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Cyclopentenone Derivative Trichoderma Atroviride for Soil Application

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Description

Fungi of the genus Trichoderma are soilborne, green-spored ascomycetes that can be found all over the world. They have been studied with respect to various characteristics and applications and are known as successful colonizers of their habitats, efficiently fighting their competitors. Once established, they launch their potent degradative machinery for decomposition of the often heterogeneous substrate at hand. Therefore, distribution and phylogeny, defense mechanisms, beneficial as well as deleterious interaction with hosts, enzyme production and secretion, sexual development, and response to environmental conditions such as nutrients and light have been studied in great detail with many species of this genus, thus rendering Trichoderma one of the best studied fungi with the genome of three species currently available. Efficient biocontrol strains of the genus are being developed as promising biological fungicides, and their weaponry for this function also includes secondary metabolites with potential applications as novel antibiotics. The cellulases produced by Trichoderma reesei, the biotechnological workhorse of the genus, are important industrial products, especially with respect to production of second generation biofuels from cellulosic waste. Genetic engineering not only led to significant improvements in industrial processes but also to intriguing insights into the biology of these fungi and is now complemented by the availability of a sexual cycle in T. reesei/Hypocrea jecorina, which significantly facilitates both industrial and basic research. This review aims to give a broad overview on the qualities and versatility of the best studied Trichoderma species and to highlight intriguing findings as well as promising applications.

A central ecological tenet is to understand the status of a population, its abundance and activity and its survival, in brief its total temporal development. It is also said that ecology is the study of biology under the worst possible conditions. This is critical, and from this perspective the following discussion on methodology is presented. For determination of Trichoderma and Gliocladium populations, the primary approach has been through soil dilution plating. Factors affecting this methodology include the nature of culture media used to optimize the recovery of strains, the effects of physical factors such as temperature on the recovery of soil populations, besides the use of modern approaches including the application of monoclonal antibodies and of molecular biological methodology in the identification of Trichoderma mycelium and spores. The basic dilution/plating technique appears generally sufficient to isolate Trichoderma spp. because most species grow rapidly and their spores are abundant. Indeed, they often out compete other microbes, and in order to isolate slower-growing fungi, inhibitors are used to slow the development of Trichoderma spp. For instance, lithium chloride (0.6%) selectively inhibits their germination and retards their mycelial growth. Recoveries of Trichoderma and Gliocladium based on soil dilution plating protocols have clearly indicated their ubiquitous status in soils worldwide, even though emphasizing the ability of these fungi to profusely conidiate. Quantitative isolation of Trichoderma has been approached through the development of selective culture media. The archetypal concoctions employ chemicals and dyes such as rose bengal, crystal violet, oxgall (2-deoxycholate) and Penta Chloro Nitro Benzene (PCNB) in combination with various fungicides. Analogous inhibitors such as allyl alcohol in combination with vinclozolin have been usefully employed. The classic recovery medium is (TSM) Trichoderma Selective Medium, later improved to restrict the development of Fusaria by the incorporation of benomyl for strains resistant to this fungicide. A range of alternate fungicides has been usefully employed. For instance, promamocarb or metalaxyl were successfully substituted for the fenaminosulf that was originally included to inhibit Oomycetes. Other media have been developed to circumvent the use of the general inhibitors rose bengal and PCNB though finally using an alklyaryl polyether alcohol to obtain optimal results. In principle, it has been the use of narrow spectrum inhibitors active towards other dominant fungi (e.g. Fusaria and Oomycetes) that has aided the quantitative recovery of Trichoderma and Gliocladium.