International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

Antimicrobial Activities of *Streptomyces* sp. Obtained from Garden Soil

Pallavi

Assistant Professor, Department of Botany, Ganga Devi Mahila Mahavidyalaya
(Constituent College Under Patliputra University)
Kankarbagh, Patna-800020, Bihar, India

Abstract: ***Streptomyces sps. is well known antibiotic producing Actinomycetes. These are most abundant strains of bacteria present in soil. In present study, Streptomyces sps. was isolated from garden soil samples collected from Patna town (Bihar, India). Samples were identified as Streptomyces sp. with help of morphology, microcopy and biochemical tests. Antimicrobial activities of isolated bacteria was examined against three pathogenic fungal members such as Penicillium sp., Candida albicans and Aspergillus niger as well as three pathogenic bacteria such as Escherichia coli, Salmonella typhi and Enterococcus faecalis. Cell free supernatant of Streptomyces species is used for this experimental study. The zone of inhibition of pathogens were measured after 2 and 5 days of incubation. Penicillium sp. was observed as most sensitive and showed 28 mm and 26mm zone of inhibition after 2 and 5 days of incubation. Candida albicans, Escherichia coli and Enterococcus faecalis showed similar sensitiveness as 20 mm zone of inhibition after 2 days of incubation. Aspergillus niger remained least sensitive (5-6 mm zone of inhibition). Almost all pathogens remained more sensitive after 2 days of incubation. The results indicates that Streptomyces sp. can be used as biocontrol agent for pathogenic microbes.***

Key words: Antimicrobial, *Streptomyces* sp., Garden Soil, Pathogenic microbes

1.Introduction

Streptomyces sp. is a group of mycelium forming soil bacteria. *Streptomyces* sp. is known for production of several antiobiotics as secondary metabolites (Hitit *et al*.2022). Continuous efforts are being made in direction of identification of new bioactive compound produced by these filamentous bacteria. They are known for production of extracellular microbicidal compounds particularly the antibiotics (Janandhan *et al*.2014). Different species belonging to Actinomycetes are known for inhibition of the growth of pathogenic fungi (Oskay, 2009, Djebaili, 2021). *Streptomyces* sp. remain highly affected by the physicochemical conditions of the soil such as temperature etc. (Kaur *et al*.2019). These bacteria remain most abundant in acidic soil and less abundant in alkaline soil. *Streptomyces* sp. are identified on the basis of morphological and biochemical properties. These are long-chain spore producing filamentous prokaryotic bacteria. Exploration of the antimicrobial potentiality of *Streptomyces* sp. became more important due to increasing resistance of plant and human pathogenic fungi and bacteria towards synthetic chemical antibiotics. As well as use of *Streptomyces* sp. as biocontrol agent for crop infecting fungi will ultimately reduce concentration of chemical pesticides in food grains. In the pretext of above-mentioned facts, evaluation of the antimicrobial capability of *Streptomyces* sp. obtained from garden soil of Patna against pathogenic fungi such as *Penicillium* sp., *Candida albicans* and *Aspergillus niger* as well as pathogenic bacteria such as *Escherichia coli, Salmonella typhi* and *Enterococcus faecalis* was evaluated during present research work. Several scientists evaluated antifungal activities of *Streptomyces* sp. But effectivity of *Streptomyces* sp. against plant and human pathogens was not comparative examined uptill now.

The antimicrobial potentiality of extracellular metabolites produced by *Streptomyces* sp. was reported from different locations of the world, but there is not documented information available about antimicrobial activity of soil borne *Streptomyces* sp. obtained from soil of Patna town. Present study was conducted to fill-up this gap present in available literature.

2.Materials and Method

Soil samples were collected from 4 cm depth from the soil surface of a garden situated at Patna City locality. The soil samples were taken with a sterile spatula and kept in sterilized polythene bags. These samples were transferred to laboratory. Soil was suspended in distilled water and heated for 5 minutes at 55^{o}C temperature. Serial dilutions were prepared. Isolated bacteria was cultured on Yeast malt extract Agar (ISP2) medium and single colony screening was made. Identification of *Streptomyces* sps. was conducted by morphological observations and biochemical tests as prescribed by Oskay (2009).

Fungal specimens such as *Penicillium* sp., *Candida albicans* and *Aspergillus niger* were isolated from infected materials and cultured on Potato dextrose agar (PDA) plates adopting standard protocol mentioned by Babu *et al. (*2022).

Pathogenic bacterial samples were obtained from a reputed pathological laboratory of Patna. *Escherichia coli, Salmonella typhi* and *Enterococcus faecalis* were cultured on Mueller-Hinton broth and stored in nutrient agar at 4^{o}C.

Agar discs (6 mm diameter) seeded with *Streptomyces* sp. was transferred to the surface of respective fungi and bacterial culture containing petri dishes and kept in incubator for 24 hrs. The antifungal and antibacterial activity around the cultures were recorded after 2 and 5 days of incubation by measuring zone of inhibition in mm.

3.Result and Discussion

Pathogenic microorganisms cause serious problem around the world. Natural products such as extracellular metabolites produced by *Streptomyces* sp. can control these pathogenic fungi and bacteria (Kumar *et al*., 2010). Chemical toxigenic materials remain toxic to other beneficial organisms and also accumulates in soil due to slow degradation process. These synthetic materials also remain responsible for development of resistance among pathogens. Some species of Actinomycetes are reported as biocontrol agents that inhibit spread of pathogens. Thus, *Streptomyces* sp. isolated from Garden soil of Patna was evaluated for their ability to inhibit pathogenic fungi and bacteria.

The colony of *Streptomyces* exhibited good growth. The colour of aerial mass and substrate mycelium were observed as white-bluish grey and pale-greenish yellow respectively. Spiral spore chain was observed with grey colour. The shape of spore remained oval. Melanoid pigment production was also detected. Negative results of methyl red test as well as Voges-Proskauer test and positive results of Citrate, Catalase and Oxidase test confirmed the specimen as *Streptomyces* sp. Gram Staining of this actimycetes showed positive result.

Cell free supernatant of *Streptomyces* was used for test of antimicrobial activities against three pathogenic fungi and three pathogenic bacteria. The results obtained is presented in below mentioned table.

Table 1: Antimicrobial activities of cell-free supernatant of *Streptomyces* sp. obtained from Garden Soil.

Sl. No.	Target Microbe	Zone of Inhibition (in mm)	
		After 2 days	After 5 days
1.	*Penicillium* sp.	28	26
2.	*Candida albicans*	20	20
3.	*Aspergillus niger*	05	06
4.	*Escherichia coli*	20	18
5.	*Salmonella typhi*	12	10
6.	*Enterococcus faecalis*	20	16

The zone of inhibition in *Penicillium* sp. was observed as 28 and 26 mm after 2 and 5 days of inoculation respectively. The zone of inhibition remained similar in *Candida albicans* after 2 and 5 days of inoculation as 20 mm. The minimum zone of inhibition was observed in *Aspergillus niger* as 5 and 6 mm after 2 and 5 days of inoculation respectively. The zone of inhibition in *Escherichia coli, Salmonella typhi* and *Enterococcus faecialis* were observed as 20, 12 and 20 mm respectively after 2 days of inoculation. Reduced zone of inhibition was observed in all bacterial specimens after 5 days of inoculation as compared to 2 days of inoculation. This result indicates about reduction of anti microbial activity of cell free supernatant of *Streptomyces* by increase of days of inoculation.

Ayari *et al*. (2012) also observed during their research work that *Streptomyces* sp. produces antifungal compounds effective for control of *Aspergillus fumigatus* and *Candida albicans.* Oskay (2009) observed antibacterial activity of *Streptomyces* sp. for effective control of several human pathogenic bacteria such as *S. aureus, K. pneumonia, E. coli* and *S. typhimurium.* Babu *et al*. (2022) observed the efficacy of secondary metabolites produced by *Streptomyces* against pathogenic bacteria and fungi. They obtained significant results. They pointed out that determination of the molecular structure of bioactive metabolites produced by *Streptomyces* will be the subject of future research. Thus, it became clear that the results obtained during present research work corresponds with the results obtained by Oskay (2009), Ayari *et al*. (2012) and Babu *et al*. (2022).

4.Conclusion

The *Streptomyces* sp. obtained from Garden soil of Patna was identified by morphological observations and biochemical tests. Among all six pathogens examined during present research work maximum sensitivity was exhibited by *Penicillium* sp. and minimum by *Aspergillus niger* with regard to *Streptomyces* sp. Among pathogenic bacteria *Escherichia coli* and *Enterococcus faecalis* exhibited more sensitivity as compared to *Salmonella typhi.* Thus, it can be concluded on the basis of results of this study that *Streptomyces* sp. remain as effective biological agent for control of pathogenic microbes such as *Penicillium* sp., *Candida albicans, Escherichia coli* and *Enterococcus faecalis.*

References

[1] Ayari, A., Morakchi H. and Djamila K. G., 2012, Identification and antifungal activity of *Streptomyces* sp. S72 isolated from Lake Oubeira sediments in North-East of Algeria, *African Journal of Biotechnology,* 11 (2): 305-311.
[2] Babu M. K., Shabana S., Erum I., Kadhim Q. T. and Satya A. K., 2022, Secondary metabolites of *Streptomyces* and their antibacterial, antifungal properties, *International Journal of Innovative Research in Technology,* 9 (4): 502-508.
[3] Djebaili R., Pellegrini M., Bernardi M., Smati M., Kitouni M. and Del Gallo M., 2021, Biocontrol activity of actinomycetes strains against fungal and bacterial pathogens of *Solanum lycopersicum* L. and *Daucus carota* L. : *In vitro* and in planta antagonistic activity, *Biology and Life Sciences Forum,* 4: 27.
[4] Hitit Z. Y., Eldemir S., Buyukegen H., Kesenci K., Ertuns S. and Akay B., 2022, The isolation of *Streptomyces* species in different soil sources from middle Anatolian Regions of Turkey, *Journal of the Turkish Chemical Society,* 5 (2): 157-166.
[5] Janandhan A., Kumar A. P., Vishwanath B., Saigopal D. V. R. and Narasimha G., 2014, Production of bioactive compounds by actinomycetes and their antioxidant properties, *Biotechnol. Res. Int.,* 217030.
[6] Kaur T., Rani R. and Manhas R. K., 2019, Biocontrol and plant growth promoting potential of

phylogenetically new *Streptomyces* sp. MR14 of rhizospheric origin, *AMB Express,* 9: 125.

[7] Kumar N., Singh R., Mishra S., Singh A. and Pachouri U. G., 2010, Isolation and screening of soil Actinomycetes as source of antibiotics active against bacteria, *Int. J. Microbiol. Res.,* 2: 12-16.

[8] Oskay M., 2009, Antifungal and antibacterial compounds from *Streptomyces* strains, 8 (13): 3007-3017