



## Note

### Studies on the distribution of actinobacteria in the Gaderu mangroves of Gautami Godavari estuarine system, east coast of India

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#### Abstract

Occurrence of actinobacteria species in mangrove sediments of the Gaderu River of Gautami- Godavari estuarine system was studied during May 2007. The actinobacteria cultures were grown on czapeks agar, tyrosine agar, kuster agar, oatmeal agar and glucose-asparagine agar media. Twenty two strains of actinobacteria were isolated from the mangrove sediments. Of these isolates, fourteen isolates belonged to the genus *Streptomyces*; three isolates to *Streptovercillium*, and four isolates to *Micromonospora*. The genus *Streptomyces* was represented by three species viz., *S. parvulus*, *S. flavoviridis* and *S. lusitanus*. The distribution of actinobacteria species is compared with similar studies elsewhere in India.

The screening of natural microbial products is an important route to the discovery of novel chemicals for the development of new therapeutic agents. Wildman and Kurtboke (1998) pointed out the paucity of data on screening of microbial populations for antibiotics. Takizawa *et al.* (1993) stated that approximately two-thirds of the naturally occurring antibiotics are produced by actinobacteria. Aquatic environment is one of the potent sources for actinobacteria with high antimicrobial activity (Okami and Okazaki, 1972). There are earlier investigations on mangrove actinobacteria from India (Lakshmanaperumalsamy, 1978; Vanajakumar, 1979; Balagurunathan, 1992; Ratnakala, 1993; D' Souza *et al.*, 2000; Siva Kumar, 2001; Niladevi and Prema, 2005; Sahu *et al.*, 2005, 2007; Siva Kumar *et al.*, 2005 a, b; Senthilkumar *et al.*, 2005; Surajitdas *et al.*, 2006). In the present investigation, an effort has been made to screen the actinobacteria from the mangrove sediments of the Gaderu River of Gautami-Godavari estuarine ecosystem, east coast of India.

#### Materials and methods

Twenty four sediment samples were collected from seven mangrove stations in the Gaderu mangroves (Fig. 1). The Gaderu mangroves are

dominated by *Avicennia* and *Excoecaria* forests. Station 1 is located in young *Avicennia marina* vegetation. Station 2 is covered with *Excoecaria agallocha* and *Acanthus ilicifolius* species. Station 3 is composed of mixed vegetation of *Avicennia* and *Excoecaria*. Station 4 is located in the well grown *Avicennia* forest. Station 5 is again mixed vegetation of *Avicennia* and *Excoecaria* forest. Station 6 is located in *Sonneratia* vegetation in an *Avicennia* forest. Station 7 is dominated by the salt marsh plant *Salicornia*. At stations 1 to 5, samples were collected from four sampling points per station. Of these, 1 and 2 sampling points are located along the channel. Sampling points 3 and 4 are located interior into the forest. At stations 6 and 7, samples were collected from two sampling points along the channel. Isolation of actinobacteria was carried out by soil dilution technique and cultures were grown on different agar media namely, kuster agar, czapeks agar, oatmeal agar, glucose-asparagine agar and tyrosine agar using 50% aged seawater. The cultures were aseptically incubated upto seven days at 32°C and purified isolates of actinobacteria were identified upto genus level using standard taxonomic keys (Waksman, 1961; Krasilnikov, 1964; Bergey, 1989). The densities of actinobacterial populations were expressed as nos.

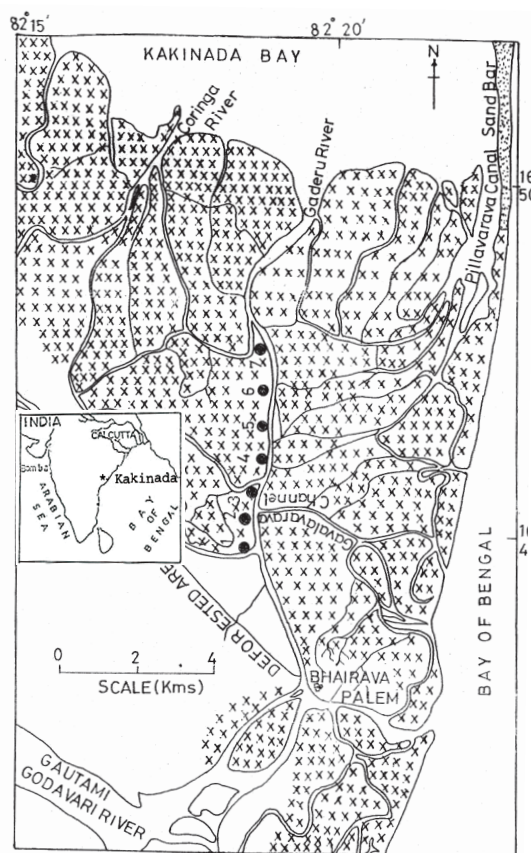


Fig. 1. Map showing the sampling stations 1 to 7 in the Gaderu mangroves, Gautami-Godavari estuarine system, xxx... forest area

$\times 10^2$  cfu/g. The genus *Streptomyces* was identified upto species level as per International *Streptomyces* Project (Shirling and Gottlieb, 1966). Physico-chemical parameters of mangrove sediments were also collected. Temperature was measured using hand-held thermometer (0.1°C sensitivity). Salinity was measured using Knudsen's method (Strickland and Parsons, 1972). Sediment pH was measured by digital pH meter (Hanna). Sedimentary organic matter (S.O.M) was determined by using chromic acid digestion method (Jackson, 1967).

### Results and discussion

The physico-chemical parameters did not fluctuate widely between stations during the present study. The mean values of temperature (°C), salinity

(ppt), pH and sedimentary organic matter (%) were 32.2, 25.7, 7.4 and 2.41 respectively. The distribution of salinity and sedimentary organic matter (Table 1) indicate the presence of saline conditions and high organic matter load in the studied habitat. Of the twenty two strains isolated, fourteen belonged to the genus *Streptomyces*, three belonged to the genus *Streptoverticillium* and four isolates belonged to the genus *Micromonospora*. The genus *Streptomyces* was represented by *S. parvulus*, *S. flavoviridis* and *S. lusitanus* and was recorded in the stations dominated by *Avicennia* and *Salicornia* vegetation (Stations 1, 4 and 7). The genus *Micromonospora* was dominant in the stations dominated by mixed vegetation of *Excoecaria* and *Acanthus* (Stations 3 and 4). The preference of *Micromonospora* to the mixed vegetation of *Excoecaria* and *Acanthus* could not be attributed to the physico-chemical parameters. It may be postulated that the biochemical characteristics of decomposing foliage of *Excoecaria* and *Acanthus* may promote the growth of *Micromonospora*. The species *S. parvulus* was recorded in the stations dominated by *Avicennia* vegetation. *S. flavoviridis* was present in Station 7 which is dominated by *Salicornia* vegetation. *S. lusitanus* was present in one sample only (Station 3). The genus *Streptoverticillium* was observed sporadically in the samples and was present only in oatmeal agar medium. Of the five agar media tested, kuster agar was found to be more suitable for the isolation of the genus *Streptomyces*, which was observed very frequently on this medium. This study identified the order of preference for the five media tested for the culture of actinobacteria as follows: kuster agar, oatmeal agar, tyrosine agar, glucose-asparagine agar and czapeks agar. Lakshmanaperumalsamy (1978) described four species of *Streptomyces* community in the Pitchavaram mangroves. They include *S. olevancious*, *S. lusitanus*, *S. hydrogenus* and *S. orientalis*. *S. lusitanus* was observed in one sample only in the present study. Vanajakumar (1979) identified five species of *Streptomyces* from the Pitchavaram mangroves namely, *S. mutabilis*, *S. albosporius*, *S. halstedii*, *S. flavoviridis* and *S.*

Table 1. Density (Nos.  $\times 10^2$  cfu/g) of soil actinobacteria in different culture media in relation to physico-chemical parameters of the Gaderu mangroves during May 2007

Station	Temp.	Salinity	pH	S.O.M	TA	KA	OA	GA	CA
1.1	34.2	27.1	7.5	2.67	6	4	5	6	8
1.2	32.2	27.0	7.5	2.59	4	8	5	3	6
1.3	32.2	28.2	7.5	2.31	9	6	4	2	2
1.4	32.4	28.2	7.0	2.58	4	—	3	—	—
2.1	31.5	25.2	7.5	2.13	8	4	3	5	7
2.2	32.2	25.2	7.5	2.38	5	—	—	—	—
2.3	30.5	25.3	7.0	4.50	7	5	3	2	2
2.4	32.5	25.2	7.5	2.31	8	4	3	—	—
3.1	30.5	25.3	7.2	2.46	12	3	4	7	6
3.2	32.2	25.0	7.2	2.29	9	4	3	5	3
3.3	32.5	25.3	7.5	2.60	8	4	4	4	4
3.4	32.5	25.2	7.0	2.61	8	4	4	4	4
4.1	32.0	25.5	7.5	2.55	6	4	4	3	4
4.2	32.5	25.1	7.5	2.23	7	3	3	—	2
4.3	32.1	25.2	7.5	2.37	5	4	3	3	3
4.4	32.5	25.0	7.5	2.56	8	4	4	4	4
5.1	32.5	25.2	7.0	2.21	4	—	—	—	—
5.2	32.3	25.2	7.5	2.29	5	8	3	4	4
5.3	32.0	25.2	7.5	2.21	5	6	2	2	2
5.4	32.4	25.2	7.5	2.56	5	4	4	4	4
6.1	32.2	NS	7.5	2.23	5	4	4	4	4
6.2	32.2	NS	7.5	2.40	5	—	—	4	4
7.1	32.2	NS	7.5	2.44	6	4	5	3	8
7.2	32.2	NS	7.5	2.37	3	7	—	—	5

Stations: 1 *Avicennia* vegetation; 2. *Excoecaria* and *Acanthus* vegetation; 3. Mixed vegetation of *Avicennia* and *Excoecaria*; 4. *Avicennia* forest; 5. Mixed vegetation of *Avicennia* and *Excoecaria*; 6. *Sonneratia* vegetation; 7. *Salicornia* salt marsh. Sampling points 1 and 2: forest channel borders; 3 and 4: interior of the forest; — = absent; N. S. = No sample; S. O. M.: sedimentary organic matter (%); Temp = Temperature (°C); Salinity (ppt); TA: Tyrosine agar; KA: Kuster agar; OA: Oatmeal agar; GA: Glucose-asparagine agar; CA: Czapeks agar.

*paruvulus*. *S. paruvulus* was frequently recorded in *Avicennia* forests during the present study and *S. flavoviridis* was present in *Sonneratia* habitat (Station 6). Balagurunathan (1992) identified *S. paruvulus* and *S. alboniger* in the Pitchavaram mangrove sediments. The present study recorded

*S. paruvulus* at stations 3 and 5. D' Souza *et al.* (2000) recorded *Streptosporangium* and *Streptomyces* genera from the mangrove regions of Mandovi, Chapora and Zuari estuaries of Goa, where *Rhizophora* and *Avicennia* were predominant. *Streptosporangium* was not observed in the present

investigation where *Avicennia* and *Excoecaria* are dominant. Siva Kumar (2001) carried out a detailed investigation on actinobacteria of Pitchavaram mangroves wherein the following eight species of *Streptomyces* were identified: *S. xantholyticus*, *S. kanamycetes*, *S. gaiteri*, *S. gibsoni*, *S. clavifer*, *S. alboflavus*, *S. parvulus* and *S. flavoviridis*. Among these, *S. flavoviridis* and *S. parvulus* were recorded in the present study. The present study has indicated the occurrence of actinobacteria in the Godavari mangrove ecosystem, which is being examined for their potential to provide resources for antibiotic producing strains.

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