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Short Communication

Innovative Use of Corticioid Fungi Derivatives for Therapy of Antibiotics Resistance to Robust Gram Positive and Gram Negative-Bacteria

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Abstract

Having reviewed the role of different significant phage's in eradication of escalating antibiotics resistance and eradication of multi drug resistant Tuberculosis (MDR) epidemic in India resulting from etiopathogenetisc *Mycobacterium Tuberculosis* agent. The aim of this short communication'' is emphasizing the part of corticioid fungi in treating future infections resulting from drug resistant bacteria. As per authors from Poland, documented the extracts from 58 species of corticioid fungi (phylum Basidiomycota), which basically belonged to the orders Hymenochaetales, Polyporales as well as Russulales, were evaluated for their hampering activity against five species of bacteria: *Corynebacterium striatum, Haemophilus influenzae, Klebsiella pneumoniae, Pseudomonas aeruginosa*, in addition to Staphylococcusaureus14 fungal species investigated, possessed moderate activity against just two bacteria, *P. aeruginosa* in addition to C. striatum; 17 species possessed activity against just *C. striatum.* The total hampering was found with quantities of extract 25 or 50 mg/mL. Thereby putative information whose presence has been accepted since 1940's, however later not pursued has resurfaced with escalating antibiotics resistance, thereby dead trees having such corticioid fungi possessed significant bacteria in contrast to ones without corticioid fungi. Thereby this brings hope for replacing antibiotics with resistance developed due to misuse of antibiotics by we physicians, in generating therapies from derivatives of such corticioid fungi. Hopefully this would be translated in clinical scenario to combat antibiotics resistance or MDR.

Keywords: Antibiotics Resistance; Corticioid Fungi; *Staphylococcus aureus; Klebsiella pneumoniae; Pseudomonas aeruginosa*; MDR

Abbreviations

Bacterial pathogens possess an important part in reference to health problem in humans. The escalating prevalence of antibiotic-resistant strains reinforces the rapid requirement for innovative therapeutic approaches [1,2]. Scientific researchers are escalatingly concentrating on evaluation of utilization of natural initiation for tackling such disturbing pathogens [2]. Certain of the maximum robust inimical bacteria are inclusive of *Staphylococcus aureus, Klebsiella pneumoniae, Pseudomonas aeruginosa, Haemophilus influenzae*, as well as *Corynebacterium striatum*. Noticeably, they have been acknowledged for their correlation with robust respiratory infections, that are bothersome in reference to management in view of their capacity of generating biofilms in addition to form resistance to antibiotics [3].

The aforementioned bacteria possess the capability of apart from causing respiratory diseases, they further result in other health botherations. *Staphylococcus aureus* portray's a gram-positive opportunistic prokaryote that is a significant constituent of the respiratory microbiota [4]. It is a main etiological factor of pneumonia, however further has the capacity of resulting in sinusitis [5], skin as well as cardiovascular infections, sepsis, in addition to, nosocomial bacteremia [6]. *Klebsiella pneumoniae* portray's a gram-negative bacterium that has natural presence in the human digestive tract. In the present decade, it has bounced in the form of a pathogen in view of the escalating of hypervirulent along with antibiotic-resistant strains. It results in infections of the lungs, urinary tract, bloodstream, wound or surgical region, along with brain [7].

Pseudomonas aeruginosa represent 's a gram-negative opportunistic prokaryote observed in humans basically in the gastrointestinal tract (GIT) or on the skin. It is a main constituent of the respiratory microbiota [4] as well as results in pneumonia, bacteremia, urinary tract in addition to, surgical infections [8]. *Haemophilus influenzae* portray's a gram-negative bacterium which gets transmitted by airborne droplets. It is capable of resulting in sinusitis, pharyngitis [5], meningitis, otitis media, along with septicemia [9]. *Coryne bacteriumstriatum* represent 's a gram-positive, multi-drug resistant prokaryote that has the capacity of leading to nosocomial outbreaks. It portray's a normal skin commensal however is capable of stimulating bacteremia, endocarditis, as well as pneumonia in case of appropriate situations [10].

The epidemiological botherations of present time, along with the substantially pacey generation of the resistance of bacteria to commercial antibiotics [11], represent 's the reasons for looking for new antibacterial compounds. Fungi are believed to be a source of plethora of till date not invented antibacterial substances for prospect for further use [12]. There is a plausibility that certain of the new antibacterial compounds will not be of utility in therapy of bacterial infections. This is dependent on the observations that certain antibacterial compounds have been recognized in the form of antibacterial substances which possess antiviral effect against SARS-CoV-2 in addition to an immunomodulatory activity [13]. Deadwood correlated with fungi have illustrated considerable plausibility in the invention of bioactive compounds which possess medicinal characteristics. Such fungi have been recognized to generate secondary metabolites which possess antimicrobial, antiviral, along with anticancer actions, guaranteeing them an attractive resource for drug generation. Research into such fungi might have the capacity of yielding option for tackling botherations for instance antibiotic resistance.

Of the Basidiomycota, corticioid fungi portray a significant group of organisms which result in decaying of wood, observed in total wood- possessing ecosystems on Earth. They are frequent on fallen wood, both small-sized as well as coarse, in temperate in addition to, boreal forests, along with ultimately take part in soil generation. Morphologically corticioid fungi possess the properties of flatfruiting bodies (basidiomata), generally with 0.05–0.5 mm thickness as well as extruded over the substratum in addition to bearing one-celled basidia [14]. Nonetheless, with regards to natural classification, they are part of variable orders of Agaricomycetes, other than occasional transgression of the genera allocated to the classes Dacrymycetes along with Tremellomycetes [15]. Wood-colonizing Basidiomycota inclusive of the corticioid fungi, battle with bacteria for low molecular weight nutrients in wood which is demised [16]. Experimentally it has been shown that the colonization of wood by certain corticioid fungi possesses significantly lesser bacterial cells, in contrast to the wood without such fungi, the manner observed in *Phlebiopsis gigantea* [17], as well as *Resinicium bicolor* [18]. Sequentially, it got recognized that corticioid fungi possess the capacity of generating antibacterial compounds. Certain of such have been identified from the genera *Dentipellis, Merulius, Peniophora, Stereum*, as well as Xylobolus [19]. Nevertheless, neither of such substances have been utilized in reference to commercial purpose till date with regards to application in medicine in addition to, their mechanistic modes on the bacterial cell continue to be uncharted.

There have been plenty of pathfinding articles on the antibacterial characteristics of extracts obtained from the fruiting bodies of wild basidiomycetes, inclusive of three who initially conducted studies that identified corticioid fungi. Wilking along with Harris [20] performed screening 37 corticioid fungi, of whom just 9 species illustrated antibacterial characteristics. In the study by Mathieson [21], 13 species of corticoid fungi were evaluated as well as 3 of them showed antibacterial activity. Wilkins [22], studied 8 corticioid species, 2 of which possessed action against bacteria. In such studies, these authors attained extracts from ground basidiocarps, with or without adding water, in addition to, their application to the agar plates inoculated with bacteria. Such experiment were believed to be a precedence test, while the investigations with fungi identified in pure culture were greater considerable.

In following work, just basidiomata of adequate thickness, length, as well as the manner elimination from the substratum was easy got utilized for antibacterial studies. Gianetti., *et al*. [23] identified the antibacterial compounds: merulinic acids A, B, in addition to C from the fruiting bodies of *Merulius tremellosus* along with *Phlebia radiata*. Zjawiony., *et al*. [24] confirmed that the ethanolic extract of the fruiting bodies of *Byssomerulius incarnatus* possesses antibacterial characteristics against *S. aureus*. Cateni., *et al*. [25], purified along with extracted four substances by methanol from fresh *Stereum hirsutum basidiomata,* as well as displayed the activity of compounds from this fungus against *Mycobacterium tuberculosis*. Ferreira-Silva., *et al*. [26], observed that ethyl acetate

extract from *Stereum ostrea* basidiomata possessed action against *S. aureus*. Tamrakar., *et al*. [27], observed the antibacterial activity of ethanolic extracts from fruiting bodies of *Phlebia tremellosa* in addition to, *Xylobolus princeps*. Sevindik., *et al*. [28], illustrated that ethanolic along with methanolic extracts from fruiting bodies of *Stereum hirsutum* were possessing effects against five species of bacteria. ˙Inci., *et al*. [29], observed that ethanolic extract from *Hymenochaete rubiginosa* basidiomata possessed action against five bacterial strains. For maximum species of corticioid fungi, possessing thin basidiomata an intricately adnate (alias growing closely attached to an adjacent part or organ) to the wooden substratum, no antibacterial investigations have been tried from 1946.

Additionally, a plethora of publications have been obtained subsequent to evaluation of the antibacterial actions of pure cultures of corticioid fungi. In these cases, subsequent application of the live fungi or substances obtained from them was performed against bacteria *in vitro*. The mycelium of corticioid fungi growing on agar/agar fragments subsequent to obtaining from the encompassing of the growing fungi have been utilized in screening studies [30]. The broth from the submerged culture of the fungi was utilized in the experiments [31]. Methanolic extracts of the fully submerged culture of the fungi got examined by Suay., *et al*. [32]. Extracts from mycelia obtained subsequent to submerged cultivation were utilized by Grey., *et al*. [30], as well as Rosa., *et al*. [33]. Methanolic extracts from mycelium subsequent to solid-state cultivation were examined by Zrimec., *et al*. [34].

The objective of this study was to screen the crude extracts of corticioid fungi, inclusive of 24 species for the first time, for antibacterial characteristics against the major presumptive bacteria in the form of agents of respiratory co-infections.

Thereby, Yurchenko., *et al*. [35], extracts from 58 species of corticioid fungi (phylum Basidiomycota), which basically belonged to the orders Hymenochaetales, Polyporales as well as Russulales, were evaluated for their hampering activity against five species of bacteria: *Corynebacterium striatum, Haemophilus influenzae, Klebsiella pneumoniae, Pseudomonas aeruginosa, in addition to Staphylococcus aureus*. Twenty-four of the species in this study were evaluated for antibacterial action for the first time. The fruiting bodies of the fungi were obtained from dead wood in the forests of north-eastern Poland, along with macerated in methanol. Dried extracts were redissolved in dimethyl sulfoxide as well as application on broth cultures of the bacteria was done, which were subsequently inoculated on agar plates. *Noblesia crocea* demonstrated moderate hampering action against total five investigated bacteria; *Amylocorticium subincarnatum, Laxitextum bicolor, Peniophoralaeta*, *P. rufomarginata*, *Phanerochaete sordida,* as well as *Xylobolus frustulatus* hampered four bacterial species. The extracts from 14 fungal species investigated, possessed moderate activity against just two bacteria, *P. aeruginosa* in addition to *C. striatum*; 17 species possessed activity against just *C. striatum*. The total hampering was found with quantities of extract 25 or 50 mg/mL.

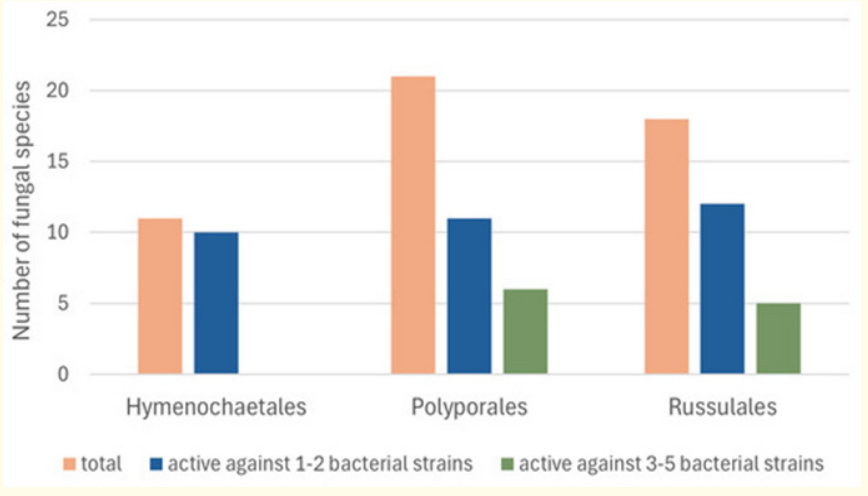

Figure 1: Courtesy ref no-35-Distribution of antibacterial activity according to fungal order.

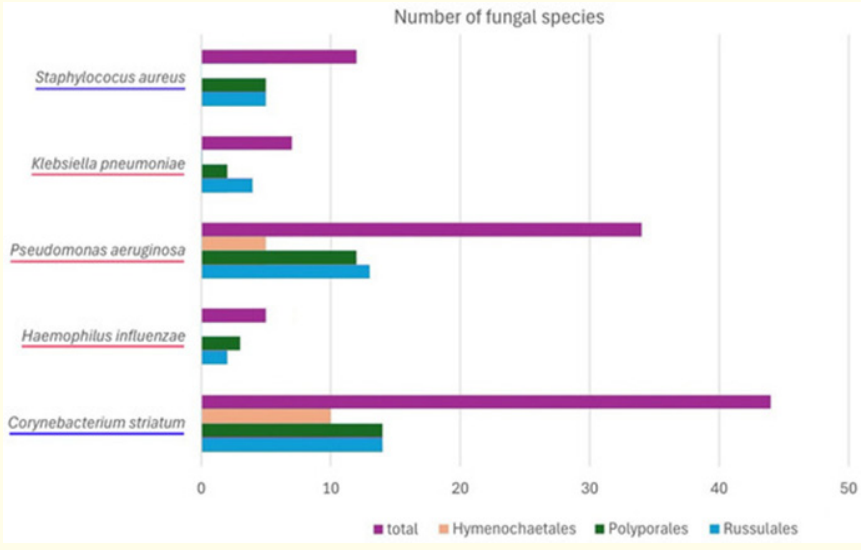

Figure 2: Courtesy ref no-35-Susceptibility of the bacterial strains—the number of fungal species for which inhibition of the strains by at least one of the samples tested was observed. Names of the Gram-positive strains are underlined in blue and the Gram-negative strains in pink.

Conclusions

Having reviewed the role of different significant phage's in eradication of escalating antibiotics resistance and eradication of multi drug resistant Tuberculosis (MDR) epidemic in India resulting from etiopathogenesis *Mycobacterium Tuberculosis* agent [7,36]. The aim of this Short Communication'' is emphasizing the part of corticioid fungi in treating future infections resulting from drug resistant bacteria. As per Yurchenko., *et al*. [35], The extracts from 58 species of corticioid fungi, 14 fungal species investigated, possessed moderate activity against just two bacteria, P. aeruginosa in addition to *C. striatum*; 17 species possessed activity against just *C. striatum*. The total hampering was found with quantities of extract 25 or 50 mg/mL. Thereby putative information whose presence has been accepted since 1940's, however later not pursued has resurfaced with escalating antibiotics resistance, thereby dead trees having such corticioid fungi possessed significant bacteria in contrast to ones without corticioid fungi. Thereby this brings hope for replacing antibiotics with resistance developed due to misuse of antibiotics by we physicians, in generating therapies from derivatives of such corticioid fungi.

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