

Antagonistic Activity of *Streptomyces* sp. LCC-05 Isolated from the Chennai Coast of Bay of Bengal, India

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Abstract: *Streptomyces* sp. is known to produce two-third of pharmaceutically imperative antibiotics. They are predominantly found in terrestrial environment. In the current study, soil samples were collected from the Chennai coast along Bay of Bengal, India. Pre-treatment of soil was implemented by enrichment techniques paving the growth of slow growing Actinobacteria and obstructing gram negative bacteria. After serial dilution method, suspension from 10^{-4} dilution was inoculated in starch casein agar medium. Isolated culture inoculate from colony was examined based on morphological characteristics, that proved it to be a *Streptomyces* sp. and was named as *Streptomyces* sp. LCC-05. It was grown in Production medium-I, as it revealed favorable results and was further optimized for significant antibiotic production. Biomass free broth was mixed with equal concentration of ethyl acetate and methanol (1:1, v/v). Secondary metabolite extract so obtained was air dried and observed for their antimicrobial activity. They exhibited an incredible result against gram positive, gram negative and fungi. *Streptomyces* sp. LCC-05 like every other species from Actinobacteria possesses a tremendous antimicrobial activity and marine environment is one of the appropriate locations for isolating *streptomyces* sp.

Keywords: *Streptomyces* sp., isolation, antimicrobial activity, drug discovery and marine soil.

1. Introduction

Ocean covers 70% of earth's surface and encompasses diverse structural and functional chemotherapeutic agents^{1,2}. Microbes in ocean grow in high salinity with deviations in temperature, pressure, pH and oxygen concentration³. This evolutionary progress has led to physiological and metabolic diversity⁴. Actinomycetes isolated from marine environment produce prolific antibiotics as they have a large genome with hundreds of transcription factors for controlling gene⁵.

Few of those antibiotic isolated are streptomycin, erythromycin, anthracycline, doxorubicin, kanamycin and rapamycin⁶. Their secondary metabolites display activities like antimicrobial, antitumorigenic, antioxidant, immunosuppression, enzyme inhibition, immunomodulation and other regulatory functions^{7,8}. Composition of culture media also influences biosynthesis of antibiotics⁹. *Streptomyces* sp., the largest genus of Actinobacteria is the foremost pharmaceutical organism¹⁰.

There are more than 200 known diseases caused by human pathogenic microbes. The hunt for less toxic, novel potent drug to overcome resistance against long-standing antibiotics has begun in the arena of drug discovery¹¹. The aim of the present study is to isolate *Streptomyces* sp. from the Chennai coast of Bay of Bengal, India and to their action against human pathogens.

2. Materials and Methods

Isolation of *Streptomyces* sp. LCC-05

Marine soil samples were collected along the Chennai coast of Bay of Bengal, India. The soil was treated with calcium

carbonate to escalate the growth of Actinomycetes. The suspension obtained from serial dilution method was inoculated in starch-casein agar (SCA) medium and grown for 14 days at 37°C. Culture isolate from colony was retrieved in SCA medium. Morphological characteristics like mycelial structure, spore formation, color and adherence to agar surface, the isolate was found to be *Streptomyces* sp. and named as LCC-05, where LCC represents "Loyola College Chennai".

Extraction of Secondary metabolite

Inoculation of *Streptomyces* sp. LCC-05 in production medium-I boosted the production of antibiotics and was grown for 14 days at room temperature. Biomass was filtered and the broth media was mixed with equal concentration of ethyl acetate and methanol (1:1, v/v) for secondary metabolite extraction. The extract was air-dried and considered for their antimicrobial activity.

Antimicrobial activity

Antimicrobial activity was carried by well diffusion method and pathogenic strains like *Staphylococcus aureus*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Klebsiella pneumonia*, *Escherichia coli* were obtained from Microbial type cell culture (MTCC), Chandigarh, Punjab, India. Bacterial strains were grown in Mueller-Hinton agar medium and *Candida albicans* was grown in potato dextrose agar medium. The Secondary metabolite extract dissolved in DMSO was poured in well with concentrations 25uL, 50uL, 75uL and 100uL and zone of Inhibition were measured.

3. Result

Table.1 represents the aftermath of secondary metabolite extracted from *Streptomyces* sp. LCC-05, and their counter to disease causing pathogens.

Table 1: Antimicrobial activity of LCC -05

| S.No. | Test organism | Zone of inhibition per concentration (mm) | | | |
|-------|-------------------------------|---|------|------|-------|
| | | 25uL | 50uL | 75uL | 100uL |
| | Gram Positive | | | | |
| 1. | <i>Staphylococcus aureus</i> | 10 | 11 | 13 | 15 |
| 2. | <i>Bacillus subtilis</i> | - | 10 | 11 | 13 |
| | Gram Negative | | | | |
| 3. | <i>Pseudomonas aeruginosa</i> | - | 10 | 11 | 12 |
| 4. | <i>Klebsiella pneumonia</i> | - | 10 | 11 | 12 |
| 5. | <i>Escherichia coli</i> | 10 | 11 | 13 | 14 |
| | Fungi | | | | |
| 6. | <i>Candida albicans</i> | - | 10 | 11 | 13 |

4. Discussion

Secondary metabolite extracted from *Streptomyces* sp. LCC-05 acts against a wide range of diseases and the above result has just evidenced in accordance with it. The extract was tested against disease causing microbes and they unveiled a magnificent result towards gram positive bacteria in comparison to gram negative bacterial strain and fungal pathogen. The least and the highest concentration of 25uL and 100uL showed paramount results against *Staphylococcus aureus* and *Escherichia coli*. The former displayed the highest zone of inhibition of 15mm and the later with 14mm. *Candida albicans* are the most common fungi affecting human beings. Extracts of *Streptomyces* sp. LCC-05 indicated a finest result of 13mm against them and were illustrating a broad spectrum of activity.

5. Conclusion

Streptomyces sp. LCC-05 isolated from the marine soil of Chennai shores, along the coast of Bay of Bengal, India possesses an exceptional activity against human disease causing microbes.

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