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Fungi with Great Promises: A Review.

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ABSTRACT

Fungi from the start are very important for human life. They play main role in the process of decomposition and mineralization. In recent year's special attention have been made to fungi because of its ability to produce good number of new and interesting bioactive secondary metabolites, which are of pharmaceutical, industrial and agricultural importance. Several decades of research and numerous articles on fungi have resulted in a surfeit of knowledge of the group. The data in part however, has been biased by the biological activities of the fungal extracts used, and one question that should come to our mind is "how much do we really know about fungal species? Keeping these facts in view, the literatures on the biological assays of fungal extracts are reviewed in this paper.

INTRODUCTION

Fungi are the important components of ecosystem. They play main role in the process of decomposition and mineralization. Thermophilic fungi are present worldwide due to self-heating masses, present in the natural habitat, soil and where decomposition of plant, plants parts, animal, birds and municipal refuse, takes place. The thermophilic fungi are those which can grow at temperature from 20-60 ^{0}C. Fungi are very diverse group of organisms. They consist of microscopic single cell yeast to large macro-fungi like mushrooms and toad stools. Fungi are very important for ecosystem and are the big decomposer of dead organic matter of forests, fruits etc. They are mainly saprobes which help in decomposition and also play a key role in mineralization. Some of fungi form mycorrhiyzal association, the symbiotic association of plant and fungi. Several fungi produce bio-active compounds, secondary metabolite and chemical models having pharmaceutical importance. Fungi are the major components of bio-diversity, necessary for the survival of other living organism and are crucial in ecological processes. Fungi are ubiquitous organisms and adaptable in all habitats. The soil is most important habitat for fungi, bacteria, and actinomycetes etc. Fungi mainly contribute in the soil biomass. Many fungi are very much important for humans as industries and commercially preparing products. The oldest fungi used for fermentation is yeast, e.g; brewing, wine making and bread making. Yeasts and fungi play great role in drugs production, food processing, bio control agent, enzymes production, enzymes biotechnology and research development. Fungi are also used in the production of cheese and different flavor in the industries due to methyl ketones. A large number of fungal extracts or extracellular product shave been found to have antimicrobial activity, mainly from the filamentous fungi. It is believed that secondary metabolites are useful in performing some secondary functions and serve as competitive weapons, used against predators, metal transporting agents, symbiotic agents, sexual hormones and differentiation effectors. Fungi are very important as well as it has an important role from the start of world in many biological processes, fungal

flora should be further investigated for their secondary metabolites to develop new antifungal and antibiotic drugs, fungicide and insecticides.

Antimicrobial activity

Sohail *et al.* [1] investigated the antimicrobial activity of the fungal specie *Aspergillus flavus* against different fungal *A. niger, A. oryzae, C. albican, P. digitatum, F. oxysporum* and bacterial pathogenic strain *P. aeruginosa, E. coli, S. aureus, S. aureus* (methicillin resistant), *S. aureus* (vancomycin resistant). The extract of *Aspergillus flavus* was found effective against all tested pathogenic strains.

Idris *et al.*[2] isolated endophytic fungi from the medicinal plant, *Kigelia africana*. The isolated fungal species were identified as *Aspergillus flavus, Aspergillus sp., Curvularia lunata*, *Cladosporium sp.* and three unknown species. The fungal species were screened for antibacterial test against *E. coli,Bacillus subtilis, Staphylococcus aureus.* The zones of inhibition ranged from 14-37 mm.

Anita *et al.*[3] reported the antifungal activity of the compounds obtained from *Trichoderma atroviride* was able to inhibit the growth of pathogens and showed 100% inhibition at concentration of 500 ppm.

Sohail *et al.*[4] reported the antimicrobial activity of the fungal specie *Rhizopus stolonifer*extracts against different bacterial pathogenic strain *P. aeruginosa, E. coli, S. aureus, S. aureus* (methicillin resistant), *S. aureus* (vancomycin resistant) and fungal strains *A. niger, A. oryzae, C. albican, P. digitatum, F. oxysporum*. The extract of *Rhizopus stolonifer* was found to be effective against all pathogenic strains.

Tawfik *et al* [5] reported the antibacterial activity of fungal extracts of some fungi, against bacterial species, *E.coli* and *S. aureus*. The zone of inhibition by fungal extracts ranged between 22-28 mm diameters. MIC test showed that the extracts of *D. australiensis* exhibited a minimal inhibition values (12.5 and 6.25 ug/ml) against *E. coli and S. aureus*, respectively.

Castlebury *et al.*[6] reported the antibacterial activity of the compound beauvericin isolated from fungal extract and was check against *Clostridium perfringens, Enterococcus faecium, Escherichia coli. Pseudomonas aeruginosa, Listeria monocytogenes, Salmonella enterica, Shigella dysenteriae, Yersinia enterocolitica* and *Mycobacterium tuberculosis.*

Cytotoxic Activity

This assay measures the ability of the fungal extract to inhibit the growth of cancer cells in vitro.

Swenson *et al.*[7] reported thatthefungus *Trichocladium opacum* (X116) extract showed cytotoxicity against two human tumor cell lines, HeLa and MCF-7.

Jow *et al.*[8] stated the beauvericin compound showed good cytotoxic activity for leukemia cells and could be used to determine other mechanisms of beauvericin cytotoxicities.

Nadumane *et al.*[9] reported the cytotoxic activity of endophytic fungi isolated from *Brucea javanica* (L.) and were tested against cancer cells. The observations were done for 24 hours and 48 hours. IC_{50} were calculated using the Rich and Muench theory. The cytotoxic assay of endophytic fungi showed the IC_{50} of 58.35µg/ml, 88.39 µg/ml on Raji cell, 162.09µg/ml, 66.24 µg/ml on NS cell, 361.21µg/ml, 219.97µg/ml on HeLa cell; and lastly 1075.18 µg/ml, 656.82 µg/ml on Vero cell, after 24 and 48 hours incubation, respectively. The result of this study showed that secondary metabolites of endophytic fungus have selective cytotoxic effect towards cancer cell.

Ruckdeschel *et al.*[10] Stated that the extracts of fungal endophytes species*B. robillardoides, B. theobromae, C. gloeosporioides, P. pauciseta, P. terminaliae* and *P. arnoldiae* were tested against various cancer cells viz., human breast cell BT220, human colon H116, human intestine Int407, human lung HL251 and human leukemia HLK 210 at different concentrations. In all the cell death wasinduced by fungal taxol.

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Phytotoxic Activity

Mata *et al.*[11] reported that *Malbranchea aurantiaca* as a source of phytotoxic agent, exhibited the noted phytogrowth inhibitory activity against *A. hypochondriacus* seedlings of the extracts prepared from broths and mycelia of the fungus, fermented in different conditions.

Dayan *et.al*. [12] reported the studies in Linzhi, Tibet, P. R. China that microorganisms in the particular soil actinomycetes are most relevant source of potential herbicides agents.

Macias [13] stated that the fungus *G. polythrix* was grown in liquid-substrate fermentation on potato dextrose broth (PDB). The culture broth and the mycelium were extracted with CH_2Cl_2. The combined extract showed phytotoxic activity when evaluated on seedlings of *A. hypochondriacus* and *E. crusgalli* using the Petri dish bioassay. Bioactivity guided fractionation of this extract led to the isolation of fourteen phytotoxic agents.

Insecticidal Activity

Noma and Strickler [14] stated that *Beaveria bassiana* is currently registered in the United States as Mycontrol ES (Mycotech, Butte) and Naturalis L (Troy Biosciences). These products are registered against sucking pests such as, whitefly, aphids, thrips, mealybugs, leaf hoppers,andweevils. Studies also showed that *Beaveria bassiana* is virulent against *Lygus hesperus* Knight (Hemiptera: Miridae), a mirid species that is a major pest of alfalfa and cotton in the United States.

Xu *et al.*[15] reported the insecticidal activity of beauvericin compound isolated from fungal specie *Beaveria bassiana*. Later studies confirmed that beauvericin has insecticidal activty.

Begum and Desphande [16] described a detailed study on the pecteolytic enzyme of *P. herbarum*.This showed remarkable insecticidal activity.

Hamill *et al.*[17] stated that beauvericin is a cyclic hexadepsi peptide mycotoxin, which has insecticidal, antimicrobial, antiviral and cytotoxic activities. It is a potential agent for pesticides and medicines. Beauvericin is a famous mycotoxin produced by many fungi, such as *Beaveria bassiana* and *Fusarium* sp.

Hamill *et al*.[17] stated that beauvericin is a cyclic hexadepsipeptide that belongs to the enniatin antibiotic family, isolated from *Beaveria bassiana*. It contains three D-hydroxy isovaleryl and three N-methyl phenyl alanyl residues in an alternating sequence. Beauvericin is a common and commercial entomopathogenic mycoinsecticide.

CONCLUSION

In the respect of above review it can be concluded and suggested that fungal Secondary metabolites are responsible for medicinal activities. Different phytochemical properties for curing various ailments and possesses potential leads to the isolation of new and novel compounds.

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