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Research Paper

A report on the diversity of Zooplankton recorded from Chennai District of Tamil Nadu

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Abstract: The zooplankton are very sensitive to the environment where they live; so, any change in the environment may leads to change in the zooplanktonic communities in terms of tolerance, abundance, diversity and dominance in the habitat. They are of primary importance of aquatic food chain and are also good bio-indicators of aquatic environment. The present study was conducted during 2015 based on some local surveys conducted to water bodies in and around Chennai district of Tamil Nadu. Nearly 35 lots of zooplankton samples were collected. A total of 54species of zooplanktonic organisms belonging to the different groups viz. Protozoa: Rhizopoda, Rotifera, Cladocera and Ostracoda were identified. Rhizopods belonging to 7 species, 1 order, 5genera under 4families; 16 species of Rotifers belonging to8 genera, 2 orders, under 6 families; Cladocerans belonging to 17 species, 9 genera, 2 orders under 5 families and Ostracods belonging to 14 species, 9 genera, 1 order under 1 family were recorded during the present study. Cladocerans were the dominated group followed by Rotifers, Ostracods and Rhizopods. The polymorphic forms of the Rotifer *Brachionuscalyciflorus* viz. *Brachionuscalyciflorus f. amphiceros*and *Brachionuscalyciflorus. f. borgeti* were also recorded. The study reports several alkaline - eutrophic indicators also.
Keywords: *Aquatic body, Zooplankton, Food chain, Bio-indicator, Tamil Nadu.*

INTRODUCTION:

The aquatic bodies inclusive of freshwater as well as marine contain a large assemblage of microscopic as well as macroscopic organisms comprising of Protozoans, Rotifers, Cladocerans, Copepods and Ostracods that are free swimming or suspended in water. These organisms comprise the zooplankton and many of them are too small to move independently of water currents. According to Khangarot& Das (2009) the planktonic life is an essential part of aquatic ecosystem to maintain a healthy and productive environment. They are of primary importance of aquatic food chain and are also good bio-indicators of aquatic environment and are also used for assessing the nature of polluted waters Barnes (1968); Ferdous and Muktadir (2009). So planktonic population

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observation can be used as a reliable tool to assess the pollution status of water bodies (Basu et. al., 2010; Prabhakar et.al., 2011).

The free-living protozoan community plays a functional role in aquatic biotopes (Finlay and Esteban, 1998). Since protozoa are small and have accelerated growth rates, they control the growth of bacteria and fungi, besides being prey to invertebrates and even some aquatic vertebrates. According to analyses of stomach contents, Hardoim and Heckman (1996) report that testate amoebae were the preferred item in the diet of several fish species. Thus, they provide a major link in the transfer of energy to higher order consumers. Except the contributions made by Thilak & Bindu (2012) no work has been reported from the state of Tamil Nadu. The present study reports 7 species of Rhizopoda comprising of 1 order, 5 genera under 4 families from the water samples collected from Chennai.

Rotifers are often the most abundant metazoans in inland waters. Their size varies from 0.3 to 4 mm. They constitute an important component of aquatic ecosystems and form an integral link in aquatic food-chain and contribute significantly to secondary production in freshwater ecosystems. They are also regarded as ecological indicators (Sharma, 1998). Rotifers were first described by Leeuwenhoek (1703). Systematic studies of the Indian Rotifera were initiated by Anderson (1889). Globally about 2000 species are known. Rotifers are divided into two classes such as Digononta and Monogononta. Out of the two subclasses of Rotifera only one subclass Eurotatoria is represented in India. Among the 29 Eurotatorian families, 25 families are reported with 330 species belonging to 120 genera from India. Of the total rotifer count worldwide only 360 species have been reported from India (Vanjare et.al., 2010). Systematic studies of the Indian Rotifera were initiated by Anderson (1889), Sharma (1988) provided data regarding the rotifers from West Bengal. Sharma & Sharma (2008) recorded rotifers from the floodplain lakes of Assam. Sharma & Naik (1996) made some contributions to the study of the rotifer fauna of the Narmada River in Madhya Pradesh (Central India). Studies on Rotifera in Tamil Nadu were initiated in the last century Edmondson and Hutchinson (1934), very few studies have been carried out in the districts of Tamil Nadu except the contributions made by Sivakumar and Althaf (2001); Raghunathan and Suresh Kumar (2002); Raghunathan and Valarmathi (2007); Sharma & Sharma (2009). The present study reports 16 species of Rotifersbelonging to 2 orders,8 genera under 6 families.

Cladocera, commonly known as the 'Water fleas' forms an important constituent of freshwater organisms and the size range of 0.2 to 3.0 mm. The trunk is invariably covered with a bivalve carapace which is usually ornamented. Head bears the eye and the ocellus and two pairs of appendages. The order Cladocera with eight families belongs to the subclass Branchiopoda of class Crustacea. This group mostly inhabits freshwaters except the three marine genera Podon, Penilia and Evadne. About 400 species of Cladocera are known from different parts of the world Frey (1967). A total of 110 species of Cladocerans are known from India belonging to Chydoridae, Daphniidae and Macrothricidae (Michael and Sharma, 1988). Raghunathanand Suresh Kumar (2003) reported 190 species from India. The global diversity of Cladocerans is more than 600 species (Vanjare et.al., 2010). Contributions were made to the study of the Indian Cladocera by Yousf and Qadri, (1977); Venkataraman, (1991, 1992, 1993; Nandi et al., 1999; Venkataraman & Das

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(2000); Raghunathan and Valarmathi (2007); Mohideen et.al (2008). The present study reports 17 species of Cladocerans to 9 genera, 2 orders under 5 families from the different localities of Chennai district.

Fresh water Ostracods the neglected little crustaceans are commonly known as seed shrimps. They are commonly benthic organisms but some occurs in algal mats and a few are planktonic. They act as ecological indicators and acts as a secondary host for a number of fish parasites. Ostracods are considered as a separate class under the class Crustacea and divided into the subclasses Myodocopa andPodocopa (Martin& Davis 2001; Horne et al., 2002). The Subclass Podocopa has three Orders: Platycopida, which includes marine and a very few brackish water forms; Podocopida which is present in both freshwater & marine environment and Palaeocopida known only from fossil records (Karanovic, 2012). From the different zoogeographic regions of the Oriental region 200 species are reported, of which 83% are endemic and the Australian region alone accounts for176 species (Martens et.al. 2008). According to Martens and Savatenalinton (2011) there are 2103 subjective species and 209 genera of freshwater Ostracods throughout the world.

Taxonomic studies on Indian Ostracoda were initiated by Baird (1859) Klie (1972), Arora (1931), Hartmann (1964), Deb (1972, 1973 & 1978), Michael &Victor (1975) and Battish (1978, 1981). Later 56 freshwater Ostracoda species were reported by Victor & Fernando (1979) from India. 29 species of Ostracoda was reported from the Western zone of Narmada basin inclusive of two new species (Thilak Jayasree 1992). Thilak et.al., (1994) reported 27 species of Ostracoda from the Western zone of Narmada basin. Later Venkataraman Krishnamoorthy (1998) reported 120 species of Ostracoda from freshwater and marine habitats and Venkataraman (1999) while studying the faunal diversity of Tamil Nadu reported 3 species of Ostracods from Chennai district. 120 species of Ostracoda belonging to 24 genera and 4 families are reported from India (Patil, 2004). 41 Species of Ostracoda belonging to 3 families under 14 genera were reported from Madhya Pradesh including Chattisgarh by Harshey& Thilak (2011). A checklist of Indian Ostracoda comprising152 valid species belonging to 39 genera, five families and two super families were reported by Karuthapandi et.al., (2014). From Tamil Nadu Victor & Fernando (1979) recorded 29 species belonging to 16 genera and 4 families and all the species reported were belonging to the Superfamily Cypridoidea and are mostly from the Madurai district of Tamil Nadu. The present study reports 14 species of Ostracoda belonging to 9genera, 1 order under the Superfamily Cyprididae.

MATERIALS AND METHODS:

Samples were collected during early morning by sweeping the plankton net made of bolting silk of 63µm through water among aquatic weeds and by disturbing the bottom of the water bodyand also by filtering 50 liters of water through the plankton net. The collected samples were persevered in 4% formaldehyde and later subjected to detailed taxonomic identification with the help of standard references viz.Chattopadhyay and Das (2003); Das et. al., (1993); Deflandrae (1959); Edmondson (1959); Needham & Needham (1962); Pennak, (1978);Victor& Fernando(1979); Michael and Sharma (1988); Sharma & Sharma (2008).The samples collected were deposited in the National Zoological Collections of SRC, Chennai.

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Table: 1. Showing the details of sample collection localities of Chennai, district of Tamil Nadu.

No	Locality	Latitude	Longitude	Altitude	Date	Coll. By
1	Pallavaram pond, Pallavaram.	N 12°57.519'	E 080°07.109'	101Ft	31-1-2015	J. Thilak
2	Nathamkuttai, Thirumudivakkam	N 12°59.128'	E 080°05.387'	78 Ft	31-1-2015	
3	Thiruneermalaiaar, Aathur bridge, SIDCO.	N 12°57.754'	E 080°06.795'	70Ft	31-1-2015	
4	Porur lake, porur.	N 13°02.138'	E 080°08.941'	19Ft	31-1-2015	
5	Chembarampakkam lake	N 12°59.297'	E 080°03.865'	135Ft	31-1-2015	
6	Srinivasa koil pond, Chettiyaaragaram.	N 13°02.914'	E 080°09.737'	59 Ft	31-1-2015	
7	Agastheeswarakoil pond Valsaravakkam	N 13°02.492'	E 080°10.665'	50 Ft	31-1-2015	
8	Srikulathurkuttai, on way to Chembarampakkam.	N 12°59.664'	E 080°04.518'	90 Ft	31-1-2015	
9	Arasanamkulam, Srikulathur	N 12°59.722'	E 080°04.812'	94ft	31-1-2015	
10.	Thiruneermalaikoil pond, Thiruneermalai	N 12°57.936'	E 080°06.647'	70 Ft	31-1-2015	
11.	Srikulathureri, Sriperambadur Road.	N 12°59.686'	E 080°04.991'	78 Ft	31-1-2015	
12	Kundathureri, Kundathur.	N 13°00.279'	E 080°06.227'	56 Ft	31-1-2015	
13	KundathurMuruganKoil Pond, Korai urachi	N 12°59.050'	E 080°05.529'	71 Ft	31-1-2015	
14.	Vellanur pond, Vellanur village, Avadi	N 13°09.754'	E 080°06.803'	120 Ft	14-2-2015	
15.	Solavarameri,	N 13°13.162'	E 080°09.221'	69 Ft	14-2-2015	
16	Ethachtammankoil pond, Alamathi	N 13°12.403'	E 080°06.818'	88Ft	14-2-2015	
17.	Vathukuttai, Kollumedu.	N 13°09.869'	E 080°07.033'	107 Ft	14-2-2015	
18	Edappalayamkuttai, Red Hills Road.	N 13°12.525'	E 080°08.790'	91 Ft	14-2-2012	
19	Rettakulam, Solavaram.	N 13°13.123'	E 080°09.722'	42Ft	14-2-2015	
20	Palpinnipinpurameri, Alamathi, Thiruvallur Road	N 13°12.495'	E 080°06.447'	97 Ft	14-2-2015	
21	Renganathanagar pond, Korattur	N 13°06.960'	E 080°11.848'	50 Ft	14-2-2015	
22	Puzhal lake, Puzhal	N 13°11.168'	E 080°11.406'	44Ft	14-2-2015	
23	Retteri, Lekshmipuram	N 13°08.243'	E 080°12.706'	48 Ft	14-2-2015	
24	Kolathureri, Kolathur	N 12°56.926'	E 080°12.032'	55 Ft	15-2-2015	
25	Vellakkaleri, Vellakkal	N 12°55.709'	E 080°10.919'	60 Ft	15-2-2015	
26	Athampakkameri, Thillaiannanagar	N 12°59.210'	E 080°11.740'	110 Ft	15-2-2015	
27	Karthikapurameri, Madipakkam	N 12°57.874'	E 080°11.472'	45Ft	15-2-2015	
28	Puzhithavakkameri, Puzhithavakkam	N 12°57.992'	E 080°12.133'	43 Ft	15-2-2015	
29	Keelkathalaieri, Keelkathalai.	N 12°56.995'	E 080°10.777'	46 Ft	15-2-2015	
30	Medavakkameri, Medavakkam	N 12°55.013'	E 080°11.055'	43Ft	15-2-2015	
31	Kovilampakkam pond Kovilampakkam.	N 12°56.515'	E 080°11.434'	19Ft	15-2-2015	
32	Pedariammankoil pond Nanmangalam	N 12°56.347'	E 080°10.667'	78 Ft	15-2-2015	
33	Nanmangalameri, Nanmangalam	N 12°56.431'	E 080°10.213'	30 Ft	15-2-2015	
34	Velacherieri, Velacheri.	N 12°59.275'	E 080°13.006'	59 Ft	15-2-2015	

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QUALITATIVE LIST OF ZOOPLANKTON RECORDED FROM CHENNAI, DISTRICT.

RHIZOPODA

Subkingdom PROTOZOA
Phylum SARCOMASTIGOPHORA
Subphylum SARCODINA
Superclass RHIZOPODA
Class LOBOSEA
Order ARCELLINIDA
Family ARCELLIDAEEhrenberg, 1830
Genus *Arcella*Erhenberg, 1832

1. *Arcelladiscoides*Ehrenberg, 1843
2. *Arcella vulgaris*Ehrenberg, 1832

Family CENTROPYXIDAEJung, 1942
Genus *Centropyxis* Stein, 1857
3. *Centropyxisecornis*(Ehrenberg, 1843)
4. *Centropyxis spinosa* (Cash and Hoopkinson, 1905)

FamilyDIFFLUGIDAEWallich, 1864
Genus *Difflugia,*Leclerc, 1815
5. *Difflugiacorona*Wallich, 1864

Family NEBELIDAETaranek, 1882
Genus *Lesquereusia* Schlumberger, 1845
6. *Lesqureusia spiralis* (Ehrenberg 1830)

Genus*Heleopera* Leidy, 1879
7. *Heleoperarosea*Penard, 1980

ROTIFERA

Phylum ROTIFERA
Class EUROTATORIA
Subclass MONOGONONTA
Order PLOIMA
Family BRACHIONIDAEWesenberg-Lund, 1899
Genus*Brachionus* Pallas, 1776
8. *Brachionusfalcatus*Zacharias, 1898
9. *Brachionusrubens* Ehrenberg, 1838
10.*Brachionusquadridentatus*Hermann, 1783.
11.*Brachionuscalyciflorusf.amphiceros,* Ehrenberg, 1838.
12.*Brachionuscalyciflorus. f.borgeti*Apstein, 1907
Genus*Platiyas*Harring, 1913.
13. *Platiyasquadricornis*(Ehrenberg, 1832)
GenusKeratellaBory de St. Vincent, 1822
14. *Keratella quadrata* (O.F. Muller, 1786)
15. *Keratellatropica*(Apstein, 1907)

Family LECANIDAE Bartos, 1959
Genus*Lecane*Nitzsch, 1827
16. *Lecaneungulata*(Gosse, 1887)
17. *Lecaneluna*(O.F. Muller, 1776)
18.*Lecane (M) bulla*(Gosse, 1851)
19. *Lecane (M) closterocerca*(Schmarda, 1859)

Family LAPADELLIDAEHarring,1913
Genus*Lapadella*Bory de St. Vincent, 1826
20. *Lapadella ovalis* (O.F. Muller, 1786)

Family ASPLANCHNIDAEHarring& Myers, 1926
Genus*Asplanchna Gosse*, 1850
21.*Asplanchnabrightwelli*(Gosse, 1850)

Order GINESIOTROCHA
Family TESTUDINELLIDAE, Bartos, 1959
Genus *Testudinella*Bory de St. Vincent, 1826
22. *Testudinella patina* (Hermann, 1783)

Family FILINIDAEBartos, 1959
Genus *Filinia*Bory de St. Vincent, 1824
23.*Filinialongiseta*(Ehrenberg, 1834)

CLADOCERA

Phylum ARTHROPODA
Superclass CRUSTACEA
Class BRANCHIOPODA
Super order CLADOCERA
Order CTENOPODA
Family SIDIDAEBaird,1850
Genus*Diaphanosoma* Fischer, 1850
24.*Diaphanosomasarsi*Richard, 1895
25. *Diaphanosomaexcisum*Sars
Order ANOMOPODA
Family DAPHNIIDAEStraus, 1820
Genus*Ceriodaphnia*Straus, 1820
26.*Ceriodaphniacornuta*Sars, 1885
Genus *Daphnia*O.F. Muller, 1785
27. *Daphnia carinata* King
Genus*Simocephalus*Schoedler, 1853
28. *Simocephalusserrulatus*(Koch, 1841)
29. *Simocephalusacutirostratus*(King, 1853)

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Family MACROTHRICIDAE Norman & Brady, 1867
Genus*Macrothrix*Baird, 1843
30. *Macrothrix spinosa*King, 1853
31. *Macrothrixgoeldi*Richard, 1897
Family MOINIDAEGoulden, 1968
Genus*Moina*Baird, 1850
32. *Moinamicrura*Kurz, 1874
Family CHYDORIDAEStebbing, 1902
Genus*Chydorus*Leach, 1860
33. *Chydorussphaericus*(O.F. Muller, 1776)
34. *Chydorus parvus* (Daday)
35. *Chydorus reticulata*Daday
Genus*Alona* Baird, 1843
36. *Alonarectangula*Sars, 1862
37.*Alonacostata*Sars, 1862
38. *Alonapulchella*King, 1853
39.*Alonadavidipunctata*(Daday, 1898)
Genus*Euryalona*Sars, 1901
40.*Euryalonaorientalis*(Daday, 1898)

OSTRACODA

Phylum ARTHROPODA
Superclass CRUSTACEA
Class OSTRACODA
Subclass PBODOCOPA
Order PODOCOPIDA
Family CYPRIDIDAE Baird, 1845
Genus *Cypris* O.F. Muller, 1776
41. *Cypris subglobosa*Sowerby, 1840
Genus*Strandesia*, Stuhlmann, 1888
42.*Strandesiacalapanensis,* Tressler, 1937
43.*Strandesialabiata* Hartmann, 1964
44. *Strandesia parva*Klie, 1935
45. *Strandesiasaetosa*Hartmann, 1964
46.*Strandesia indica*Hartmann, 1964
Genus*Heterocypris* Claus, 1892
47*Heterocyprisnudus*Victor & Michael 1975
Genus*Stenocypris*Sars ,1889
48. *Stenocypris major* (Baird) 1859
Genus*Chrissia* Hartmann ,1957
49. *Chrissiahislopi*(Ferguson) 1969
50. *Chrissiahalyi*(Ferguson) 1969
Genus*Cypretta*Vavra, 1895
51. *Cyprettafontinalis* Hartmann, 1964
Genus*Physocypria*Vavra, 1897
52. *Physocypriafurfuracea* (Brady, 1886)
Genus*Potamocypris*Brady, 1870
53. *Potamocyprisdubia* (Masi, 1905)
Genus*Oncocypris* G.W. Muller, 1898
54. *Oncocyprisvoeltzkowi*G. W. Muller, 1898

RESULTS AND DISCUSSION:

The presentstudy represents 54 species of zooplanktons comprising of Rhizopods belonging to 7 species, 4 genera (13.0%); Rotifers belonging to 16 species, 5 genera (29.5%); Cladocerans belonging to 17 species (31.5%), 8 genera and Ostracods belonging to 14 species, 7 genera (26%). Among the zooplanktonic organisms Cladocerans were the dominated group followed by Rotifera, Ostracoda and Rhizopoda. Biodiversity is fluctuated with different factors like water level as well as physicochemical parameters. Any changes in aquatic environment due to pollution are a cause of growing concern and require monitoring of physicochemical as well as biological parameters (Vandysh, 2004; Chugathai et.al., 2013).

Table: 2. Showing the group wise composition of zooplankton from Chennai district of Tamil Nadu.

No	Group	Species	Genera	Family	%Composition
1	Rhizopoda	7	5	4	13.0
2	Rotifera	16	8	6	29.5
3	Cladocera	17	9	5	31.5
4	Ostracoda	14	9	1	26.0

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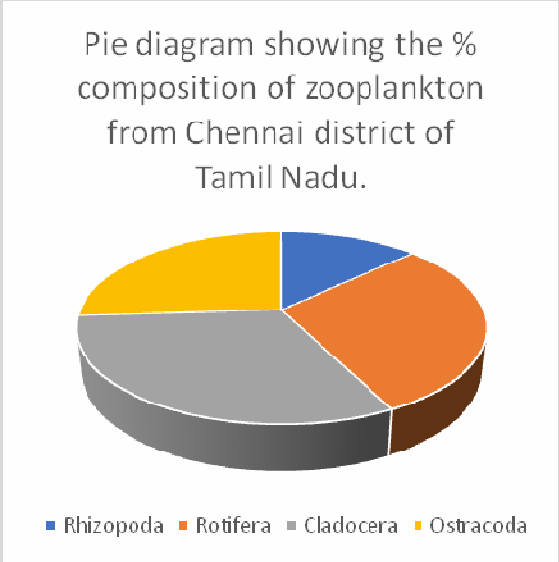

CONCLUSION:

Planktonic life is an essential part of aquatic ecosystem to maintain a healthy and productive environment. They are of primary importance of aquatic food chain and are also good bio-indicators of aquatic environment and are also used for assessing the nature of polluted waters. Any change in the environment may leads to change in the plankton communities in terms of tolerance, abundance, diversity and dominance in the habitat. So plankton population observation can be used as a reliable tool to assess the pollution status of water bodies.

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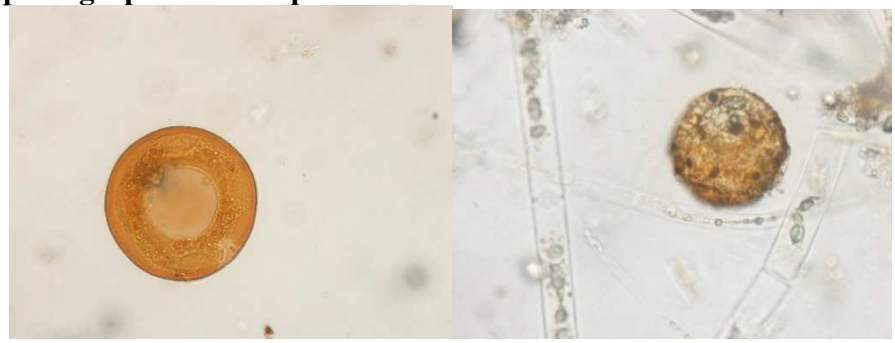
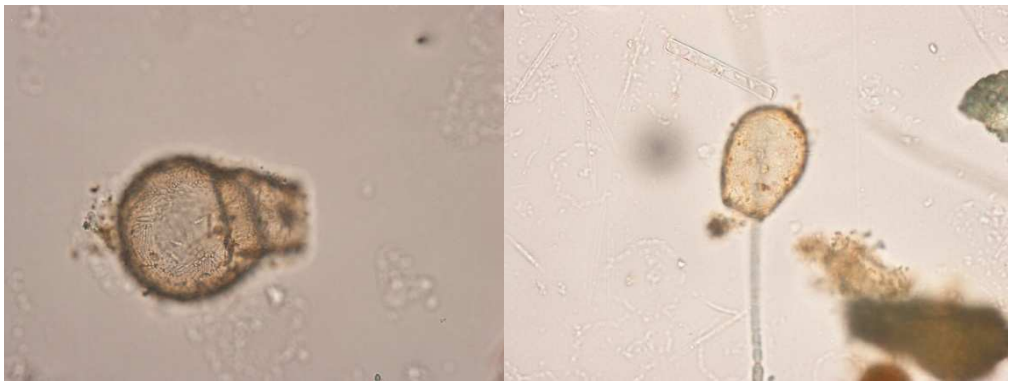
Plate 1
Some photographs of Rhizopods recorded from Chennai district of Tamil Nadu



*Arcelladiscoides*Ehrenberg, 1843*Centropyxisecornis*(Ehrenberg, 1843)

Centropyxis spinosa (Cash and Hoopkinson, 1905)*Difflugiacorona*Wallich, 1864

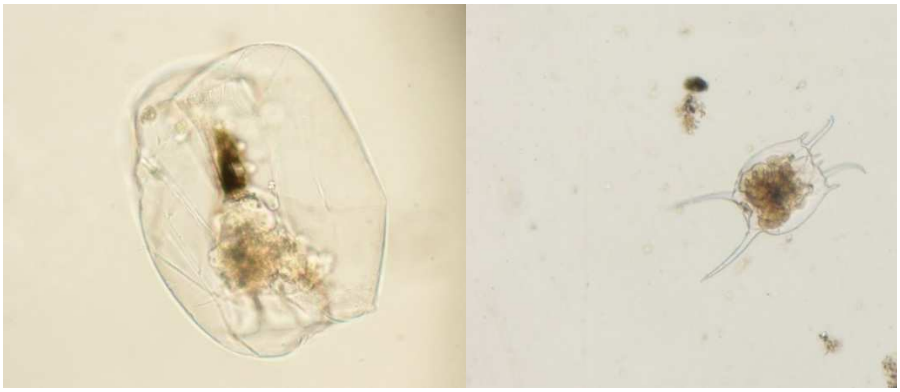


Lesqureusia spiralis (Ehrenberg 1830)*Heleoperarosea*Penard, 1980

International Journal of Global Science Research
Vol. 6, Issue. 1, April 2019, pp. 916-929
Available Online at www.ijgsr.com

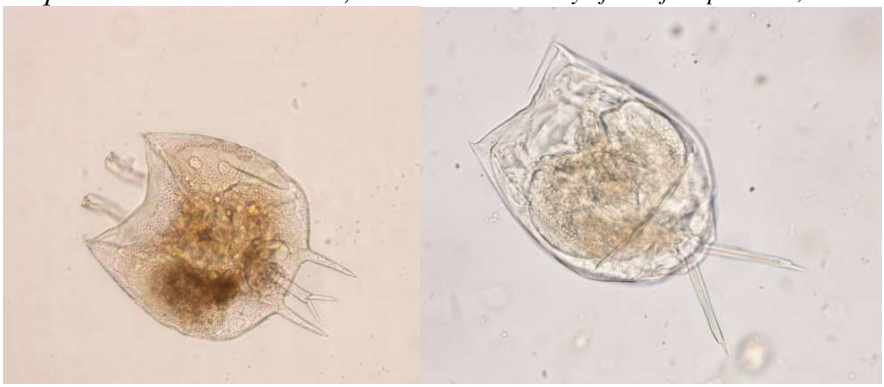
ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v6.i1.2019.119

Plate 2
Some photographs of Rotifers recorded from Chennai district of Tamil Nadu



Asplanchnabrightwelli(Gosse, 1850)*BrachionusfalcatusZ*acharias, 1898

*BrachionusquadridentatusH*ermann, 1783*Brachionuscalyciflorusf.amphiceros,* Ehrenberg, 1838.



Platiyasquadricornis(Ehrenberg, 1832)*Lecaneungulata*(Gosse, 1887)

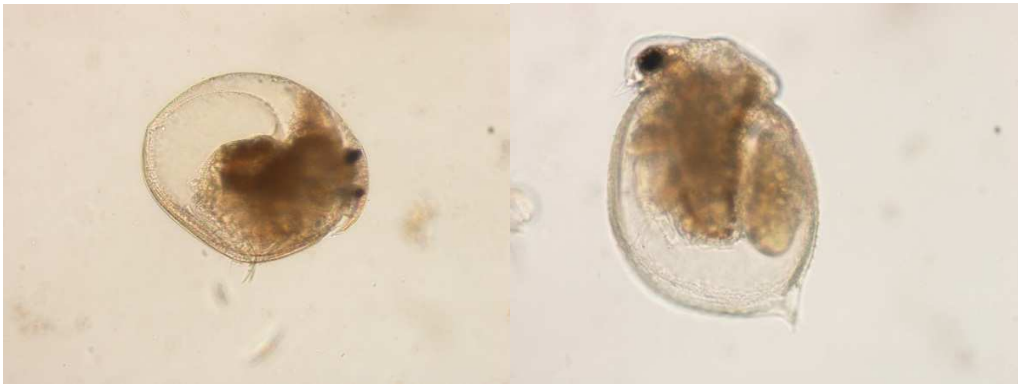
International Journal of Global Science Research
Vol. 6, Issue. 1, April 2019, pp. 916-929
Available Online at www.ijgsr.com

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v6.i1.2019.119

Plate 3
Some photographs of Cladercerans recorded from Chennai district of Tamil Nadu.

*Diaphanosomasarsi*Richard, 1895*Macrothrix spinosa* King, 1853

*Moinamicrura*Kurz, 1874*Alonarectangula*Sars, 1862



Chydorussphaericus(O.F. Muller, 1776)*Ceriodaphniacornuta*Sars, 1885

International Journal of Global Science Research
Vol. 6, Issue. 1, April 2019, pp. 916-929
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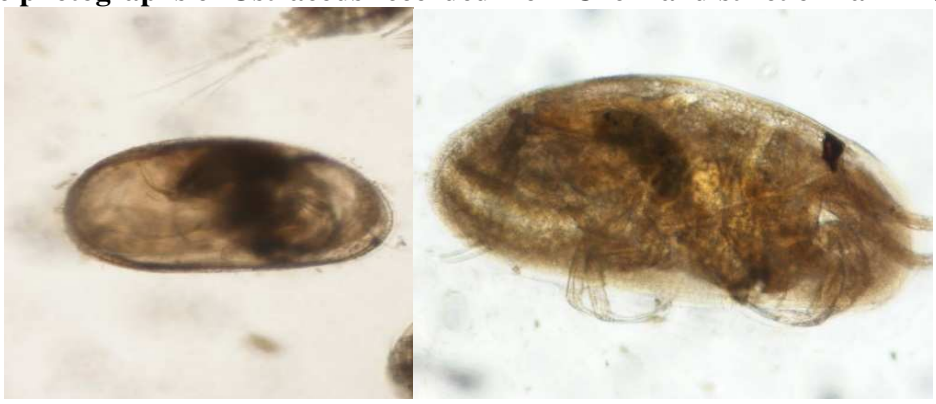
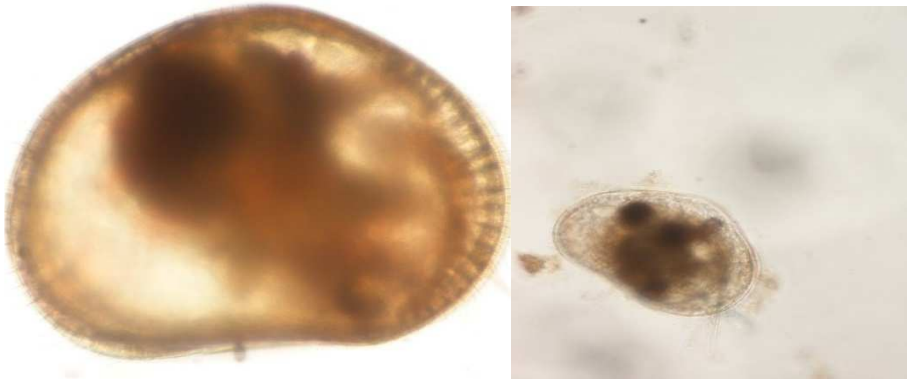
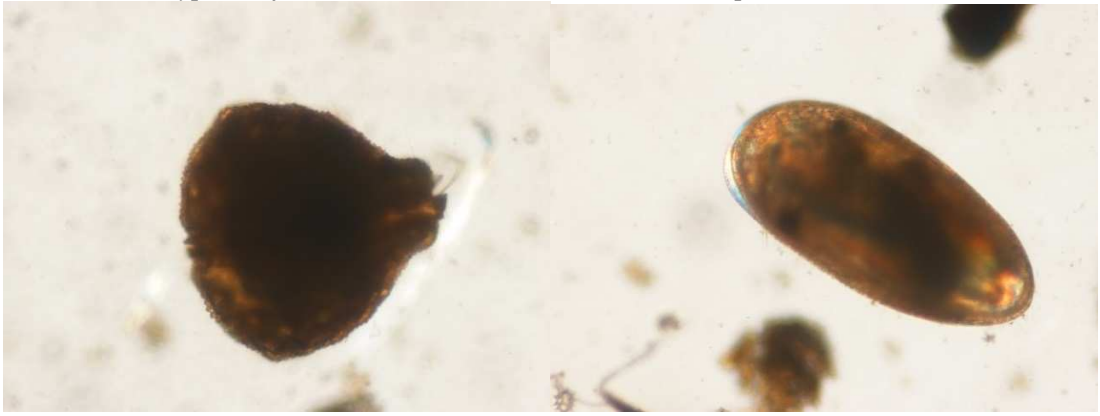
Plate 4
Some photographs of Ostracods recorded from Chennai district of Tamil Nadu.



*Cypris subglobosa*Sowerby, 1840*Chrissiahalyi*(Ferguson) 1969



Cypretta fontinalis Hartmann, 1964*Strandesiaparva*Klie, 1935



*Oncocyprisvoeltzkowi*G.W .Muller, 1898 *Strandesiasaetosa*Hartmann, 1964