

Diversity of *Actinomycetes* from Muthupet mangrove sediment of Tamilnadu, South India

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Abstract

A total number of 55 strains of *Actinomycetes* were isolated from mangrove sediments of Muthupet Coast of Tamilnadu. Among them only 16 isolates were morphologically distinct and from them 10 predominant organisms were selected and their morphological, cultural and biochemical characteristics were described.

Keywords: *Actinomycetes*, biochemical characteristics, biodiversity, cultural characteristics, mangrove soil, population dynamics

INTRODUCTION

Actinomycetes are gram positive bacteria with high G+C content in their DNA, and are generally considered to be an intermediate group between bacteria and fungi but now are recognized as prokaryotic organisms (Xu *et al.*, 2005). They are well known for the production of secondary metabolites. They produce many Industrially important metabolites like, antibiotics, enzyme inhibitors, immunomodifiers and some pigments. There is a great promise to develop several biotechnological industries using *actinomycetes*.

Most of the *actinomycetes* have clinical applications on the basis of their activity against different kinds of microorganisms *viz.*, antibacterial, antiparasite (Campbell *et al.*, 1983) and antiviral (Hayashi *et al.*, 2000).

Augustine and Kapadnis (2005) reported diversity of *actinomycetes* from different locations in three Indian states *viz.*, Maharashtra, Karnataka and Kerala. Steger (2006) reported *actinomycetes* from inorganic matter such as composts. John *et al.* (2007) reported that the influence of wildfires on microbial community populations including *actinomycetes* in the flood plains of the Okavango Delta of Botswana. Paul *et al.* (2007) reported the association between secondary metabolite production and phylogenetically distinct but closely related marine *actinomycetes* species belonging to the genus *Salinispora*. This paper describes the diversity of *actinomycetes* in the sediments of Muthupet mangroves, South India.

MATERIALS AND METHODS

ISOLATION OF ACTINOMYCETES

Sediment samples that were collected from Chief Corner Area in Muthupet mangrove forest by Geological

Survey of India were used for the present study. Soil samples were obtained from a depth 10-15 cm from the surface of the soil. The texture of the soil was sandy with brown to blackish colour. Then, 10 fold serial dilution of the samples were prepared, using filtered and sterilized 50% sea water. 1 ml of the serially diluted sample was plated in the starch casein agar medium and incubated at 28°C for 2-3 weeks. All the colonies that were growing on the petriplates, were sub cultured, ensured for their axenicity and maintained in slants.

Characterization

Characterization of isolates was done according to ISP procedure (Waksman 1961, Shirling and Gottlieb 1966). The protocols include the use of physico-chemical parameters, culture characteristics, and microbiological and biochemical tests. Biochemical and carbohydrate fermentation was determined by the method of Shirling and Gottlieb (1966). The production of carbohydrate fermentation has been considered for the identification of *Streptomyces* sp. production of citrate and urease was considered for characterizing *actinomycetes* as per Nitsch and Kutzner, (1969) and O' Callaghan *et al.* (1972).

RESULTS AND DISCUSSION

Totally 55 strains of *actinomycetes* were isolated from the mangrove soils, of the Chief Corner Area in Muthupet mangrove forest. Diversity of *actinomycetes* isolates was high, perhaps due to the nutritive status of the soil. The physico-chemical features of the test soil are given in Table 1. The cultural and biochemical characteristics of the isolates are presented in tables 2 & 3, respectively.

The first report on marine *actinomycetes* was made by Nadson (1903) from the salt muds of St. Petersburg. Other reports on the isolation of *actinomycetes* from marine soil were by Dhanasekaran *et al.* (2005); Kathiresan *et al.* (2005) and Chen *et al.* (2005). Various biochemical characteristics of the *actinomycetes* for the identification was reported Waksman (1957)

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Table 1. Physico-chemical characterization of sediment soil of Chief Corner Area of Muthupet mangroves, South India

S.No	Physico-chemical parameters	Values
1	pH	7.2
2	Temperature (°C)	31
3	Total Dissolved Solids (ppt)	2.26
4	Electrical Conductivity (ppt)	142
5	Turbidity (NTU)	60.2

Table 2. Cultural characteristics of *Actinomycetes* isolates from the sediment soil of Chief Corner Area of Muthupet mangroves, South India

S.No.	Actinomycetes isolates	Colour of mycelium	Other characters
1	<i>Streptomyces</i> sp.	White	2.5mm, flat with pearls like arrangement
2	<i>Micro monospora</i> sp.	Light Yellow	2.5mm, centrally raised with round margin
3	<i>Streptomyces</i> sp.	Dark Ash	4mm, ash substrate mycelium
4	<i>Pseudonocardia</i> sp.	Creamy White	2mm, pale yellow substrate mycelium
5	<i>Catellospora</i> sp.	Yellow with Brown	2.4mm, centrally raised with flat margin
6	<i>Actinolithospora</i> sp.	Ash with Brown	4.5mm, dark brown substrate
7	<i>Actinoplanes</i> sp.	Pale Yellow	3mm, yellow substrate mycelium.
8	<i>Actinomodurus</i> sp.	Sandal Yellow	2.5mm, fully yellow margin
9	<i>Agromyces</i> sp.	Light White	2.5mm, sandal colour substrate mycelium
10	<i>Streptovercillium</i> sp.	Light Gray	6mm, dark brown substrate mycelium

Table 3. Biochemical characteristics of *Actinomycetes* sp. recorded in the sediment soil of the Chief Corner Area of Muthupet mangroves, South India

S. No	Actinomycetes isolates	Indole	Methyl red	Voges Proskauer	Citrate	Urease	Nitrate	CHO
1	<i>Streptomyces</i> sp.	-	+	-	+	+	-	+
2	<i>Micro monospora</i> sp.	-	-	-	+	+	+	-
3	<i>Streptomyces</i> sp.	-	+	-	+	+	-	+
4	<i>Pseudonocardia</i> sp.	-	-	-	+	+	-	-
5	<i>Catellospora</i> sp.	-	-	-	+	+	-	-
6	<i>Actinolithospora</i> sp.	-	+	-	+	+	-	-
7	<i>Actinoplanes</i> sp.	-	-	-	+	+	-	-
8	<i>Actinomodurus</i> sp.	-	-	-	+	+	+	-
9	<i>Agromyces</i> sp.	-	-	-	+	+	-	-
10	<i>Streptovercillium</i> sp.	-	-	-	+	-	-	-

and Manfio *et al.* (2003). The present investigation clearly reveals that the diversity and distribution of *actinomycetes* population were high in the Chief Corner Area in Muthupet mangrove. Further more the present investigation lends support to the view that the isolates of *actinomycetes* vary in their ability to reduce nitrogen and hence this aspect could potentially be used as a taxonomic criteria.

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REFERENCES

- Augustine, S.K. and Kapadnis, B.P. 2005. Bioactive compounds from *actinomycetes* with a potential to inhibit pathogenic fungi. *J. Microb. World*, 7: 328 - 331.
- Campbell, W.C., Fisher, M.H., Stapley, E., Schonbery, A. and Jacob, T.A. 1983. Ivermectin a potent new antiparasitic agent. *Am. Assoc. Adv. Sci.* 221: P. 823 - 828.
- Chen, M., Xiao, X., Wang, P., Zeng, X. and Wang, F. 2005. *Arthrobacter ardleyensis* sp. isolated from Antarctic lake sediment and deep -sea sediment. *Arch. Microbiol.*, 183: 301-305.
- Dhanasekaran, D., Sivamani, P., Arunagirina-than, N., Panneerselvam, A. and Thajuddin, N. 2005. Screening and identification of antibiotic producing strains of marine *Streptomyces*. *J. Microbial. World* 7: pp. 62-66.
- Hayashi, K., Kawahara, K., Nakai, C., Sankawa, U., Seto, H. and Hayashi, T. 2000. Sphydrofuran derivative isolated from a *Streptomyces* sp. as an antiviral herpes virus drug. *J. Antimicrobial. Chemotherapy*, 46, pp 181-189.
- John, T.M., Wutor, V.C., Yeboch, S.O. and Ringrose, S. 2007. Microbial community structure and soil biochemical properties in the Okavango Delta, Botswana. *Sci. Res. Essays*, 2: 047 - 054.
- Kathiresan, K., Balagurunathan, R. and Masilamani Selvam, M. 2005. Fungicidal activity of marine *actinomycetes* against phyto pathogenic fungi. *Indian. J. Biotechnol.* 4: 27- 276.
- Manfio, G.P., Atalan, E., Zakrzewska, C.J., Mordarski, M., Rodriguez, C., Collins, M.D. and Good fellow, M. 2003. Classification of novel soil *Streptomyces* as *Streptomyces aureus* sp. nov. and *S. laceyi* sp. nova. *S. sangalieri*. *Ant. Von Leeuwenhoek*, 83: 245-255.
- Nadson, G.A., 1903. Microorganisms, Kak geoligitsheskie dieiatieu. Comm. Inv Salvian Mineral lakes, st. petersbourg. *Nat. Biotechnol.*, 21: 526 -531.
- Nitsch, B. and Kutzner, H.J. 1969. Decomposition of oxalic acid and other organic acids by *Streptomyces* as a taxonomic aid. *Z. Allg. Microbiol.*, 9: 613 -632.
- O' Callaghan, C., Morris, A. Kirby, S.M. and Shingler, A.H. 1972. Novel methods for detection of β -lactamase by using a chromogenic cephalosporin substrate. *Antimicrob. Agents Ch.* 1: 283- 288.
- Paul, R., Jensen, P., Williams, G., Chan, D., Zeigler, L. and Finical, W., 2007. Species - specific secondary metabolite production in marine *Actinomycetes* of the genus *Salinispora*. *Appl. Environ. Microbiol.*, 73: 1146-1151.
- Shirling, E.B. and Gottlieb, D. 1966. Methods for characterization of *Streptomyces* species. *Int. J. Syst. Bacteriol.*, 16: 312 -340.
- Steger, K., 2006. Composition of Microbial Communities in Composts. A tool to Assess process Development and Quality of the final product. Ph.D. Thesis *Swedish University of Agriculture Sciences, Uppsala*.
- Tao, M., Wang, L., Wendt - Plenkowski, E., George, N.P., Galm, V., Zhang, G., Coughlin, J. M., Shen, B., 2007. The tallysomycin biosynthetic gene clusters from *Streptoalloteichus hindustanus* E465 -94 ATCC 31158 Unveiling new insights in to the biosynthesis of the bleomycin family of antitumor antibiotics. *Mol. Biosyst.*, Jan; 3: 60 -74.
- Waksman, S.A., 1957. Species concept among the *actinomycetes* with special reference to the genus *Streptomyces*. *Bact. Rev.*, 21:1 -29.
- Waksman, S.A., 1961. The *Actinomycetes*: classification, identification and descriptions of genera and species. Vol, II, Williams and Wilkins co., Baltimore, U.S.A., P. 363.
- Xu, L.H., Yang, Y., Wen Jun, L., Lang Wen, M., Gang, M.L. and Jiang, C.L. 2005. *Streptomyces roseoalbus* sp. nov., an *actinomycetes* isolated from soil in Yunnan, China. *Ant. Von. Leeuwenhoek*. 87: 189 - 194.