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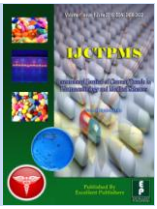

Original Research Article

A Study on the Antimicrobial Activity of Ten Wild Mushrooms of Sirumalai Hills

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Abstract

Based on the biodiversity study of mushrooms of Sirumalai hills, Dindigul District, Tamil Nadu, dominant ten wild mushrooms were selected for antimicrobial activity against seven common human pathogens. Crude methanol extract, petroleum ether extract and hot water extract were prepared from the ten mushrooms. The antimicrobial assay was performed by agar disc diffusion method in Muller Hinton agar medium. Of the ten mushrooms selected, *Auricularia auricula, Trametes versicolar* and *Fomis fomentarius* inhibited all the seven bacterial pathogens. *Polyporus varius* and *Ganoderma tsugae* inhibited 6 pathogens, followed by *Ganoderma lucidum, Ganoderma applanatum* and *Innonatus radiatus* each of which inhibited 5 pathogens. From this study, it is suggested that antibacterial properties of mushroom compounds may lead to the discovery of new drugs.

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Keywords

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Auricularia auricula
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Introduction

Antibiotic resistance has become a global concern (Westh et al., 2004). The clinical efficacy of many existing antibiotics is being threatened by the emergence of multidrug resistant pathogens (Bandow et al., 2003).Mushrooms need antibacterial and antifungal compounds to survive in their natural environment (Lindequist et al., 2005). Hence, they are rich sources of natural antibiotics.

The current study deals with the screening of ten wild mushrooms of Sirumalai hills for their antimicrobial activity. These ten mushrooms were the most frequently encountered and most abundantly occurred mushrooms. Their anti microbial activity was tested against seven human pathogens.

Materials and methods

Mushrooms selected

Based on the abundance, the following ten mushrooms viz., *Auricularia auricular, Daldina concentric, Fomis fomentarius, Ganoderma applanatum, Ganoderma lucidum, Ganoderma tsugae, Innonatus dryadeus, Innonatus radiates, Polyporus varius* and *Trametes versicolar* were selected for the study

Pathogens used

Seven common human pathogens culture *viz., Escherichia coli, Proteus vulgaris, Staphylococcus aureus, Pseudomonas aeruginosa, Micrococcus luteus, Klebsiella pneumoniae,* and *Corynebacterium*

diptheriae procured from MTCC were used for the study. The cultures were maintained in nutrient broth.

Extract preparation

Extracts using solvents with different polarity to ensure the maximum chance of extraction were prepared. Three types of extracts, methanol extract, petroleum ether extract and hot water extract were used for this study.

Preparation of crude methanol and petroleum ether extract

The dried fruit bodies were cut in to small pieces and pulverised. In two 300ml Erlenmeyer flasks, 50.0g of mushroom powder was placed to this 95% methanol and petroleum ether was added separately. The flasks were covered with aluminium foil and were allowed to stand for seven days for extraction. The mixture was filtered through Whatman filter paper no.1 and the filtrate was concentrated in a rotary evaporator. The methanol and petroleum ether was recovered and the extract was collected and dried (Jonathan and Fasidi, 2003). Alcohols have been proved to have antimicrobial effects (Benedict and Brady, 1972). In order to eliminate the antagonistic effect of methanol, 1 g of methanol extract was mixed with 20ml of ethyl acetate shaken vigorously .To this, 30 ml of sodium bicarbonate was added to remove the weak acids. The mixture was then filtered through Whatman filter paper no 1 and dried under reduced pressure (Hirasawa et al., 1999).

Preparation of hot water extract

In the hot water extraction process 50.0 g of the dried mushroom powder was placed in a 300ml Erlenmeyer flask. To this 200ml of distilled water was added and boiled to 60º C and then allowed to stand for four hours with intermittent shaking. The mixture was then filtered through Whatman filter paper no.1 and the filtered extract was collected.

Assay for antibacterial activity

The antimicrobial assay was performed by agar disc diffusion methods. The surface of the Muller Hinton Agar was swabbed with log phase cultures of the pathogens separately. Filter paper discs measuring 7.0 mm diameter were cut from Whatman No. 1 filter paper using a paper perforator. The discs were sterilized in an autoclave. Each disc was saturated with each of the reconstituted mushroom extracts by immersion. The discs were aseptically placed over the swabbed surface and the plates were incubated for 24 - 48 h at 37°C.

Antimicrobial activities were determined by measuring the diameter (in millimetre) of the zone of inhibition. A disc with a halo was considered as positive for antibacterial activity and the one which lacks was recorded as negative.

Results and discussion

Results of the antibacterial assay reveals all the ten mushrooms exhibited antimicrobial activity though their efficacy varies (Tables 1, 2 and 3). Of the ten mushrooms selected *Auricularia auricula*, *Trametes versicolar* and *Fomis fomentarius* inhibited all the 7 pathogens. *Polyporus varius* and *Ganoderma tsugae* inhibited 6 pathogens, followed by *Ganoderma lucidum*, *Ganoderma applanatum* and *Innonatus radiatus* each of which inhibited 5 pathogens.

Table 1. Antibacterial assay of selected mushrooms hot water extract against common human pathogens.

Species	PA	CD	KP	SA	ML	PV	EC
Innonatus dryadeus	-	-	√	-	√	-	-
Polyporus varius	-	√	-	√	-	-	-
Fomis fomentarius	√	√	-	-	√	-	-
Ganoderma lucidum	-	-	√	√	-	√	√
Auricularia auricula	√	√	√	√	√	-	-
Ganoderma tsugae	-	√	-	√	√	√	√
Innonatus radiatus	-	√	-	√	√	-	-
Trametes versicolar	√	-	√	-	√	√	√
Daldina concentrica	-	-	√	-	-	-	-
Ganoderma applanatum	√	-	√	√	√	√	-

– = Negative (no zone); PA = *P. aeruginosa*; CD = *C. diptheriae*; KP = *K. pneumonia*; SA = *S. aureus*; ML = *M. luteus*; PV = *P. vulgaris*; EC = *E. coli.*

Table 2. Antibacterial assay of selected mushrooms methanol extract against common human pathogens.

Species	PA	CD	KP	SA	ML	PV	EC
Innonatus dryadeus	-	-	-	√	-	-	-
Polyporus varius	√	-	√	-	√	√	-
Fomis fomentarius	√	-	√	√	√	√	√
Ganoderma lucidum	-	√	-	-	-	-	-
Auricularia auricula	-	√	-	√	√	√	-
Ganoderma tsugae	√	-	-	-	√	-	√
Innonatus radiatus	-	-	-	√	√	√	√
Trametes versicolar	√	-	-	√	√	√	-
Daldina concentrica	-	√	-	-	-	-	-
Ganoderma applanatum	-	-	-	-	√	√	-

– = Negative (no zone); PA = *P. aeruginosa*; CD = *C. diptheriae*; KP = *K. pneumonia*; SA = *S. aureus*; ML = *M. luteus*; PV = *P. vulgaris*; EC = *E. coli.*

Table 3. Antibacterial assay of selected mushrooms petroleum ether extract against common human pathogens.

Species	PA	CD	KP	SA	ML	PV	EC
Innonatus dryadeus	-	-	-	-	-	-	-
Polyporus varius	√	-	-	-	√	-	-
Fomis fomentarius	√	√	-	-	-	-	-
Ganoderma lucidum	-	-	-	-	-	-	-
Auricularia auricula	√	√	-	√	√	√	√
Ganoderma tsugae	-	-	-	√	-	-	-
Innonatus radiatus	-	-	-	-	-	-	-
Trametes versicolar	√	√	-	-	-	-	-
Daldina concentrica	-	-	-	-	√	-	-
Ganoderma applanatum	-	-	-	-	√	-	-

– = Negative (no zone); PA = *P. aeruginosa*; CD = *C. diptheriae*; KP = *K. pneumonia*; SA = *S. aureus*; ML = *M. luteus*; PV = *P. vulgaris*; EC = *E. coli.*

Hot water extract was found to be very effective. The activity of the mushrooms varied with the type of extracts. *T. versicolar, I. dryadeus, G. tsugae, G. lucidum,* and *G. applanatum* performed well in hot water extract. *I. radiatus, P. varius* and *F. fomentarius* performed well in methanol extract and *D. concentrica* performed equally with all the three extracts. Many antimicrobial compounds such as terpinoids, lectins, polysaccharides etc. have been reported to be the reason for antimicrobial effects and they are supposed to act on the bacterial cytoplasmic membrane (Lin and Chou, 1964).

The method of extract preparation alters the efficacy because sometimes the high temperature treatment may lower the antimicrobial activity as the active ingredients may degrade (Diker et al., 1991). The variations in the antimicrobial activities of mushrooms may be due to the differences in their bioactive compositions or concentrations, methods of extraction and mechanism of action of active ingredients in these edible mushrooms (Iwalokun et al., 2007). The results suggested that these mushrooms possess compounds with antibacterial properties that can be used as antibacterial agents in new drugs the therapy of infectious disease caused by pathogens.

Conflict of interest statement

Authors declare that they have no conflict of interest.

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