Research Paper

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Microfungi From Soil Sediments and Water Quality Analysis of Tamiraparani River Basin, Western Ghats

Zoology

KEYWORDS : Microfungi, Soil Sediments, Water Quality, Tamiraparani River, Western Ghats

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ABSTRACT

Tamiraparani is one of the important perennial rivers in south India. It originates from Podihai hills meanders through a distance of 120 Km on Tirunelveli and Tuticorin districts, Tamil Nadu and drains into the Bay of Bengal at Punnakayal Village of Tuticorin district. The point source (PS) and Non-point source (NPS) of pollution are analysed in four sampling stations of river Tamiraparani. Water and soil samples were taken from four sampling stations for physico-chemical analysis and for studying micro fungal assemblage. The BOD and COD levels were high in station 2, V.K.Puram where the textile-mill effluent enters into the river. Dilution plating method was adapted to isolate the fungal species. A total of 14 genera belonging to 17species could be recovered .Aspergillus sp. dominated the micro fungal assemblage.Results obtained showed slight variations from the normal standard water qualities of the river. The analysis suggests the distinct nature of different source/ way of water and it depends on geographical location, time zone and geological foundation. This study would help to create and develop awareness among the people to maintain the quality of the river waters.

Introduction

In India lakes, ponds, rivers and groundwater are used for domestic, agricultural and industrial purposes. The quality of water may be described according to their physico-chemical and microbiological characteristics. For effective maintenance of water quality through appropriate control measures, continuous monitoring of large number of quality parameter is essential (Takarkhede and Kamble, 2013). At present, approximately one-third of the world's people live in countries with moderate to high water stress and the worldwide freshwater consumption raised six fold between the years 1900 and 1995 more than twice the rate of population growth. Thus, many parts of the world are facing water scarcity problem due to limitation of water resources coinciding with growing population. Fresh water is a finite resource, essential for agriculture, industry and even human existence, without fresh water of adequate quantity and quality, sustainable development will not be possible(Kumar, 1997). Rivers play a major role in assimilation or carrying off of municipal and industrial wastewater and runoff from agricultural land, the former constitutes the constant polluting source whereas the latter is a seasonal phenomenon(MuduliBipraPrasanna and Panda ChittaRanjan, 2010).

With the rapid development in agriculture, mining, urbanization, and industrialization activities, the river water contamination with hazardous waste and wastewater is becoming a common phenomenon. In India almost 70% of the water has become polluted due to the discharge of domestic sewage and industrial effluents into natural water source, such as rivers, streams as well as lakes(Sangu and Sharma, 1987). The improper management of water systems may cause serious problems in availability and quality of water(SubbaRao and SubbaRao, 1995). Since water quality and human health are closely related, water analysis before usage is of prime importance. Certain physical, chemical and microbiological standards, designed to ensure that the water is palatable and safe for drinking, before it can be described as potableTebutt, 1983). Therefore, present study was aimed to analyze the comparative physicochemical and microbial analysis of five river water samples using standard methods.

Water quality is directly linked with the health of living beings. The water used may be unsafe chemically as well as microbiologically. Chemically unsafe water does have long term and slow term effect. While microbiologically unsafe water creates short-term problems such as dysentery, diarrhea, jaundice, gastrointestinal disorder, fever and amoebiosis which may assume epidemic proportions (UNICEF, 1990-92).

Fungi are Eukaroytic, heterotrophs and different from all other organisms in their behaviour and cellular organization made the taxonomist to place them in separate kingdom equal to plants and animals.(Deacon, 2006). They are ubiquitous and are known to lead different lifestyles vizParasite, mutual's and saprophytic mode of life. Totally the fungi kingdom offers enormous biodiversity with around 70,000 sp. Most of these are filamentous fungi with complex morphology and developmental process (Turner*etal*., 2000). The biology of fresh water fungi and various aspects of their ecology have been reviewed by various workers. The researchers have clearly indicated that aquatic fungi play a streams, estuaries and oceans (Johnson and sparrow, 1961 and Wicklow and Carroll, 1981). This study aims to document the micro fungal population and water quality analysis of Tamiraparani River across 4 sites.

Materials and Methods

The Tamiraparani is a medium river basin in Southern Tamil Nadu with a catchment area of 5482 Km^2. The river takes its origin from Podihai hills of Pabanasam mountain ranges of Western Ghats (8 ^{0} 42' N and 7^0 24' E) at a height of 2074m. The river meanders through a distance of 120 Km (24 Km in hilly terrain and 96Km in plains) in Tirunelveli and Tuticorin districts. Four sampling stations were selected on the basis of point sources (PS) and non-point sources (NPS) of pollution. Water samples were collected inrinsed polythene bottles and soil sediments

were collected by hand scooping and brought to the laboratory.

Water temperature, pH , conductivity were determined by the water and soil analysis kit (KI 161 E Model). Total dissolved solids, total suspended solids, total solids, alkalinity, total hardness, DO, BOD, COD were determined following APHA (2005).

Collection of Sample

Soil samples were collected from a depth of approximately 5cm, irrespective of the site. Soil was collected using a sterile spatula randomly from six regions for a site across 1Km. (each region 200gms). Thus for each site approximately 1200gms soil was collected and brought to the laboratory in a sterile polythene bag. The soil samples were studied for the presence of fungi within 48 hrs of collection.

Sterilization of Media and glassware

Media and glassware other than Petridishes were sterilized in an autoclave at a pressure of 103 Kpa for 20 minutes. Petridishes were sterilized in a hot air oven at 160 C for 3 hrs.

Media: Potato dextrose Agar (PDA) medium amended with chloramphenicol (150 mg) was used to isolate the fungi.

Method adapted for isolating fungi

Dilution plating method was adopted to isolate the fungus species from the soil sample. After preliminary experiment using different dilution we found 10 as suitable for this soil. Therefore this particular dilution was used for calculating number of propagules per gm of soil. For each sample six seplicates were used.

$$\frac{\text{Average number of fungal colonies / plates}}{\text{Weight of the Soil}} \times \text{dilution factor}$$

Incubation:

Petridishes containing soil samples were incubated for seven days at 26 C. The plates were incubated under light chamber provided with 12hrs light followed by 12hrs darkness.

Identification:

The fungal colonies appeared after 7 days of incubation were transferred into PDA Slants. They were identified using standard manuals. (Raper and Fennel, 1965 : Gilman,1967 : Ellis and Ellis 1988).

Results and Discussion

Along the course of the river 4 sampling stations were selected for the study; description of these study area is given in Table.1. River Tamiraparani is polluted by industrial, domestic and agricultural wastes which are directly or indirectly discharged into the river. The Madura Fabrics is the major textile - industry situated at Vikramasingapuram on its banks near its origin. This industry discharges about 7700kls of effluent and 1380 Kls of sewage daily into the river. In addition to fertilizers, pesticides and detergents are also entered into the river course.

During November 2013, the water temperature ranged from 26.4 to 30.0 ^{0}C , 26.2 to 30.2^{0}C for sediment temperature, 7.0 to 7.4 for pH , 30 to 860s/cm for conductivity, 36.8 to 724.0 mg/l for TDS, 5.8 to 7.4 mg/l for Dissolved oxygen (DO), 1.0 to 15.4mg/l for BOD, 4 to 45.0mg/l for COD, 12 to 116 mg/l for total alkalinity and 24 to 112 mg/l for total hardness. The other parameters such as salinity, nitrate, sulphate and magnesium also showed variation in each station. Sulphate and nitrate content totally absent station 1.

The pH obtained in the river waters was within the ranges suitable for aquatic life (Chapman, 1996). Based on these guidelines, the pH of the river water would not adversely affect its use for domestic and recreational purposes. The well buffered nature of the river water can be attributed to the fact that, normally, running waters are influenced by the nature of deposits over which they flow (Hynes,1970).

Comparative study of dissolved oxygen showed that Amaravathi river water had the highest amount (15.475±0.4 mg/L) while Siruvani river water had the lowest (7.737 ±0.2mg/L) observed in figure-2. These results were positively correlated with the dissolved oxygen values in the drinking water of Patil et al.(2002). The reason for the low dissolved oxygen content was due to high decomposition of organic matter, which indicates a high pollution load in the water. The deficiency of the oxygen in the water is shelter for bacteria and other pathogens, which are anaerobic and injurious to human health (Radha Krishnan et al., 2007).

Shanmuga river water had the highest BOD amount (7.737±0.2 mg/L) while Siruvani river water had the lowest (2.579±0.1 mg/L), which indicated that Shanmuga river water is highly contaminated and observed in figure-3. Comparison of COD showed that Aliyar river water had the highest amount (14.863±0.3 mg/L) while Siruvani river water had the lowest (1.524±0.1 mg/L), which indicated that Aliyar river water is highly polluted. BOD and COD at determine the organic as well as inorganic content in the water have also increased in the post-monsoon season. In reservoir the average values of BOD, COD recorded higher in monsoon compare to post monsoon, which could be due to acidification of water by elevated microbial degradation of organic debris and concentrated dissolved solids in monsoon period. As a momentous role of DO amount in water quality of ground water, the average concentration of DO was highest in post monsoon period and lowest in monsoon consequently increase in BOD and COD (HemantPathak et al., 2012).

The pollution level is high (total hardness-520±5 mg/L) in Shanmuga river water while pollution least (total hardness-100±2 mg/L) in Bhavani river water and observed in figure-5. This result was positively correlated with the total hardness of the water samples collected from Chirala Town at Prakasam district (Srinivasa, Rao and Venkateswarlu, 1999). The high level of total hardness is due to mixing of sewage effluents into the river. The permanent hardness is mainly caused by chlorides and sulphates (Roy and Kumar 2002).

Calcium level is high (200 mg/L) in Shanmuga river water while it is low (80±4 mg/L) in both Aliyar river and Bhavani river water showed in figure-6 and figure-7 showed high levels (320±6 mg/L) of Magnesium in Shanmuga river water and low levels (20±0.5 mg/L) in Bhavani river water.

This result was positively correlated with the calcium content of the drinking water samples in eastern part of the Hisar at Haryana, where the calcium content ranged from 12 to 160 mg/l in the drinking water (Garg et al., 1999). The high quantity of calcium may be because of entry of calcium by leaching process of the rocks into the water body. The levels of Calcium and Magnesium in Amaravathi river exhibited large variation compared to that obtained by Sivakumar et al. Magnesium level obtained in this study was correlated with the magnesium content of the water samples analyzed by SubhadradeviGandi et al., (2003).

In microbial analysis the bacterial colonies ranged from 100 to 120 CFU/ml and fungal colonies ranged from 30 to 45 CFU/ml showed in figure-8. Highest microbial count was observed in Shanmugariver and lowest range observed in Siruvani river. Fecal coliforms counts/100 ml should be zero for water to be considered as no risk to human health. In general high levels of free CO2 might be the reason for low pH values obtained in the river water samples, which may consequently affect the bacterial

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counts (Edema et al., 2001).

According to a study by Baxter-Potter and Gilliland (1988) on straight river water shed when precipitation and stream flows are high, the influence of continuous sources for pollution. It is a common practice for people living along the river catchment to discharge their domestic and agricultural wastes as well as human excreta/wastes into rivers. In addition to using the river as a source of drinking water people use the source for bathing, washing of clothes and for recreational purposes such as swimming. Wild and domestic animals seeking drinking water can also contaminate the water through direct defecation and urination(Karikari and Ansa-Asare, 2006).

Conclusion

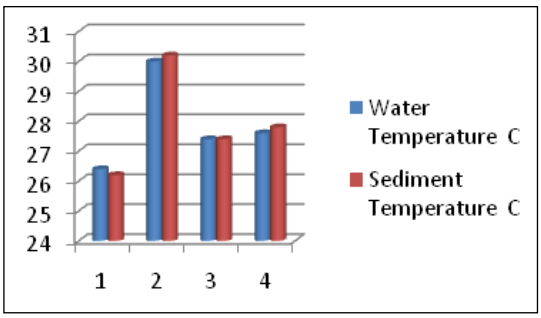
Physico chemical and microbial analysis was performed on fiver river water samples collected from various districts in Western Tamil Nadu, India by standard methods. These rivers are used as such as for drinking, fishing, irrigation and other domestic purposes. This study would help the water quality monitoring and management in order to improve the quality of water with maintaining better sustainable management. Results obtained showed slight variations from the normal standard water qualities of the river. The analysis suggests the distinct nature of different source/ way of water and it depends on geographical location, time zone and geological foundation. This study would help to create and develop awareness among the people to maintain the quality of the river waters.

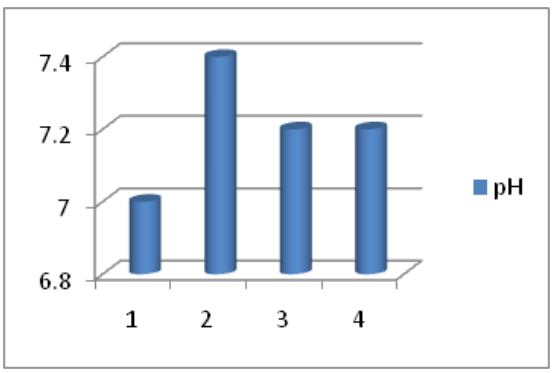
Table-1 Description of sampling stations of river Tamiraparani

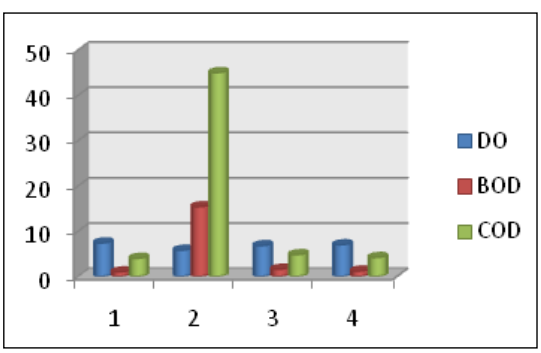
Station	Name of the station	Distance from Reservoir	Land use pattern	Pollution source
1	Pabanasam	1.5	Rice field	Faecal contamination Human bathing Washing of cloths
2	Vikramasingapuram	13	Rice field	Textile-mill, effluent sewage
3	Sivanthipuram	14.5	Rice field Banana cultivation	Impact of textile - mill effluent human bathing
4	Cheranmahadevi	40	Rice field Banana cultivation	Humanbathing Cattle washing

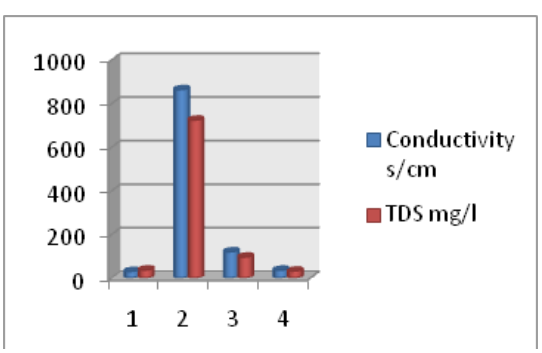
Table - 2 Physico–Chemical analysis of water in different sampling stations of River Tamiraparani Stations

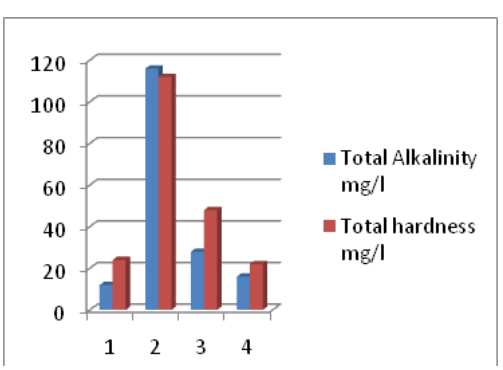
Physico - Chemical Parameters	1	2	3	4
Water Temperature C	26.4	30	27.4	27.6
Sediment Temperature C	26.2	30.2	27.4	27.8
pH	7	7.4	7.2	7.2
Conductivity s/cm	30	864	120	36
TDSmg/l	36.8	724	96	32
DO	7.4	5.8	6.8	7
BOD	1	15.4	1.6	1.2
COD	4	45	4.8	4.2
Total Alkalinity mg/l	12	116	28	16
Total hardness mg/l	24	112	48	22
Salinity ppt	0.2	0.66	0.22	0.2
Nitrate mg/l	-	1.4	1	1
Sulphate mg/l	-	100	100	100
Magnesium mg/l	0.12	0.3	0.28	0.28

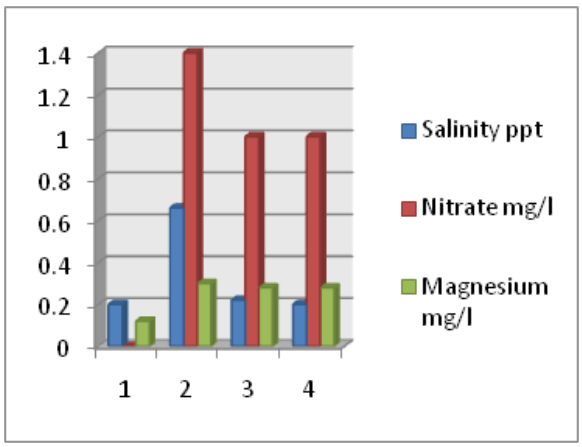


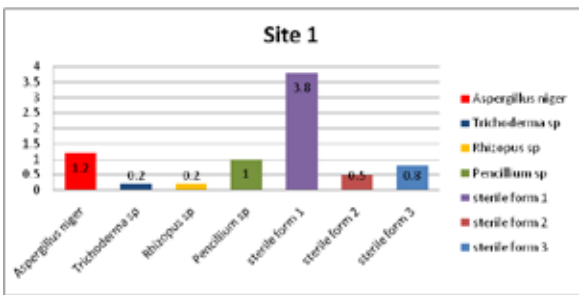


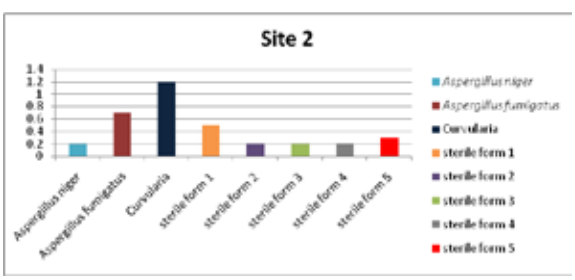


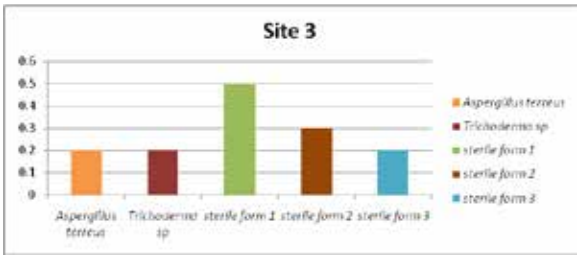


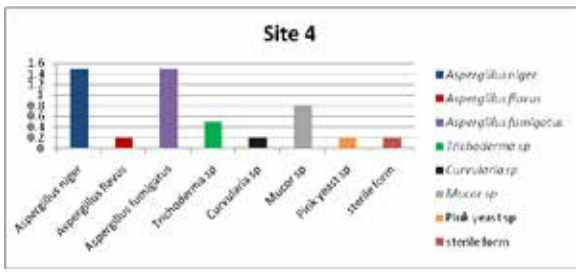












REFERENCE

Baxter-Potter W. and Gilliland M., Bacterial Pollution of Run-off from Agricultural Lands, J. Environ. Qual., 17(1), 27-34 (1988) | Chapman D., Water Quality Assessment, 2nd edn.EPFNSpon, London (1996) | Deacon, J. 2006.Fungal Biology, Blackwell Publishing Ltd. | Edema M.O., Omemu A.M. and Fapetu O.M., Microbiology and Physicochemical Analysis of different sources of drinking water in Abeokuta. Nigeria. Niger. J. Microbiol. 15(1), 57-61 (2001) | Ellis, M.B. and Ellis J.P.1988. Micro fungi on Miscellaneous substrates, an identification Hand book, Crom Helens. London and Sidney, port land, Oregon, Timber press. | Garg V. K., Gupta R., Goel S., Taneja M. and Khurana B., Assessment of underground drinking water quality ineastern part of Hisar, Ind. J. Environ. Protec., 20(6) 407-412 (1999) | Gilman, J.C. 1967 A manual of Soil fungi. Oxford and I BH Publishing Co., Calcutta. | HemantPathak, Deepak Pathak and Limaye S.N., Studies on the physico-chemical status of two water bodies at Sagar city under anthropogenic Influences, Advances in Applied Science Research. 3(1) 31-44 (2012) | Hynes H.B.N., The Ecology of Running Waters. Liverpool University Press, Liverpool, 555 (1970) | Johnson, T.W and Sparrow , F.K.1961. Fungi in oceans and estuaries, Cramer Weinhein, West Germany. | Karikari A.Y. and Ansa-Asare O. D., Physicochemical and microbial water quality assessment of the Densu River of Ghana. West Afr. J. Appl. Ecol., 10, 87-100 (2006) | Kumar N.A., View on Freshwater environment, Ecol. Env and Cons, (3), 3 (1997) | MuduliBipraPrasanna and Panda ChittaRanjan. Physico chemical properties of water collected from Dhamra estuary, International journal of environmental sciences. 1(3), (2010) | Patil P.R., Patil K.S. and Dhande A.D., Studies on drinking water quality in Bhusawal corporation water supply, Ind. J. Environ. Protec., 22(2), 161-164 (2002) | Radha Krishnan R., Dharmaraj K. and RanjithaKumari B. D., A comparative study on the physicochemical and bacterial analysis of drinking, borewell and sewage water in the three different places of Sivakasi, Journal of Environmental Biology, 28(1), 105-108 (2007) | Raper K.B. and Fenwell.O.I. 1965.The genus Aspergillus.Williams and Wilkins, Baltimore. | Roy Y. and Kumar R. A., A study of water quality of the rivers of Ranchi district, Ind. J. Environ. Protec, 21(5),398-402 (2002) | Sangu R.P.S. and Sharma S.K.An assessment of waterquality of river Ganga at Garmukeshwar. Ind. J. Ecol.,14(20), 278-287 (1987) | Srinivasa, Rao B. and Venkateswarlu P., Evaluation of ground water quality in chirala town (Prakasam district). Ind. J. Environ. Protec., 20(3), 161-164 (1999) | SubbaRao C. and SubbaRao N.V., Ground water quality in residential colony, Ind. J. Environ.Hlth., 37(4), 295-300 (1995) | Subhadradevi G., Barbuddhe S. B., Hazel D. and Dolly C., Physicochemical characteristics of drinking water at Velseo, (Goa), J. Ecotoxicol. Environ. Monit, 13(3), 203-209 (2003) | Takarkhede, A.G. and Kamble, R.K. 2013.Water quality and statistical correlation of hydrological parameters of Nag River, Nagpur.Indian J. Environ.Prof. 33 (1) : 9-19. | Tebutt T.H.Y., Principles of Quality Control, Pergamon, England, 235 (1983) | Turner , G., Panalva, M.A. and Rowlands , R.T. 2000. The optimization of Penicillin Biosynthesis in fungi .Trends Biotechnology.16 : 483 – 489. | UNICEF, 1990 – 92. Community water supply and sanitation.Annual progress report and implementation. | Wicklow, D.Tand Carroll, G.C.1981. The fungal community, its organizations and role in the ecosystems , Marcel Dekker, Inc. |