

Antimicrobial Efficacy of Medicinal Mushroom *Ganoderma Lucidum*

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ABSTRACT

Mushroom has multi beneficial effects for human welfare. The Medicinal mushrooms are widely used as traditional medicinal components for the treatment of various diseases and related health problems. Most of the medicinal extracts from mushroom are different forms of polysaccharides which strengthens the human immune system with no side effect. Medicinal mushroom *Ganoderma* species investigation has focused on the biological response of microorganisms. The antimicrobial efficacy of various solvent extracts (20g/ml) of *Ganoderma lucidum* was treated against five different bacteria such as *Escherichia coli*, *Staphylococcus aureus*, *Salmonella typhi*, *Pseudomonas aeruginosa* and *Klebsiella* sp and four different fungal pathogens like *Aspergillus niger*, *Fusarium* sp, *Penicillium* sp and *Candida* sp. Ethanol extract exhibited maximum antibacterial and antifungal activity, while the most susceptible bacterium observed was *Staphylococcus aureus*, *Pseudomonas aeruginosa* and fungi was *Fusarium* sp. respectively.

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KEYWORDS: *Ganoderma* Mushroom, Bacteria, Fungi

INTRODUCTION

Mushroom is broadly defined by Chang and Miles as "a macro fungus with a distinctive fruiting body which can be either epigenous or hypogenous and large enough to be seen with the naked eye and to be picked by hand"[1]. Mushrooms appeal to different people in different ways. They are objects of beauty for artists, and for medical people they are the possible source of new drugs. There are many traditional methods for testing these fungi but they are unreliable [2]. The mushroom attracts international attention as a valuable herb due to the wide variety of its biological activities, such as antitumor, immunomodulatory, cardiovascular, respiratory, antihepatotoxic and antinociceptive (active against pain) effect [3, 4]. Its major compounds with significant pharmacological activities are ganoderic acid, triterpenes and polysaccharides. It is interesting that during the last three decades; more than 150 triterpenes [5, 6] and more than 50 carcinostatic polysaccharides have been isolated and are known to be unique compounds in this mushroom.

Within the genus *Ganoderma*, over 250 taxonomic names have been reported worldwide including *G. adspersum*, *G. applanatum*, *G. australe*, *G. boninense*, *G. cupreum*, *G. incrassatum*, *G. lipsiense*, *G. lobatum*, *G. lucidum*, *G. oerstedii*, *G. oregonense*, *G. pfeifferi*, *G. platense*, *G. resinaceum*, *G. sessile*, *G. sinense*, *G. tornatum*, *G. tsugae* and *G. webbianum* [7].

In recent years more variety of mushrooms have been isolated and identified, and the number of mushrooms being cultivated for food or medicinal purposes has been increasing rapidly. Mushroom "nutraceuticals" are bioactive compounds that are extractable from mushrooms, and they have nutritional and medicinal features that may be used in the prevention and treatment of disease. The limitations of traditional identification techniques indicate that alternative methods need to be developed for the identification of these fungi. With the development of molecular biology, some new techniques have been applied to fungal classical taxonomy. DNA fingerprinting techniques, however, would be allowed to identify the *Ganoderma* species and cultivars, indicating that it is a useful tool for the valid protection of newly bred cultivars. The review on medicinal mushroom *Ganoderma* research in Tamil Nadu, India is very scanty, the present research is planned with biological activity of Indian *Ganoderma* species.

Material and methods

The wood rotting fungal species of *Ganoderma* sp. was collected from hard wood tree such as *Casurina equisetifolia* at Cuddalore district, Tamil Nadu. The fungal fruiting body was harvested and transferred to sterile polythene bag. The specimen was brought to the laboratory for further investigation.

Extraction of bioactive compounds from *G. lucidum*

The dried mushroom material was grounded to a fine powder with the help of mixer grinder. Ten gram of mushroom powder was subjected to extract using Soxhlet apparatus for 10 hours using 100 ml each of the following solvents like ethanol, acetone, hexane and distilled water. The extracts were recovered by filtration and kept at 40°C for further analysis. All the solvent extracted fractions were subjected to dry powder using hot air oven at the medium temperature. The crude extract were subjected as stocks using distilled water (50µg/ml) and were tested for their antimicrobial activity by disc diffusion technique.

Tested Microorganisms

The five human pathogenic bacteria *Escherichia coli*, *Staphylococcus aureus*, *Salmonella typhi*, *Pseudomonas aeruginosa* and *Klebsiella* sp and four different fungal pathogens like *Aspergillus niger*, *Fusarium* sp, *Penicillium* sp and *Candida* sp. were chosen for antimicrobial activity was measured in terms of Inhibition Zone size (in mm) obtained after the incubation at 37°C±2°C for 24 hours for bacteria and fungi 28°C±2°C for 48 hours.

In vitro evaluation of antimicrobial activity by agar diffusion assay

Agar diffusion assay carried out the antimicrobial activity of *Ganoderma* sp. was evaluated by agar diffusion method both for aqueous and solvent extracts using Mueller Hinton agar for bacteria and Sabouraud's agar for yeast and mold. The 24 hours broth cultures of test organisms were used for the assay. A sterile cotton swab was dipped into the standardized bacterial culture. The swab was then evenly inoculated in three directions over the entire surface of the agar plate to obtain the uniform inoculums. Wells were made on the seeded plates using a sterile borer (8 mm). The plates were allowed to dry for 3-5 minutes after which 50µl of the extracts (aqueous and solvent extracts) and the controls were dispensed into each well using micropipette. The concentration of the test samples were 1g/ 10ml of distilled water (10%). The plates were incubated at 37°C for 24hrs for bacteria and room temperature for 48- 72 hrs for fungi. The zone of inhibition surrounding the well was measured compared with control.

Results and Discussion

The result of the antimicrobial activity of different extracts of *G. lucidum* was determined by agar diffusion method as shown in the Table I (A & B).

It is specious from the table that ethanol extract of *G. lucidum* controlled strong antibacterial effect which was most inhibitory against *Staphylococcus aureus* (29 mm), *Pseudomonas aeruginosa* (26 mm) and fungi was *Fusarium* sp. (25.5 mm). The extract was equally inhibitory against *E. coli* (16mm), *K. pneumoniae* (13 mm) and *S. typhi* (19 mm). The other extract of *G. lucidum* was equally inhibitory to all the bacterial and fungal pathogens. The aqueous extract was found to be very little much of effective against all the strains.

Many antimicrobial compounds such as terpenes, lectins, polysaccharides etc. act on the bacterial and fungal

cytoplasmic membrane [8, 9]. Various extracts of *G. lucidum* have been found to be equally effective when compared with gentamycin sulphate. Dulger & Gonuz reported the antimicrobial properties of 4 different extracts of macrofungus (*Cantharellus cibarius*) against 50 important human pathogens [10].

Conclusion

It is concluded from the present study that, the *Ganoderma* sp. from enormous bioactive potential in particular it provides the source for antimicrobial compounds. Hence, mushroom derived antimicrobial substances have received considerable attention in recent years. The mushroom extracts from *G. lucidum* might be employed to struggle several diseases caused by pathogenic microorganisms. However, further research is evaluating the compounds from *Ganoderma* sp.

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Table I: *In vitro* Antimicrobial activity of different extracts of *Ganoderma lucidum* by agar diffusion method.**A. Antibacterial Activity**

S. No	Test Bacterial Strains	Zone of Inhibition (mm)			
		Ethanol 50mg/ml	Acetone 50mg/ml	Hexane 50mg/ml	Aqueous 50mg/ml
1.	Escherichia coli	16	14	11	05
2.	Staphylococcus aureus	29	17	16	10
3.	Salmonella typhi	19	11	12	09
4.	Pseudomonas aeruginosa	26	10	08	02
5	Klebsiella sp	13	08	10	04

B. Antifungal Activity

S. No	Test Fungal Strains	Zone of Inhibition (mm)			
		Ethanol 50mg/ml	Acetone 50mg/ml	Hexane 50mg/ml	Aqueous 50mg/ml
1.	Aspergillus niger	12	10	04	06
2.	Fusarium sp.	25.5	14	10	08
3.	Penicillium sp.	10	05	05	03
4.	Candida sp	09	-	05	05

