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STUDY OF PLANKTONIC DIVERSITY IN AMARPURA DAM AT DUNGARPUR DISTRICT (RAJ.)

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Abstract
The present paper reports the planktonic diversity in the Amarpura dam inDungarpur district, Rajasthan. The samples were collected from March 2019 to February 2021.During the course of study, the zooplankton in the dam under investigation is represented by five major groups i.e. Protozoa, Rotifera, Ostracoda, Cladocera, and Copepoda. Among phytoplankton a total of 24 forms were recorded from all the three stations under study, with 12 belonged to Chlorophyceae, 4 to Bacillariophyceae, 2 to Xanthophyceae, 4 to Myxophyceae, and 2 to Dinophyceae.

Key Words: *Amarpura dam,planktonic diversity, zooplankton, phytoplankton*

I. Introduction

Aqueous habitat's crucial biotic constituents are plankton. In lakes and reservoirs, they do ascertain the trophic condition and water quality (Sangve, 2020).As a key source of food for other creatures, phytoplankton is the dominant producer in many aquatic environments (Gupta and Dey, 2012).Omega-3 fatty acids are abundant in zooplankton, which also has significant nutritional value.Due of their sensitivity to changes in water quality, they are good bioindicators of the environment. When it comes to temperature, pollution, and nutrient levels, zooplankton is crucial. They are employed to assess the condition of an ecosystem (Goedkoop et al., 2000; Purushothama et al., 2011).Zooplankton is essential to the transformation of plant matter into animal feed in aquatic environments. It can also be utilised as a trophic status indicator for fish and other higher species, as well as a source of food for them (Verma and Munshi, 1987).
Heterotrophic microorganisms, zooplanktons consume other zooplankton as well as bacterioplankton, phytoplankton, and nektonic organisms (Ghantaloo et al., 2011).

II. Materials And Methods

Study site
Amarpura dam is constructed on the Bhadar River. This river is a tributary of river Mahi originated from hills near village Kangrua. The study area is 13 km. from Simalwara and 53 km. from Dungarpur and it is situated on latitude 23º29'23"N and longitude73º48'48"E. Amarpura dam is an earthen dam, the maximum length of the dam is 228 m, maximum height is 20.0 m. The catchment area is 67 sq. miles. The gross capacity of the dam is 15.20 Mcum. This reservoir is useful for irrigation, drinking, and fishing purposes.

Sample collection
The plankton samples were collected by filtering by 50 liters of water through plankton net of different pore size 20µ - 45µ. Then filtered planktons was preserved in 4% formalin and few drops of glycerin was added to it which prevents hardening of planktons. Plankton sample was identified under the microscope with the help of identification keys (Edmondson, 1965; Tonapi, 1980; Battish, 1992; APHA, 1995; Pennak, 1953; Ward and Whipple, 1945).

III. Result and discussion

During the present investigation, we found a total 24 forms of phytoplankton. Among them, 12 belonged to Chlorophyceae, 4 to Bacillariophyceae, 2 to Xanthophyceae, 4 to Myxophyceae, and 2 to Dinophyceae at all three stations.

The group Chlorophyceae was dominated by *Chlorella sp., Coelastrum sp., Eudorina sp., Microspora sp., Oedogonium sp., Oocystis sp., Pediastrum sp., Pleodorina sp., Spirogyra sp., Ulothrix sp., Volvox sp.,* and*Zygnemopsis sp.*Bacillariophyceae were represented by *Amphora sp., Bacillaria sp., Cymbella sp., and Pinnularia sp.*Xanthophyceae were represented by *Botryococcus sp.* and *Chlorobotrys sp.* Myxophyceae was

represented by *Anabaena sp., Nostoc sp., Oscillatoria sp. and Spirulina sp.,* and Dinophyceae was dominated by *Ceratium sp. and Peridinium sp.*

On the basis of density, the percentage composition of phytoplankton indicated the following ranking (Table-1)

Station -I

Cholorophyceae (52.94%) >Bacillariophyceae (17.64%) >Myxophyceae (11.76%) = Dinophyceae (11.76%) >Xanthophyceae (5.88%)

Ranking depicted in figure 1.1.

Station – II

Cholorophyceae (44.44%) >Myxophyceae (22.22%) >Bacillariophyceae (11.11%) = Xanthophyceae (11.11%) = Dinophyceae (11.11%)

Ranking depicted in figure 1.2.

Station – III

Cholorophyceae (52.63%) >Myxophyceae (21.05%)>Bacillariophyceae (15.78%) >Xanthophyceae (5.26%) = Dinophyceae (5.26%)

Ranking depicted in figure 1.3.

During the present investigation, we noteda total 4 forms of Protozoa belonging to 3 families. Rotifers were represented by 12 forms and 6 families; along with these, 3 forms belonging to 1 family of Cladocerans, 1 form belonging to 1 family of Copepoda and 2 forms belonging to 1 family of Ostracoda were enlisted. Beside these other zooplanktonic groups, such as insects, insect larvae, and some Arachnid forms were listed as miscellaneous planktonic forms.

The group Protozoans was dominated by*Volvox sp., Euglena sp.,* A*moeba sp., and Paramecium sp.* Rotifera were dominated by*Bronchionusangularis, Keratellacochleris, Mytilinaventralis, Trichotriasimilis, Monostyla bulla, Cephalodellaexigua, Lecaneluna, Asplanchnaherricki, Polyrthra vulgaris, Lepadellaovalis, Horellamira, and Filinialongiseta.* Cladocerans were represented by *Daphnia dubia, Daphnia lumholtzi,* and*Ceriodaphnialaticaudata.* Copepods were represented by *Cyclops leuckarti.* Ostracods were represented by *Eucypris and Heterocypris.*

The percentage composition of zooplankton indicated the following ranking(Table-2)

Station I:

Rotifers (57.14%) > Protozoan (19.04%) >Cladocerans (9.52%) = Ostracods (9.52%) > Copepods (4.76%)

Ranking depicted in figure 2.1.

Station II:

Rotifers (47.05%) > Protozoan (23.52%) >Cladocerans (17.64%) > Copepods (5.88%) = Ostracods (5.88%)

Ranking depicted in figure 2.2.

Station III:

Rotifers (41.17%) > Protozoan (23.52%) >Cladocerans (17.64%) > Ostracods (11.76%) > Copepods (5.88%)

Ranking depicted in figure 2.3.)

Statistical analysis:

Plankton species shows correlation with different physico-chemical parameters were as under: (Table- 3)

Ulothrix sp. (0.324) and Paramecium sp.(0.351) showed significant positive correlation, while Oocystis (-0.005) and Pediastrum sp. (-0.125), Chlorobotrys sp.(-0.022), Brachionusangularis(-0.012), Lepadellaovalis (-0.054) and Monostyla bulla(-0.043) showed negative correlation with temperature.

The depth of visibility showed significant positive correlation with all planktonic groups.

Peridinium sp. (-0.009), Euglena sp.(-0.039) and Paramecium sp.(-0.006) showed negative correlation with pH.

Asplanchnaherricki (0.432) showed significant positive correlation, while Nostoc sp. (0.020) showed negative correlation with DO.

Chlorella sp.(0.360), Coelastrum sp. (0.383), Eudorina sp. (0.339), Microspora sp.(0.302), Pleodorina sp. (0.327),Ulothrix sp. (0.462),Zygnemopsis sp. (0.342),Botryococcus sp.(0.441),Chlorobotrys sp.(0.332), Anabaena sp.(0.339), Ceratium sp. (0.552), and Peridinium sp.(0.388), Bacillaria sp.(0.374), Cymbella sp.(0.352), Pinnularia sp.(0.432),Paramecium sp. (0.495), Asplanchnaherricki (0.428), Filinialongiseta (0.447), Horellamira (0.374), Keratellacochleris (0.404),Lepadellaovalis (0.354), Polyrthra vulgaris (0.336),Trichotriasimilis (0.309),Ceriodaphnialaticaudata (0.350), Cyclops leuckarti (0.315), Daphnia dubia (0.449), Daphnia lumholtzi (0.404), Heterocypris(0.435), Arachnides (0.383),Insects (0.400) and Insects larvae (0.372) showed significant positive correlation with BOD.

Microspora sp. (-0.003), Oedogonium sp.(-0.058), Oocystis (-0.142), Pleodorina sp. (-0.021), Volvox sp.(-0.047), Botryococcus sp.(-0.080), Amphora sp.(-0.053), Pinnularia sp.(-0.039), Paramecium sp. (-0.022),

Horellamira (-0.009), Keratellacochleris (-0.010),Lecaneluna (-0.132), Lepadellaovalis (-0.028), Daphnia lumholtzi (-0.046) and Arachnides (-0.034) showed negative correlation with free CO_2.

Total alkalinity showed significant positive correlation with all planktonic groups.

Jeelani et al. (2005) recorded the 6 major groups of phytoplankton in Dal lake (Kashmir) and found that Bacillariophyceae was the dominant group. Rajawat and Sharma (2020) calculated 25 genera and 38 species in Rani Sagar pond in Ranthambore fort.Kumari and Pathak (2018) recorded 11 species of Rotifera, 4 cladocera and 4 copepoda from pond of Muzaffarpur (Bihar).

Deshmukh (2001) recorded 28 species of rotifers in Chhatrilake of Amravati with the highest number of species occurring during the summer. Jha and Singh (2017) identified the 3 groups of zooplankton (Rotifera, Copepoda and Cladocera) and Rotifera was the most abundant group in Dah Reoti, Ballia. Koli et al., (2012) noted 10 species of Cladocera and found the seasonal fluctuations in zooplankton. Sinha and Singh (2016) identified 12 species of Rotifera, 9 copepoda and 5 cladocerafrom perennial pond of Jharkhand.Dahegaonkar (2023) recorded 34 species of phytoplankton and 26 species of zooplankton at river Erai near Chandrapur (Maharashtra).Singh et al (2024) noted 28 genera of plankton (15 genera of phytoplankton and 13 genera of zooplankton) pond of eastern Uttar Pradesh.

Rawat (1991) identified 9 species of rotifers, 8 species of cladocerans and 4 species of copepods from Tumaria Reservoir (Uttarakhand).

Some of the works carried out in the water bodies of India on the ecology of zooplankton include those of Ramakrishna and Sarkar (1982), Meshram and Dhande (2000), Kanagasabapathi and Rajan (2010) and Sivakumar et al., (2001).

Table-1: List of Phytoplankton observed during the year 2019-21

No.	Name of Phytoplankton	2019-20			2020 -21		
		Station-I	Station-II	Station-III	Station-I	Station-II	Station-III
	A) CHLOROPHYCEAE						
1	*Chlorella sp.*	+	-	+	-	+	-
2	*Coelastrum sp.*	-	-	+	+	+	-
3	*Eudorina sp.*	-	-	+	-	-	+
4	*Microspora sp.*	+	-	+	+	+	-
5	*Oedogonium sp.*	-	+	-	-	+	+
6	*Oocystis sp.*	+	+	-	+	-	-
7	*Pediastrum sp.*	-	-	-	+	-	+
8	*Pleodorina sp.*	-	+	-	-	-	-
9	*Spirogyra sp.*	-	-	+	+	-	+
10	*Ulothrix sp.*	+	-	-	-	+	+
11	*Volvox sp.*	+	+	+	+	+	+
12	*Zygnemopsis sp.*	+	-	+	-	-	-
	B) XANTHOPHYCEAE						
13	*Botryococcus sp.*	-	-	+	-	+	+
14	*Chlorobotrys sp.*	+	+	-	-	-	-
	C) MYXOPHYCEAE						
15	*Anabaena sp.*	+	+	+	-	+	+
16	*Nostoc sp.*	+	+	-	+	-	+
17	*Oscillatoria sp.*	-	+	+	-	+	+
18	*Spirulina sp.*	-	+	+	-	+	-
	D) DINOPHYCEAE						
19	*Ceratium sp.*	+	+	-	+	-	-
20	*Peridinium sp.*	+	-	+	+	+	-
	E) BACILLARIOPHYCEAE						
21	*Amphora sp.*	-	-	+	-	-	-
22	*Bacillaria sp.*	+	-	-	+	+	-
23	*Cymbella sp.*	+	-	+	+	+	-
24	*Pinnularia sp.*	+	-	-	-	-	+

Table2: List of Zooplankton observed during the year 2019-21

No.	Name of Zooplankton	2019-20			2020 -21		
		Station -I	Station -II	Station -III	Station -I	Station -II	Station -III
	Protozoa Sub phylum – Sarcomastigophora Super class – Mastigophora Class – Phytomastigophora Order – Volvocida **Family – Volvocacae**						
1.	*Volvox*	+	+	+	+	+	+
	Family – Nebelidae						
2	*Euglena sp.*	+	+	+	+	+	+
	Class – Rhizopoda Order – Amoebida						
3	*Amoeba sp.*	+	+	-	+	-	+
	Sub phylum – Ciliophora Class – Ciliata **Family – Paramecidae**						
4	*Paramecium sp.*	+	+	+	+	+	+
	Rotifera **Family – Bronchionidae**						
5	*Bronchionus angularis*	-	-	+	+	-	-
6	*Keratella cochleris*	+	-	+	+	+	-
7	*Mytilina ventralis*	+	-	-	-	+	-
8	*Trichotria similis*	+	+	-	-	-	+
	Family – Lecanidae						
9	*Monostyla bulla*	-	+	-	+	+	-
10	*Cephalodella exigua*	+	+	-	+	+	+
11	*Lecane luna*	+	-	-	-	+	+
	Family – Asplanchnidae						
12	*Asplanchna herricki*	-	-	-	+	+	-
	Family – Synchaetidae						
13	*Polyrthra vulgaris*	+	-	-	+	-	-
	Family – Calurinae						
14	*Lepadella ovalis*	+	-	+	-	-	+
	Family – Testudinellidae						
15	*Horella mira*	-	+	+	+	-	+
16	*Filinia longiseta*	+	-	-	-	-	-
	Cladocerans **Family – Daphnidae**						
17	*Daphnia dubia*	+	+	-	-	+	+
18	*Daphnia lumholtzi*	-	-	+	-	+	-
19	*Ceriodaphnia laticaudata*	+	+	+	-	+	+
	Sub-class – **Copepoda** Order – Cyclopoida **Family – Cyclopidae**						
20	*Cyclops leuckarti*	+	+	+	-	+	+
	Ostracoda						
21	*Eucypris*	+	-	+	-	-	+
22	*Heterocypris*	+	-	-	-	+	+
	Miscellaneous planktonic forms						
23	Arachnides	+	+	-	+	+	+
24	Insects	+	+	+	+	+	+
25	Insects larvae	+	+	+	+	+	+

Table 3: Correlation Coefficients for Planktons

Variables	Temp	Turbidity	pH	DO	BOD	Free CO_2	Alkalinity
Chlorella sp.	0.051	0.576**	0.164	0.253*	0.360**	0.087	0.566**
Coelastrum sp	0.121	0.447**	0.129	0.206	0.383**	0.02	0.525**
Eudorina sp.	0.103	0.525**	0.167	0.229	0.339**	0.03	0.579**
Microspora sp.	0.059	0.494**	0.061	0.041	0.302**	-0.003	0.428**
Oedogonium sp.	0.02	0.440**	0.196	0.049	0.292*	-0.058	0.446**
Oocystis sp.	-0.005	0.536**	0.146	0.148	0.23	-0.142	0.594**
Pediastrum sp.	-0.125	0.385**	0.250*	0.175	0.205	0.067	0.481**
Pleodorina sp.	0.109	0.493**	0.175	0.174	0.327**	-0.021	0.590**
Spirogyra sp.	0.147	0.562**	0.057	0.096	0.238*	0.182	0.543**
Ulothrix sp.	0.324**	0.667**	0.083	0.195	0.462**	0.041	0.671**
Volvox sp.	0.125	0.504**	0.127	0.112	0.246*	-0.047	0.616**
Zygnemopsis sp.	0.019	0.429**	0.141	0.15	0.342**	0.084	0.526**
Botryococcus sp	0.143	0.592**	0.288*	0.185	0.441**	-0.08	0.623**
Chlorobotrys sp	-0.022	0.462**	0.217	0.202	0.332**	0.067	0.482**
Anabaena sp.	0.186	0.507**	0.177	0.176	0.339**	0.035	0.656**
Nostoc sp.	0.104	0.530**	0.194	-0.02	0.192	0.061	0.550**
Oscillatoria sp.	0.02	0.533**	0.177	0.203	0.18	0.035	0.526**
Spirulina sp.	0.106	0.438**	0.087	0.107	0.227	0.07	0.515**
Ceratium sp.	0.187	0.495**	0.116	0.196	0.552**	0.199	0.597**
Peridinium sp.	0.253*	0.438**	-0.009	0.153	0.388**	0.025	0.558**
Amphora sp.	0.083	0.587**	0.194	0.117	0.197	-0.053	0.549**
Bacillaria sp.	0.042	0.487**	0.240*	0.248*	0.374**	0.049	0.615**
Cymbella sp.	0.127	0.417**	0.11	0.16	0.352**	0.047	0.510**
Pinnularia sp	0.074	0.471**	0.201	0.188	0.432**	-0.039	0.487**
Volvox	-0.032	0.425**	0.175	0.067	0.222	0.155	0.419**
Euglena sp	0.153	0.475**	-0.039	0.058	0.216	0.194	0.560**
Amoeba sp.	0.351**	0.570**	-0.006	0.250*	0.495**	-0.022	0.585**
paramecium sp.	0.048	0.487**	0.111	0.204	0.183	0.098	0.640**
Bronchionus angularis	0.233*	0.497**	0.01	0.432**	0.428**	0.007	0.619**
Keratella cochleris	-0.012	0.504**	0.097	0.11	0.256*	0.025	0.510**
Mytilina ventralis	0.032	0.558**	0.21	0.181	0.260*	0.158	0.587**
Trichotria similis	0.194	0.590**	0.117	0.246*	0.447**	0.076	0.599**
Monostyla bulla	0.124	0.532**	0.079	0.084	0.374**	-0.009	0.535**
Cephalodella exigua	0.109	0.409**	0.221	0.141	0.404**	-0.01	0.620**
Lecane luna	0.032	0.435**	0.161	0.145	0.182	-0.132	0.592**
Asplanchna herricki	-0.054	0.457**	0.294*	0.245*	0.354**	-0.028	0.556**
Polyrthra vulgaris	-0.043	0.476**	0.155	0.156	0.280*	0.097	0.546**
Lepadella ovalis	0.154	0.589**	0.055	0.009	0.291*	0.153	0.521**
Horella mira	0.280*	0.467**	0.037	0.259*	0.336**	0.018	0.639**
Filinia longiseta	0.026	0.508**	0.211	0.166	0.309**	0.152	0.519**
Daphnia dubia	0.203	0.667**	0.088	0.203	0.350**	0.198	0.656**
Daphnia lumholtzi	0.232	0.550**	0.135	0.124	0.315**	0.12	0.598**
Ceriodaphnia laticaudata	0.117	0.613**	0.145	0.197	0.449**	0.158	0.549**
Cyclops leuckarti	0.262*	0.640**	0.089	0.103	0.404**	-0.046	0.675**
Eucypris	0.048	0.476**	0.124	0.173	0.243*	0.078	0.476**
Heterocypris	0.202	0.443**	0.16	0.12	0.435**	0.095	0.480**
Arachnides	0.162	0.553**	0.002	0.208	0.383**	-0.034	0.598**
Insects	0.096	0.545**	0.142	0.255*	0.400**	0.014	0.546**
Insects larvae	0.109	0.478**	0.238*	0.115	0.372**		0.526**

*,** Significant at 5% and 1% level of significance.

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Figure 1.1: Group-wise composition of phytoplankton at station-I of Amarpura dam during 2019-21

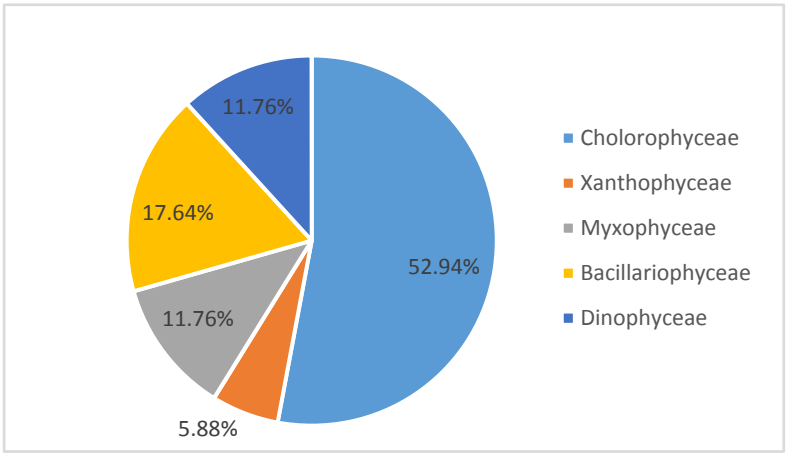

Figure 1.2 : Group-wise composition of phytoplankton at station-II of Amarpura dam during 2019-21

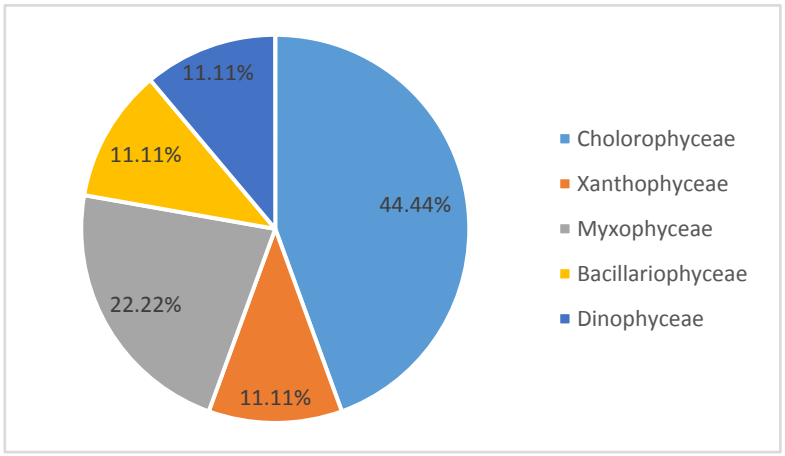

Figure 1.3 : Group-wise composition of phytoplankton at station-III of Amarpura dam during 2019-21

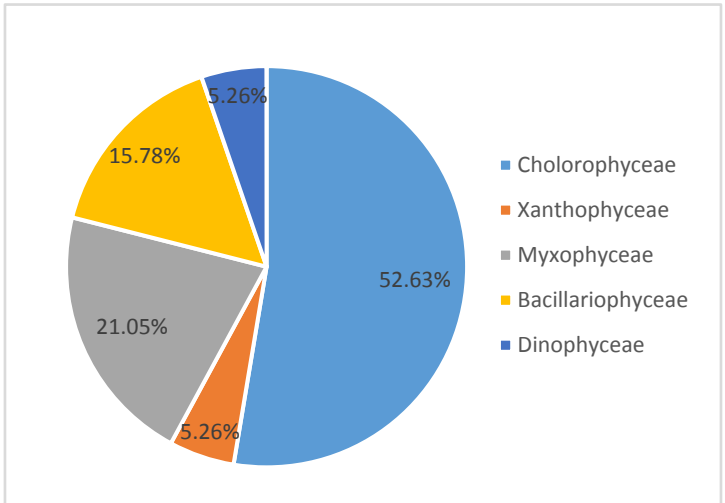

Figure 2.1: Group-wise composition of zooplankton

at station-I of Amarpura dam during 2019-21

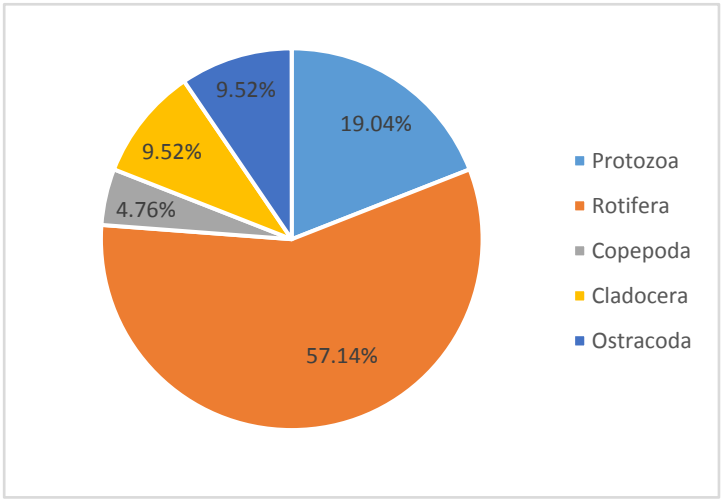

Figure 2.2 : Group-wise composition of zooplankton

at station-II of Amarpura dam during 2019-21

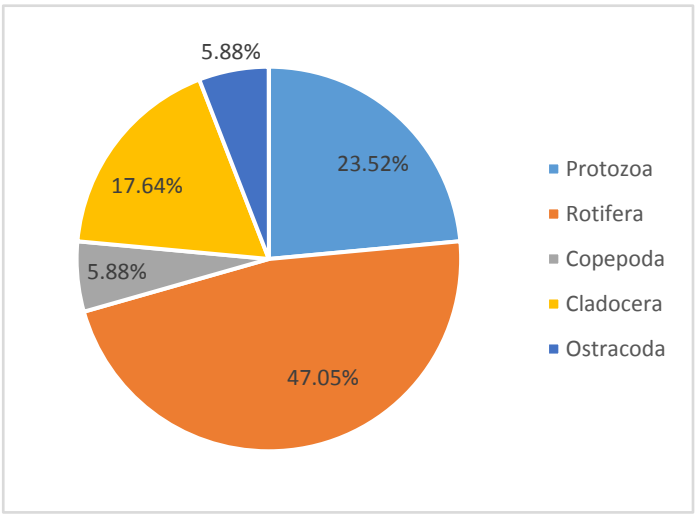

Figure 2.3 :Group-wise composition of zooplankton

at station-III of Amarpura dam during 2019-21