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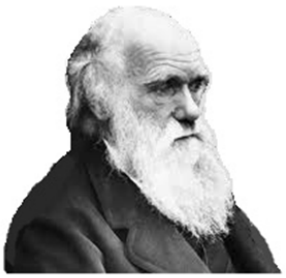

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Diversity of Recent Benthic Foraminifera and its Environmental Condition of Selected Estuaries in Tamil Nadu, India

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ABSTRACT

Micropaleontological investigation has been carried out, for the first time to study the systematic of recent Benthic Foraminifera from the southeast coast flowing river estuaries Cauvery, Athankarai and Thamirabarani, Tamil Nadu, India. Totally 16 sediment samples were collected during December 2018. Benthic foraminiferal species, belonging to 14 species, 7 families and 5 Sub-orders are identified. Among this Miliolida (>75%) occupies the dominant place followed by Rotaliida (<25%). The higher species are observed in the rivermouth area particularly in the Cauvery estuary sample (365 species of *Ammonia beccarii*). The following species are abundantly distributed in this region namely *Ammonia beccarii, Quinqueloculina* and *Miliolinella subrotunda*. The abundance of species in the river mouth may be due to the mixing of marine and nearshore environment.

***Keywords*:** Foraminifera, Systematic Paleontology, Distribution and Ecology

1. INTRODUCTION

Benthic foraminiferal assemblage's record changes in surface productivity and may play a significant role in the interpretation of recent and ancient environmental changes. Thus, benthic foraminifera are widely used in ecological and paleoceanographic studies of various marine environments (e.g. Corliss, 1985; Pravasini *et al.,* 2012; Saraswat *et al.,* 2011). Therefore, it is of special interest to study the influence of primary production in surface water in the sediment on the recent benthic foraminifera. Initial studies of benthic foraminifera in the

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southeast coast of India focused on open ocean (Nagendra *et al.*, 2015). Based on the ecology of foraminifera, a number of authors have studied environmental conditions (Murray, 1991; Kumar *et al.*, 1998; Srinjana *et al.*, 2018).

Rajeev Saraswat (2017) has studied the distribution of foraminifera in Palk Strait and related the living/dead ratio with rate of sedimentation. Similarly, several workers have studied the foraminiferal ecology and its environment along the east coast of India (Elakkiya *et al.*, 2013).

In this study we investigate the distribution and diversity of benthic foraminiferal assemblages in the surface sediments from three selected estuaries on the southeast coast of India, Tamil Nadu. the main objective of the study are: (1) to identify the foraminiferal fauna of the selected Rivers and Estuary, (2) to determine the distribution of the foraminiferal population in the study area, (3) to compare the present foraminiferal assemblage of the study area with those from the adjacent river estuary.

2. MATERIALS AND METHODS

2. 1. Study Area and Sampling

This study concentrates on three separate areas in the southeast coast of India. One of the study areas is Cauvery River estuary located along the east coast of Indian, is a part of the Cauvery River basin, encompassing about 80,000 ha (Ramanathan *et al.*, 1998). It is a vertically well mixed estuary with a shallow average depth of less than 1 m, a minimum width of 50 m, and a maximum width of 1,500 m. The second study area is located in Athankarai estuary is located 9.35° N, 79° E and originates in the Periyar Plateau of the Western Ghats range. The river confluence into the Palk Strait in Ramanathapuram District (Gandhi *et al.*, 2018).

The Athankarai estuary is formed by the river Vaigai which takes its origin in the Western Ghats and meets the Palk Bay near the village Athankarai about 15 km, west of Mandapam. The river is not perennial due to its water for irrigation purposes. At the mouth, the estuary bed is elevated and hence very shallow. It extends from covering a distance of approximately 258 km (160 mi) long, with a drainage basin 7,031 square kilometres (2,715 sq mi) large (Sanil Kumar *et al.*, 2002).

The third estuary is present in the mouth of Thamirabarani river. It is one of the oldest in the state of Tamil Nadu. South India extends between latitude 8°30′ to 9°15′ N and longitude 77°10′ to 78°10′ E (**Figure 1**) (Vignesh *et al.*, 2015). It originates from the peak of the Periya Pothigai hills of the Western Ghats above Papanasam in the Ambasamudram Taluk. Since all its tributaries are arising from the Western Ghats, the river is prone to heavy floods especially during the northeast monsoon.

A total of 17 sediment samples were collected using Peterson grab from the study area off selected estuaries in Tamil Nadu. The fieldwork was done during the month of December 2018. The offshore samples were collected at water depths ranges 2.0 m. All the samples were collected manually using a mechanical country boat, and before the sample collection study area locations were fixed using a global positioning system (GPS).

The foraminifera were separated using CCl_4 method and then handpicked under a stereo binocular microscope for mounting and counted to estimate the percentage of distribution. The Loeblich and Tappan's systematic scheme was followed for the classification of foraminiferal genera.

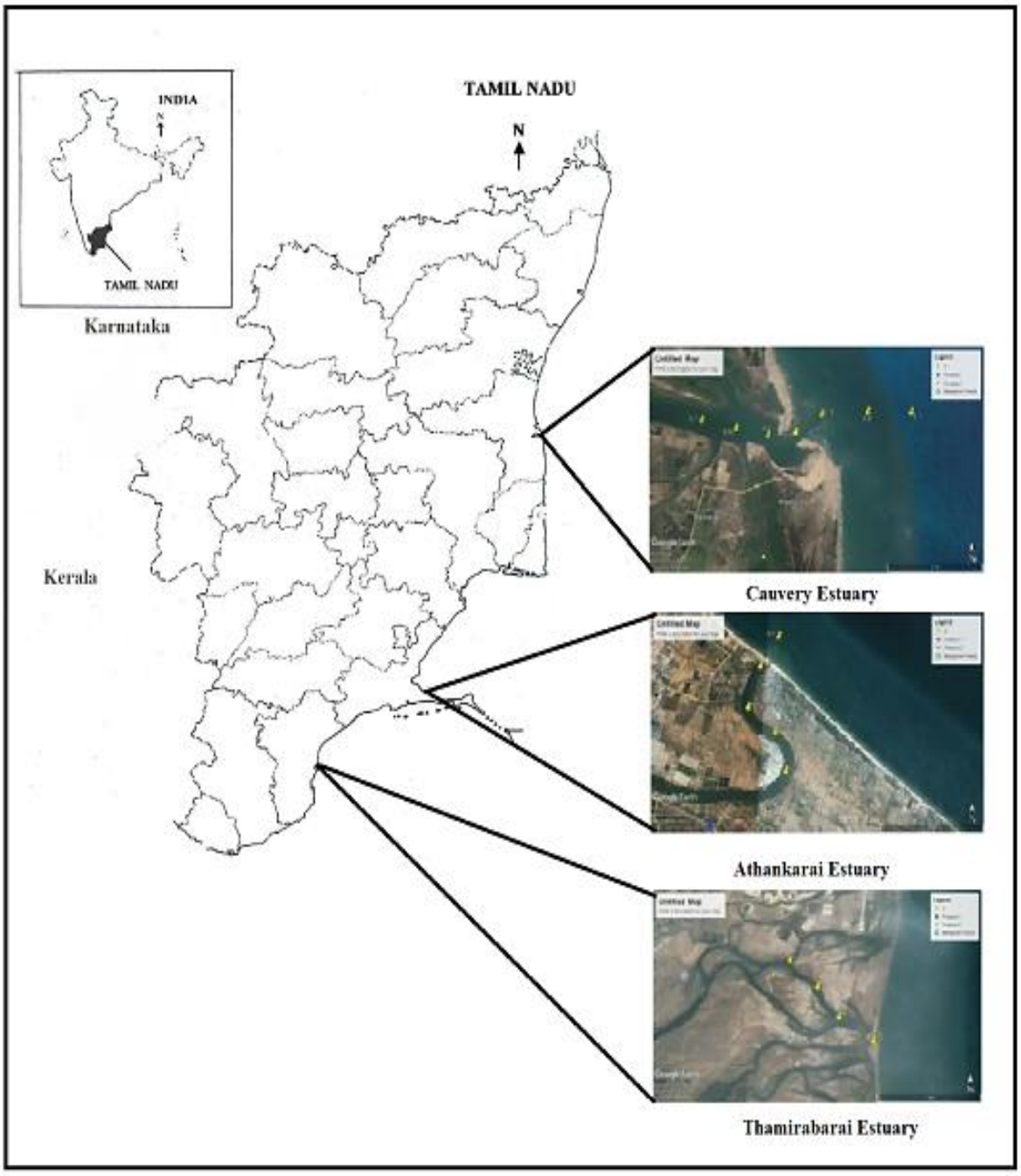


Figure 1. Sampling locations of the study Area

3. RESULTS AND DISCUSSION

From the present study, 14 benthic foraminiferal species belonging to genera, families, super families and suborders have been identified. The identified benthic foraminiferal species are listed in **Table 1**.

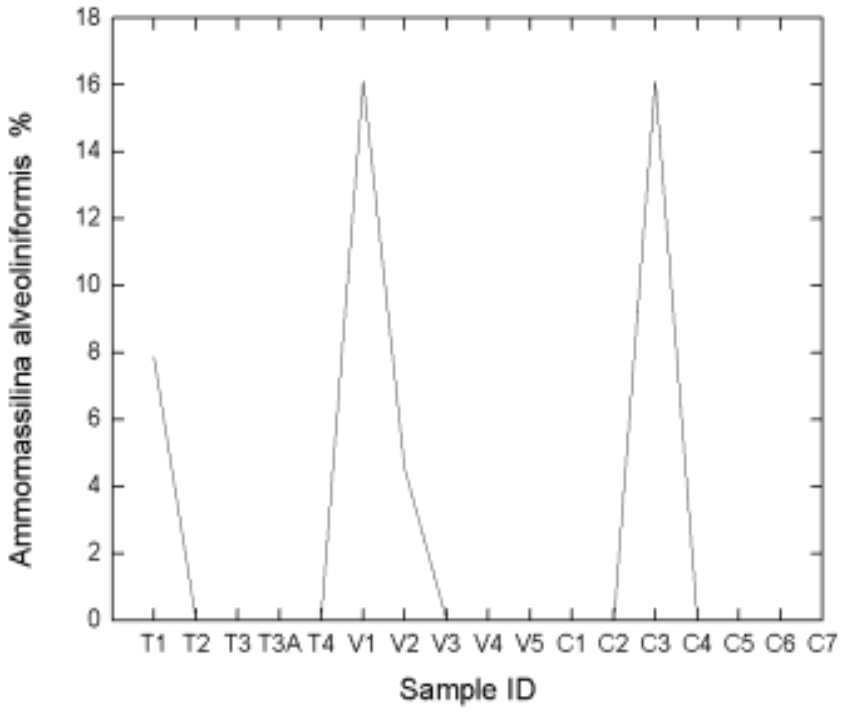
Table 1. Identified 14 Benthic foraminifera species

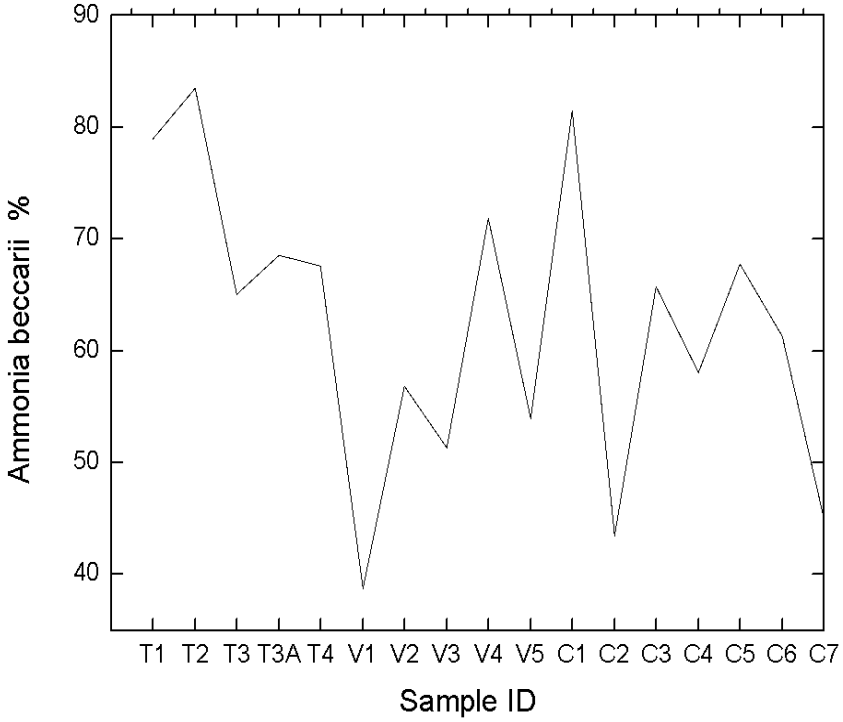
Sl. No	Species Name
1	*Ammomassilina alveoliniformis*
2	*Ammonia beccarii*
3	*Archaias compressus*
4	*Cornuspiroides foliaceus*
5	*Loxostomum karrerianum*
6	*Miliolinella labiosa*
7	*Miliolinella subrotunda*
8	*Orbiculina adunca*
9	*Peneroplis carinatus*
10	Pseudomassilina macilenta
11	*Quinqueloculina lamarckiana*
12	*Quinqueloculina venusta*
13	*Sigmoilopsis schlumbergeri*
14	*Triloculina raibliana*

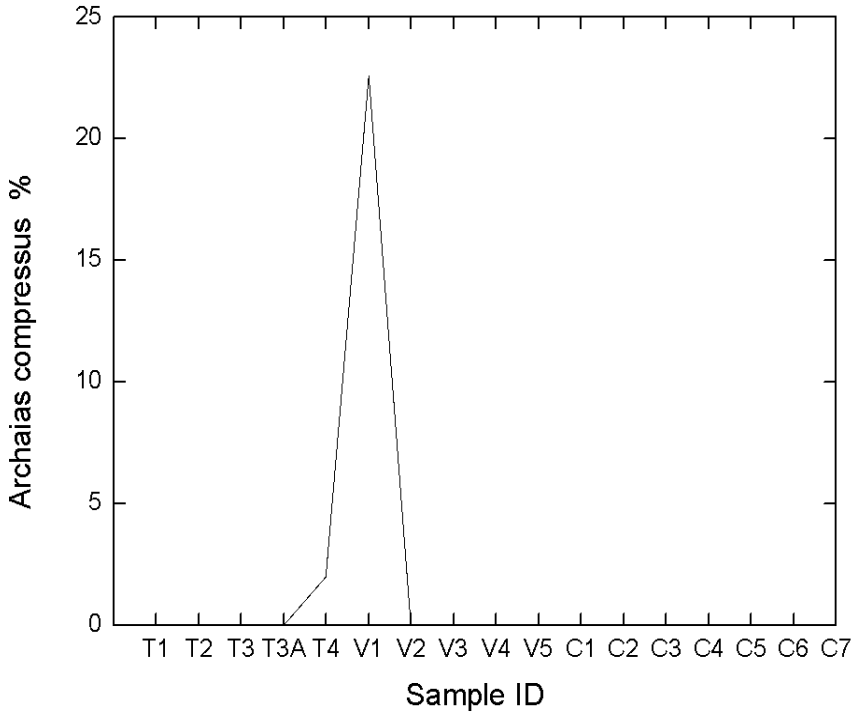
In this present study, a total of 14 benthic foraminifera (Table 1) were identified from this study area. In the present study, 14 species belonging to 7 families and 20 genera were identified. The foraminiferal taxa belong to five Suborders such as MILIOLINA, LEGENINA and ROTALIINA. The majority of benthic foraminifera are reported (**Figure 2**). Out of the fourteen species, two species are abundant namely *Ammonia beccarii* and *Quinqueloculina lamarckiana.*

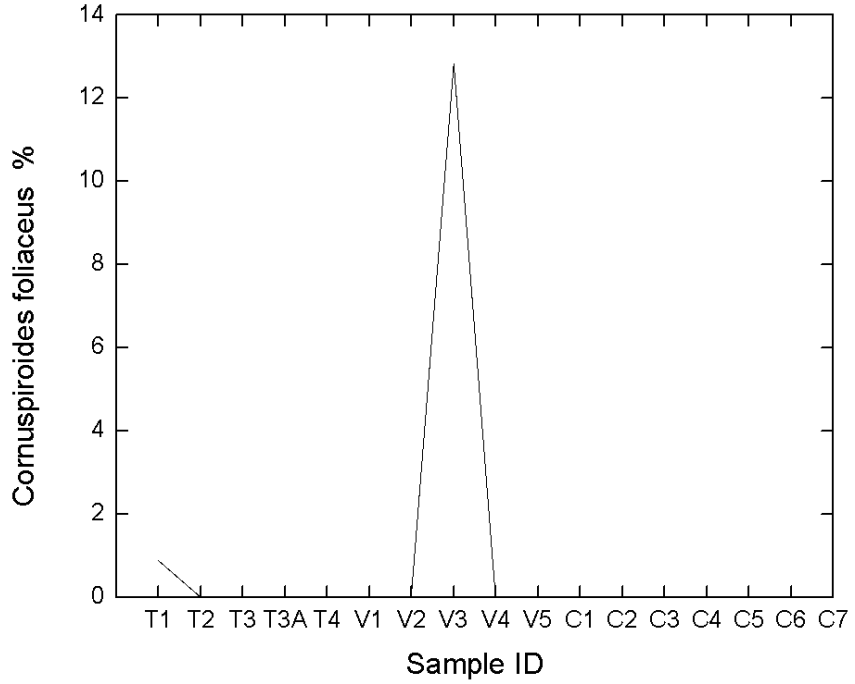
The high abundance of benthic foraminifera *Ammonia beccarii* indicates a euryhaline and shallow sea environment (Wang *et al*., 2009). A strict interpretation based on the known modern distribution of A. beccarii would confine the species to upper shoreface environment (Hayward *et al*., 2004).

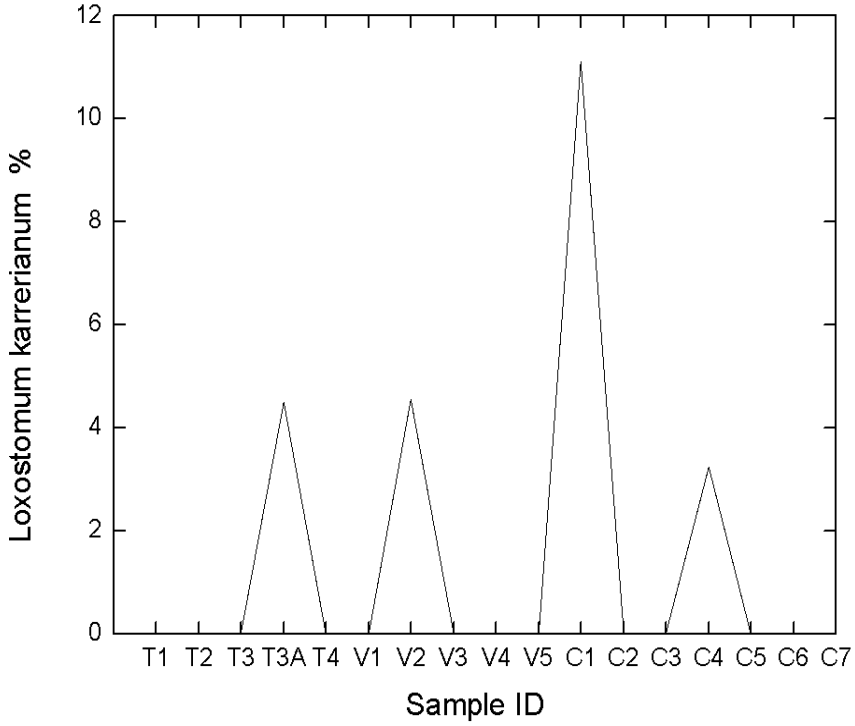
The maximum percentage of these species shows 4.13% in the station numbers 2 and minimum percentage 0.94% at the station number 1 was noticed, respectively (Sivaleela *et al*., 2013).

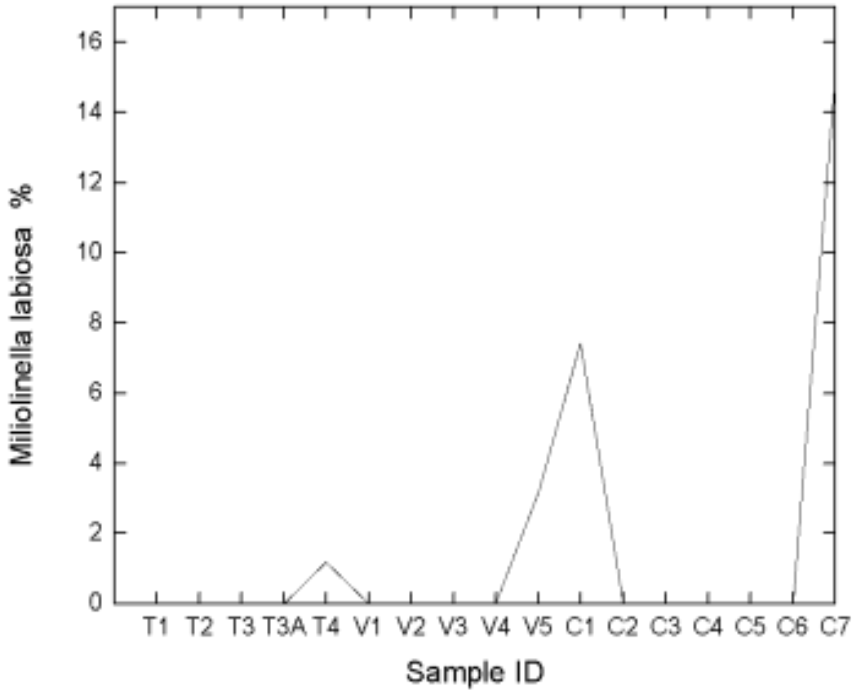

Ammomassilina alveoliniformis %
18
16
14
12
10
8
6
4
2
0
T1 T2 T3 T3A T4 V1 V2 V3 V4 V5 C1 C2 C3 C4 C5 C6 C7
Sample ID

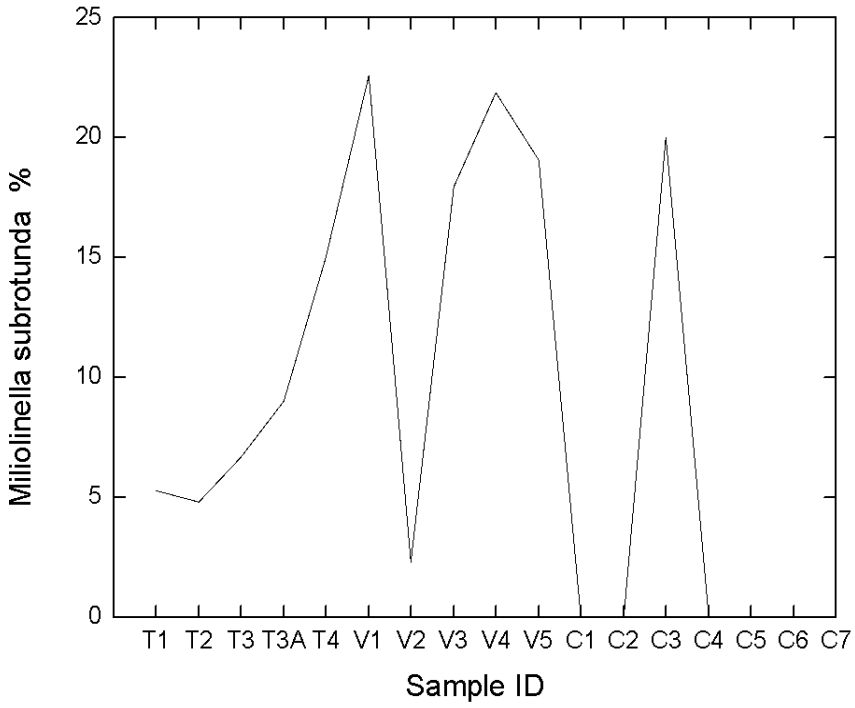

Ammonia beccarii %
90
80
70
60
50
40
T1 T2 T3 T3A T4 V1 V2 V3 V4 V5 C1 C2 C3 C4 C5 C6 C7
Sample ID

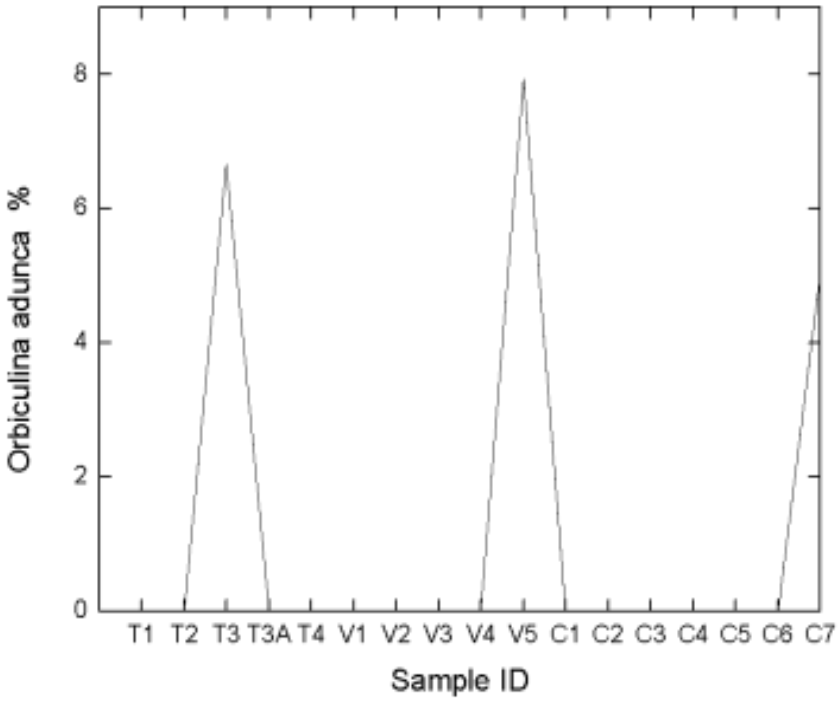

Archaias compressus %
25
20
15
10
5
0
T1 T2 T3 T3A T4 V1 V2 V3 V4 V5 C1 C2 C3 C4 C5 C6 C7
Sample ID

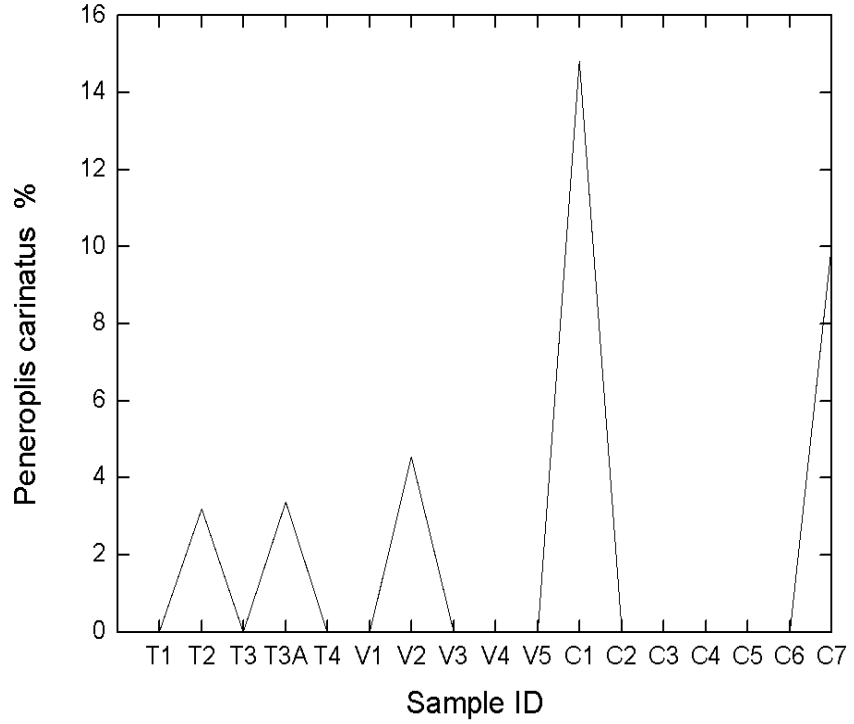

Cornuspiroides foliaceus %
14
12
10
8
6
4
2
0
T1 T2 T3 T3A T4 V1 V2 V3 V4 V5 C1 C2 C3 C4 C5 C6 C7
Sample ID

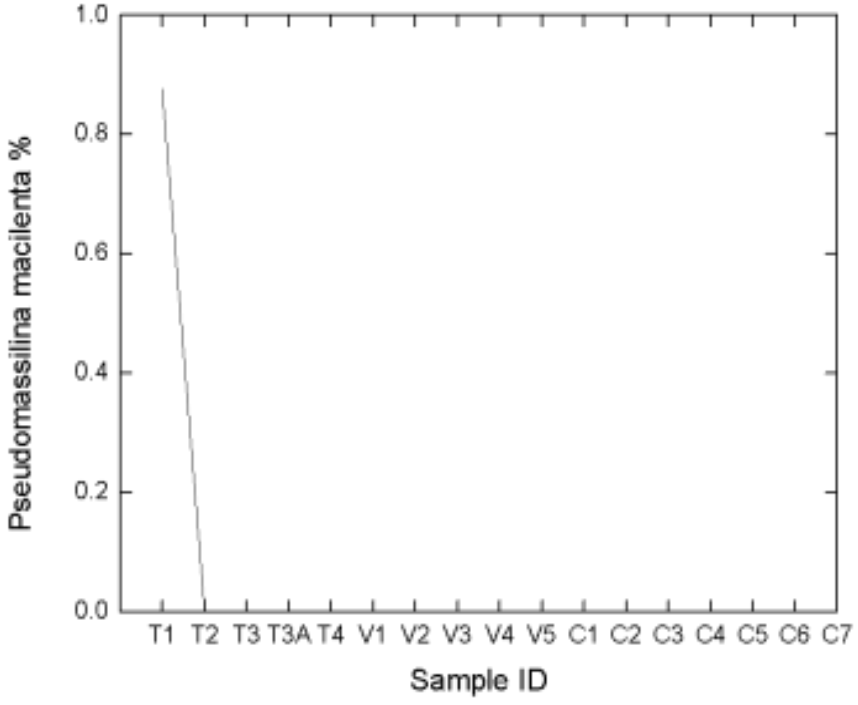

Loxostomum karrerianum %
0
2
4
6
8
10
12
T1 T2 T3 T3A T4 V1 V2 V3 V4 V5 C1 C2 C3 C4 C5 C6 C7
Sample ID

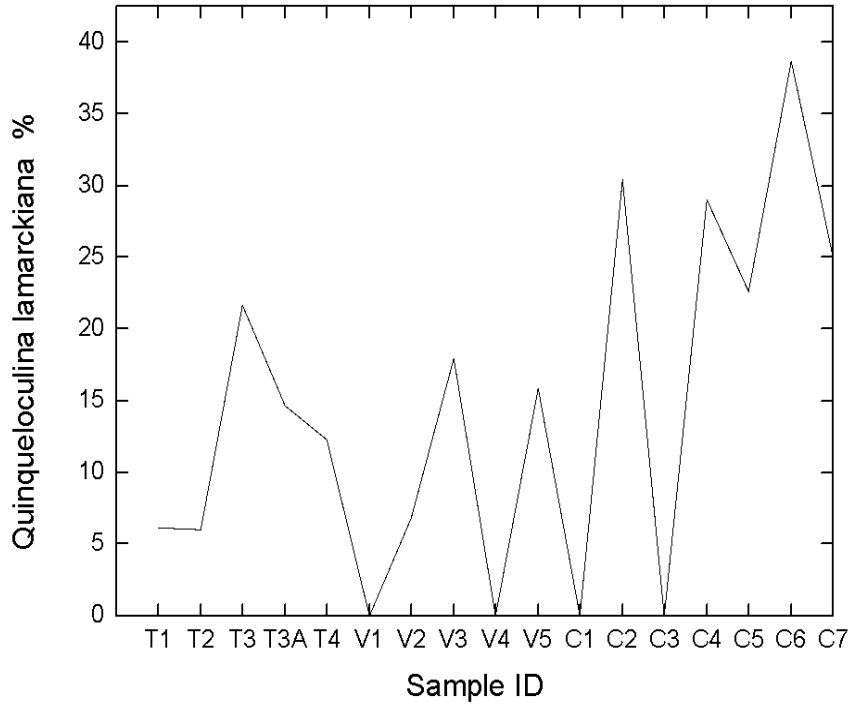

Miliolinella labiosa %
0
2
4
6
8
10
12
14
16
T1 T2 T3 T3A T4 V1 V2 V3 V4 V5 C1 C2 C3 C4 C5 C6 C7
Sample ID

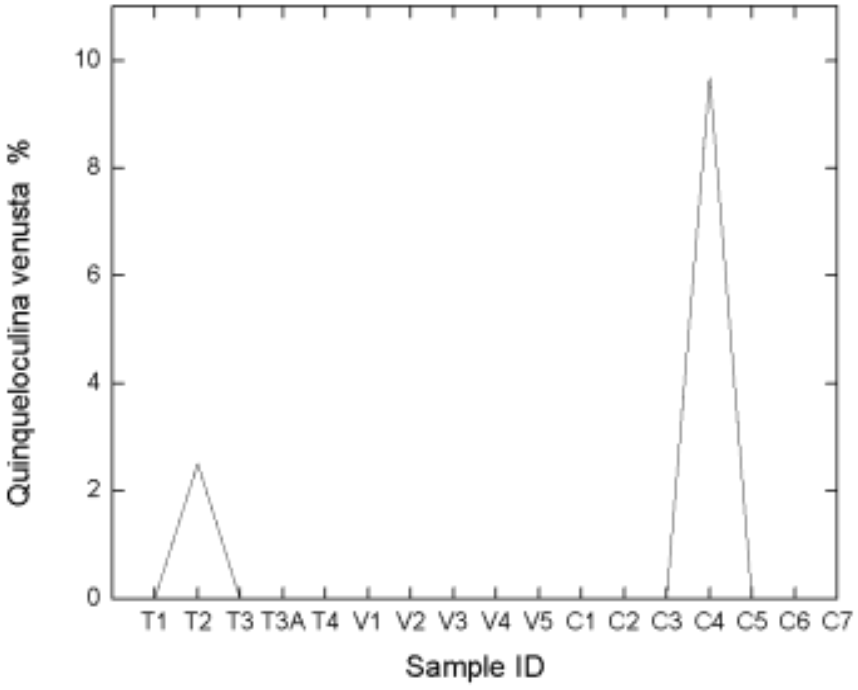

Miliolinella subrotunda %
25
20
15
10
5
0
T1 T2 T3 T3A T4 V1 V2 V3 V4 V5 C1 C2 C3 C4 C5 C6 C7
Sample ID

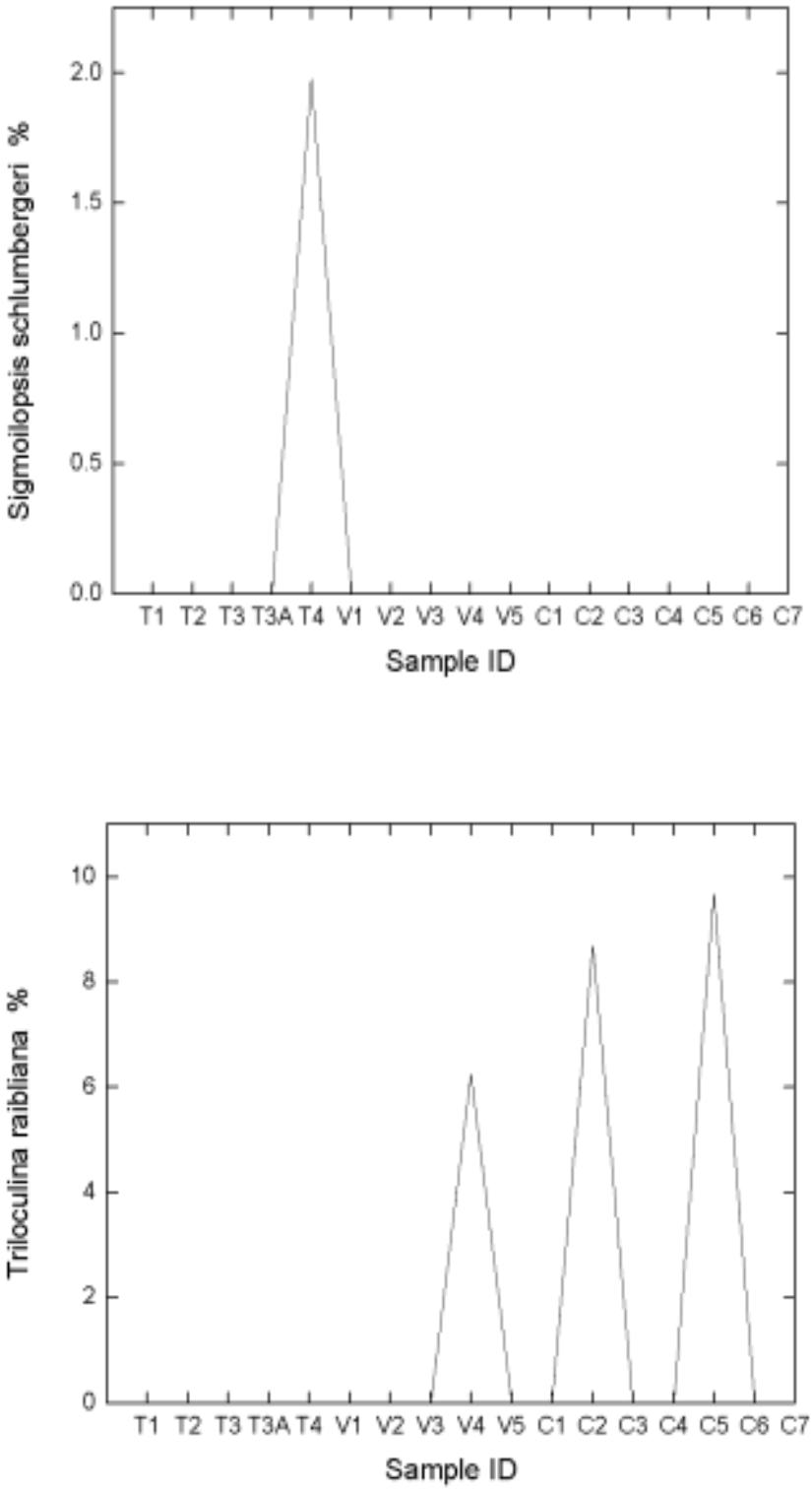

Orbiculina adunca %
8
6
4
2
0
T1 T2 T3 T3A T4 V1 V2 V3 V4 V5 C1 C2 C3 C4 C5 C6 C7
Sample ID


Peneroplis carinatus %
16
14
12
10
8
6
4
2
0
T1 T2 T3 T3A T4 V1 V2 V3 V4 V5 C1 C2 C3 C4 C5 C6 C7
Sample ID


Pseudomassilina macilenta %
1.0
0.8
0.6
0.4
0.2
0.0
T1 T2 T3 T3A T4 V1 V2 V3 V4 V5 C1 C2 C3 C4 C5 C6 C7
Sample ID


Quinqueloculina lamarckiana %
0
5
10
15
20
25
30
35
40
T1 T2 T3 T3A T4 V1 V2 V3 V4 V5 C1 C2 C3 C4 C5 C6 C7
Sample ID


Quinqueloculina venusta %
0
2
4
6
8
10
T1 T2 T3 T3A T4 V1 V2 V3 V4 V5 C1 C2 C3 C4 C5 C6 C7
Sample ID



Figures 2(14). Relative abundance of benthic foraminiferal species. All values are in percentage.

4. CONCLUSIONS

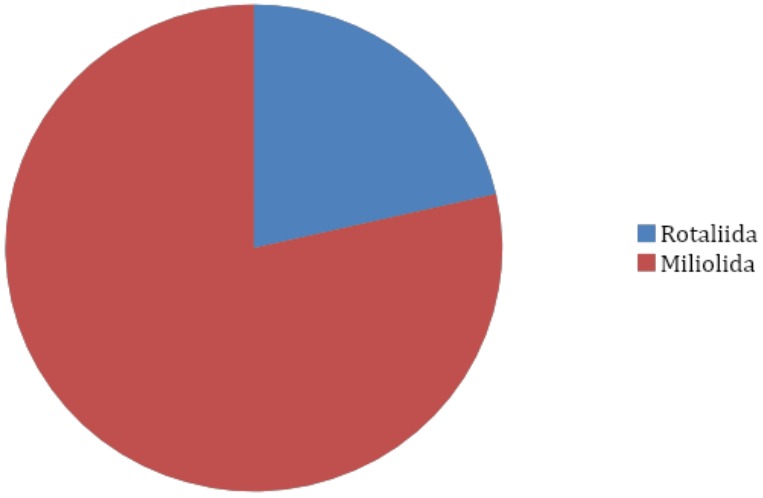


Figure 3. Pie diagram showing the distribution of the suborders in the study area

From the present study, based on widely used Loeblich and Tappan's classification, 14 benthic foraminiferal species are identified and counted belonging to 7 families. Benthic foraminifera which Miliolida (>75%) occupies the dominant place followed by Rotaliana (<25%). The 14 benthic foraminifera identified species are listed (**Figure 3**). This Study suggests that *A.beccarii* is much more favorable for thriving foraminiferal species. *Quinqueloculina lamarckiana* is the most dominated species in this region followed by *Ammonia beccarii*. All the species have been duly indexed and deposited in the Department of Marine Science, Bharathidasan University, Tiruchirappalli 620 024, India.

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