Evaluation of Bioactive Compounds Produced by Soil Fungi

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ABSTRACT

The rising antibiotic resistance globally among bacteria has posed an increasing demand for new and better antibiotics to inhibit or kill superbugs. To overcome this global issue, microorganisms, especially fungi have been found valuable to discover drugs and related compounds. Bioactive compounds produced by fungi have become significant sources of lifesaving drugs. This research confers the biological activity of secondary metabolites, particularly antimicrobial compounds produced by soil fungi which may have the potential to be developed into drugs of clinical importance.

Keywords: Antimicrobial products, Aspergillus spp, Bioactive compounds, Microorganisms Derived Products, Secondary metabolites, Soil fungi

INTRODUCTION

Globalization and the injudicious use of antibiotics has resulted in the emergence of resistant bacteria which has endangered the efficacy of the antibiotics which once used to work wonders in treating serious bacterial infections (Centre for Disease Control and prevention 15-17). Hence, it is important to unveil new biologically active molecules which have the potential to be further developed into drugs. Bioactive compounds are compounds that exhibit antimicrobial/ antitumor/ antiviral activities obtained either from micro-organisms or any other living thing (Richa S 1225). Bioactive compounds with high commercial value can be obtained from primary or secondary metabolites of microbes. These metabolites have been proven to be excellent in therapeutic means. (Mushtaq S, Haider A. B, Uzair B, Abbasi R 420451)

OBJECTIVE

The objective of this research is to analyze the current use and the future applications of microorganism-derived products (MDPs) in therapeutic treatments. The study confers the screening of bioactive, particularly, antimicrobial compounds soil produced by soil fungi.

METHODOLOGY

Isolation: For the evaluation of bioactive compounds the fungal strains were isolated indigenously from the garden soils of in Federal Urdu University of Arts, Science and Technology, Karachi, Pakistan. Soil sampling was done from the rhizosphere.

Isolation was done by using Serial Dilution Method (Jonathan F. B, Elizabeth S, and Christopher P. C 1-4) Soil was serially diluted till $1/10^5$ dilutions in distilled water and 500µl of sample taken from the $1/10^3$ and $1/10^4$ dilution tubes was dispensed into Sabouraud Dextrose Agar plates incubated at room temperatura (28 °C) for 5 days. After incubation period each colony was selected for microscopic identification and purified on SDA plates, SDA slants and as spore suspensions. Different fungal species were obtained after purification steps including *Aspergillus flavus, A. niger, A. terreus, A. glaucus, Rhizopus spp*.

SCREENING

Submerged fermentation technique (Jean-Paul O, Adrian T 222-232) was used to produce antibiotic from the fungi in 500ml flasks. Each fungus was separately inoculated into 300 ml Sabouraud Dextrose Broth and provided with agitation of 120 rpm on an orbital shaker at room temperature. *A. glaucus* was supplemented with 3% dextrose and 2% peptone due to its high nutrition demand and slow growth. Cell-Free Filterate (CFF) was taken by filteration and centrifugation after every 24 hours until 506 hours. This CFF was then used to determine antimicrobial activity. Test organisms used were *Staphylococcus aureus* and *Pseudomonas aeruginosa*. Antimicrobial activity was performed by Agar- Well diffusion method (Michael O 727-735). A thin lawn of the test organisms according to the 0.5 Macfarland standard was made on Nutrient Agar plates. The agar was punched with a sterile borer and 100ml of each sample CFF was dispensed into the wells on Nutrient Agar plates. The plates were incubated at 37°C for 24 hours. Antimicrobial.activity was observed the following day. The inhibition was determined by clear zones around the wells which indicated the inhibition of the test organism seeded on the media plate.

RESULTS

Among all the fungi isolated, species of *Aspergillus* were the most effective against the clinically important *S. aureus* and *P.* aeruginosa. *Aspergillus glaucus* being the lead antibiotic producer with inhibitory zones of 8,10, 16, 13, 19, 20, 12,10 and 12mm at 144, 168, 192, 216, 240, 264, 312, 336 and 360 h, respectively, against *Pseudomonas aeruginosa.* Whereas, inhibitory zones of 15, 14, 13, 15, 15mm at 192, 216, 240, 312 and 360 h against *S. aureus*. This was followed by *Aspergillus niger,* with inhibitory zones of 10, 10, 14, 12 at 144, 168, 192 and 216 h, respectively, against the test organism *P. aeruginosa.* However, the antibiotic was able to inhibit *S. aureus* slightly lesser with inhibitory zones of 9, 13and 14mm at 144, 192 and 216h, respectively. Lastly, *Aspergillus terreus* showed its antimicrobial potential with inhibitory zones of 9mm each at 96, 168 and 192 h, respectively, against *P. aeruginosa.* While inhibitory zones of 15 and 12mm at 168 and 192h, respectively, were found against *S. aureus.*

These results proved that each of the three fungul strains, with their antimicrobial activity, are potentially effective in killing pathogenic bacteria. Both test organisms were found to be sensitive and were inhibitted around the wells as mentioned above. The antibiotic produced by these fungi was shown to have an optimal activity against the Gram negative, *Pseudomonas aeruginosa.* The antibiotic efficacy varies with time and is higher at peak days of growth and antibiotic production gradually start to decrease as the antibiotic loses its stability and gets weaker. This antimicrobial activity of these *Aspergillus species* can be enhanced by treating them with certain mutagens such as UV radiation which may result induced mutations producing higher yields of antibiotic. Ultimately, this research concludes that the antimicrobial compounds produced by a group of soil fungi such as *Aspergillus* are potentially effective in killing pathogenic bacteria and therefore may be used as a chemotherapeutic agent in the future.

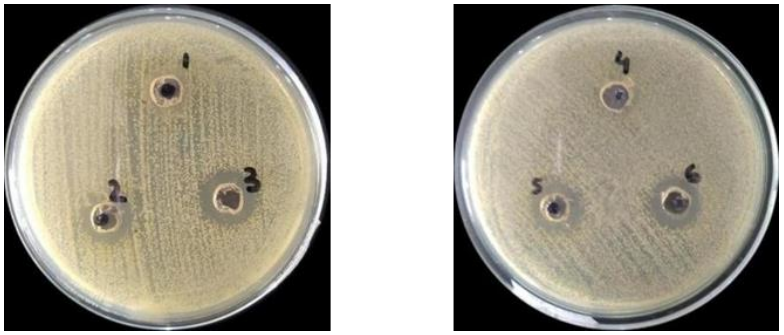

Figure 1. Determination of antibacterial activity of Aspergillus spp. by agar well diffusiom method.

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