriculture with an extremely useful tool for the identification of the most commonly encountered species. In addition to students in

mycology class who encounter the ubiquitous isolates of *Trichoderma*, future scientists working to develop improve agricultural productivity in a hungry world will find this book essential. Bravo to Gary Samuels and Prakash Hebbar for writing this outstanding book!

---Amy Rossman and Jeffrey Stone, Department of Botany and Plant Pathology,
Oregon State University, Corvallis, Oregon