

ARC '16

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<http://dx.doi.org/10.5339/qfarc.2016.HBSP2870>

Antimicrobial and Cytotoxic Activity of *Streptomyces* sp. Isolated from Desert Soils, Qatar

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Streptomyces are Gram positive aerobic bacteria from the phylum Actinobacteria with close to 570 known species. They are popular for providing a variety of compounds having medicinal properties including - antibiotics, antifungals, antitumor amongst others. Various researches in the past have tested these properties of *Streptomyces* sp. and species including *Streptomyces avermitilis*, *Streptomyces venezuelae*, *Streptomyces aureofaciens*, *Streptomyces clavuligerens* and *Streptomyces erythreus* have been found effective in producing these varied compounds. For instance, *S. avermitilis* produces avermectins which are used to treat river blindness while *S. venezuelae* secretes chloramphenicol. Additionally *S. venezuelae* has been suggested as ideal test organism for studies based on physiology and also for analysis of differentiation on biochemical basis (Chater, 2013). Although a high number of metabolites of *Streptomyces* are now available in the health care industry as effective drugs for a variety of diseases, increasing number of cases of antibiotic resistance is threatening global public health. The emergence of resistance has resulted in drug ineffectiveness and there is a wide search for suppressing these strains. Such resistance has been identified to have occurred due to both phenotypic and genotypic modifications (Suzuki, Horinouchi, & Furusawa, 2015). Properties of *Streptomyces* and increasing cases of antibiotic resistance have fuelled research to identify more and more species of *Streptomyces* and to look out for novel metabolites released from them. Other reasons for the need of identifying newer compounds include the breakout of new diseases in the second half of the last century, incompetence in fighting naturally resistant bacteria such as *P.aerogenosa* that causes fatal infections and the toxic effects resulting from consumption of currently available antibiotic drugs (Sanchez & Demain, 2011).

Hence this research attempted to study antimicrobial properties of three *Streptomyces* species isolated from the desert soil of Qatar. The antimicrobial properties were assessed firstly through direct testing against five test organisms - *Escherichia coli* and *Pseudomonas* sp. as Gram-negative bacteria, *Candida albicans* as fungi, *Staphylococcus aureus* and *Streptococcus faecalis* as Gram-positive bacteria. The three strains designated as

Cite this article as: Shaikh SS. (2016). Antimicrobial and Cytotoxic Activity of *Streptomyces* sp. Isolated from Desert Soils, Qatar. Qatar Foundation Annual Research Conference Proceedings 2016: HBSP2870 <http://dx.doi.org/10.5339/qfarc.2016.HBSP2870>.

sp. A, sp. B and sp. D exhibited good inhibition of the test organisms. Acetone, ethanol, ethyl acetate and methanol were used to prepare extracts of the three species and were used to re-assess antibacterial properties and also determine anticancer and antifungal properties. Antimicrobial properties were re-tested using disc-diffusion and puncture method while anticancer properties were studied by subjecting HCT-116 cancer cells to two different concentrations of extracts – 0.05%(v/v) and 0.5%(v/v). Acetone extracts showed some kind of inhibitory pattern hence a third concentration of 5%(v/v) was tested. Antifungal properties were examined by testing all extracts at 10%(v/v) against *Aspergillus niger* and *Penicillium* sp. Acetone extracts of all three species A,B and D displayed high inhibition of *Aspergillus niger* with $99.07\% \pm 0.12$, $99.2\% \pm 0.01$ and $99.19\% \pm 0.00$ inhibition percentages respectively, and also inhibited growth of *Penicillium* sp. with $82.62\% \pm 1.62$, $79.63\% \pm 0.11$ and $87.44\% \pm 0.2$ inhibition percentage respectively (% as compared to acetone control). These extracts were then re-tested at two other concentrations of 2.5%(v/v) and 5%(v/v). While the extracts at these concentrations were effective against *Aspergillus niger*, they could not inhibit growth of *Penicillium* sp.

References

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