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Chitinolytic enzymes from endophytic fungi

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Abstract Fungal endophytes isolated from leaves of tree species of the forests of Western Ghats, southern India were screened for chitin modifying enzyme production. Thirty-one of the one hundred and sixty two isolates were positive for chitinase, while different isolates produced isoforms of the enzyme. Many isolates produced chitosanase that acted on chitosan with different degrees of acetylation. Modified chitin and different types of chitosans are used in biomedical applications including wound healing, drug delivery, gene delivery, tissue engineering, in the food industry as preservatives and emulsifying agents, and in biocatalysis. Horizontally transmitted endophytes appear to be a good source for a variety of chitin modifying enzymes with the potential to be used in biotechnology. The possibility of chitin modifying enzymes of endophytes in regulating plant defense against pathogens and pests in vivo should also be addressed.

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Introduction

Chitin, a linear homopolymer of β-1,4 linked N-acetylglucosamine, is a constituent of the exoskeleton of insects and shells of crustaceans and forms the basic structural component of the fungal cell wall. Enzymes that degrade this insoluble polymer are chitinolytic enzymes or chitinases. Genome sequence studies have revealed that fungi have as many as 25 different chitinases (Seidl 2008). Although the need for such a wide variety of chitinases in fungi is not clear, it is well known that chitinases perform different functions. These include their controlled activity during hyphal tube extension and branching, sporulation, spore germination and cell division as well as their role in parasitism (De Marco et al. 2000; Adams 2004; Karlsson and Stenlid 2008). Fungal chitinases play a major role in the ecosystem by degrading and cycling carbon and nitrogen from chitin (Kellner and Vandenbol 2010). Chitinases of fungi are also being studied for their potential in biocontrol of phytophagous nematodes (Gan et al. 2007) and plant pathogenic fungi (Klemsdal et al. 2006). Plants also produce chitinases as a defense response to infection by pathogens (Regalado et al. 2000; Hietala et al. 2004; Onaga and Taira 2008). The products of chitinases have many desirable properties and find use in control of microbes and tumors, wound healing, wastewater treatment, and drug delivery (Dahiya et al. 2006; Aoyagi et al. 2007; Dai et al. 2009; Da Sacco and Masotti 2010; Hamman 2010; Nam et al. 2010). Due to their importance in fungal differentiation, plant defense and pharmaceut-