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ORIGINAL ARTICLE

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Muscodor albus and its biological promise

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Abstract We have found a novel fungal genus that produces extremely bioactive volatile organic compounds (VOCs). This fungal isolate was initially discovered as an endophyte in *Cinnamomum zeylanicum* in a botanical garden in Honduras. This endophytic fungus, *Muscodor albus*, produces a mixture of VOCs that are lethal to a wide variety of plant and human pathogenic fungi and bacteria. It is also effective against nematodes and certain insects. The mixture of VOCs has been analyzed using GC/MS and consists primarily of various alcohols, acids, esters, ketones, and lipids. Final verification of the identity of the VOCs was carried out by using artificial mixtures of the putatively identified compounds and showing that the artificial mixture possessed the identical retention times and mass spectral qualities as those of the fungal derived substances. Artificial mixtures of the VOCs nicely mimicked the biological effects of the fungal VOCs when tested against a wide range of fungal and bacterial pathogens. Potential applications for "mycofumigation" by *M. albus* are currently being investigated and include uses for treating various plant parts, and human wastes. Another promising option includes its use to replace methyl bromide fumigation as a means to control soil-borne plant diseases.

Keywords Volatile antibiotics · Mycofumigation · Endophyte · Plant pathogen

Introduction

As a field, microbiology has witnessed an evolution of its own. It was initially spawned out of interest in brewing and fermentation activities on which mankind had relied for millennia. The discipline was formalized when it was realized that microbes have the potential to cause infection and death. Ultimately, in the earlier part of the last century the discovery of antibiotic producing microbes triggered a search for useful microbes in every conceivable niche in the world. Today, as a result of this search, microbes produce a vast array of products ranging from antibiotics, enzymes, vitamins, to important secondary products [6]. Eventually, microbes served as models for the development of new fields including genetics, molecular biology, and industrial microbiology. The discovery processes in microbiology seem endless especially with the advent of biotechnology as it inspires new uses for microbial products and systems [3].

However, in spite of all of the knowledge gained about myriads of microbes and their products that have been put to use, only a few dozen have ever been domesticated, that is used directly, to carry out specific biological functions for mankind. Some of these include the rhizobia that nodulate legumes, cheese and wine/beer making bacteria and fungi, as well as the yeasts that are a vital part in bread making. More recently, other microbes have been directly utilized in cleaning up environmental contamination and some have been found and developed for agricultural applications. The advantages of direct use of an organism to do a specific task are great considering the reduced costs in development and production. Now, the question, given the relatively small number of microbes that have been domesticated, is it possible that there are still other previously undiscovered microbes that may have potential usefulness to mankind by direct application?

The most important and critical aspect of embarking on the endeavor of prospecting for new microbes should directly hinge upon having some ideas concerning the specific needs of society (industry/medicine/agriculture) that may drive the process. Ultimately, it seems as if the mind must be prepared to recognize uniqueness in a world filled with things that appear common. Thus, as we set out to find microbial novelty we are driven by a whole set of massive problems faced by humankind

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