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A preliminary assessment on the plankton diversity of Serlui 'B' dam in Mizoram, northeast India

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Planktonic sampling was carried out at Serlui 'B' dam, Mizoram, northeast India from July 2016 to April 2017. The present study reported the occurrence of 6 groups of phytoplankton belonging to 27 genera and 16 orders and 4 groups of zooplanktons belonging to 12 genera 7 orders. The phytoplankton group consisted of Cyanophyceae, Bacillariophyceae, Ulvophyceae, Zygnematophyceae, Chlorophyceae and Xanthophyceae. Cyanophyceae were the predominant component of phytoplankton in Serlui 'B' dam during all seasons in terms of numerical abundance and account for 64% of the total phytoplankton. The zooplankton groups consisted of Maxillopoda, Tubulinea, Eurotatoria and Branchiopoda. Of these, the class Maxillopoda was the predominant component of zooplankton in Serlui 'B' dam during all season in terms of numerical abundance and account for 73% of the total zooplankton encountered from the study site. This study provides preliminary report of planktons of Serlui 'B' dam.

Key words: Mizoram; phytoplankton; Serlui 'B' dam; zooplankton.

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Introduction

The requirement of water in all life forms, from microorganism to man is a serious problem today because majority of the water resources have reached a point of crises due to unplanned urbanization and industrialization which significantly contributes to the pollution and toxicity of aquatic ecosystems.[1] The physico -chemical characteristics of the aquatic environment directly influence the life inhabiting it. Pollutants not only bring about a change in the physico-chemical characteristics of water, but often create an adverse environment to organisms resulting in the elimination of some valuable species and cause a change in the dominant biota.[2] Species diversity is adversely affected by a marked change in the algal community.[3] Due to their rapid response to toxins and other chemicals, phytoplankton is considered as one of the most reliable detectors of environmental change. However, their scant distribution along with their transient nature cannot be totally relied upon for assessing the quality of water.[4] The present study focused on the abundance and distribution pattern of plankton in Serlui 'B' dam, an earth fill gravity dam on the Serlui river, 12 km from Bilkhawthlir village, Kolasib district, Mizoram, northeast India.

Materials and Methods

The present study was undertaken in Serlui 'B' dam located in Mizoram, northeast India be-

tween 24°20′18.18″N latitude and 92°46′06.48″E longitude. Serlui River flows through Kolasib district and is impounded by the Serlui 'B' Dam, an earth fill gravity dam located 12km from Bilkhawthlir village, Kolasib district, Mizoram. It is the largest hydro-power plant in Mizoram with a height of 51 m and length of 293 m. The catchment area is about 53km wide thick forest.

Water samples were collected from the study site with a wide mouth plastic bottle on a monthly basis from July 2016 to April 2017. Plankton were collected by submerging plankton net to a maximum depth while slowly turning the inlet in the front direction covering as much area as possible. The plankton thus collected at the tube from the end of the net were then transferred to the sample bottle and then fixed with formalin. The samples were then brought to the laboratory, Department of Zoology, Mizoram University for qualitative and quantitative analysis of plankton. The water samples containing the plankton were dropped on the slides and were then observed under microscope for the assessment of plankton diversity. Surface unit was selected instead of volume unit since it showed the actual numbers of individuals present per sq. cm. All individuals present in the sample were counted and photograph was taken. Identification was done up to the genus level with the help of published literature.[5-9]

Results and Discussion

In total, 27 genera of phytoplankton belonging to 15 orders and 6 groups were identified and quantified from Serlui' 'B' dam (Table 1). The group consisted of Cyanophyceae, Bacillariophyceae, Ulvophyceae, Zygnematophyceae, Chlorophyceae and Xanthophyceae (Fig. 1). Cyanophyceae were the predominant component of phytoplankton during all seasons in terms of numerical abundance. They account for 67% of the total phytoplankton group and were represented by 6 genera *viz. Rivularia*, *Nostoc*, *Microcystis*, *Oscillatoria*, *Spirulina* and *Anabaena*. *Rivularia* belonging to order Nostocales was the most dominant Cyanaophyceae and comprises 88% of the group and 59% of the total phytoplankton. Baccilariophyceae formed the second most dominant group and comprises about 13% of the total phytoplankton count. They were mostly represented by *Diatoma* belonging to order Pennales. Although Zygnematophyceae were represented by maximum number of genera, collectively they form only about 9% of the total phytoplankton encountered in the study site. Lowest recorded phytoplankton abundance was Xanthophyceae represented by *Ophiocytium* which comprises less than 1% of the total phytoplankton community. The least dominant genera were that of *Gonatozygon*, *Sirogonium*, *Meridion* and *Cylindrocystis*, each represented by 1 individual. Overall, summer season harbors maximum number of phytoplankton where 58% of the total phytoplankton was encountered (Fig. 2). Abundance was at its lowest during the spring season where only 11% of the total phytoplankton was reported, but practically the same groups and genus were dominant, although they were present in smaller numbers. Of the total 27 genera of phytoplankton encountered during the study period, *Ophiocytium* is the only phytoplankton found only during the spring season. *Spirulina*, *Sirogonium*, *Gonatozygon*, *Cylindrocystis* and *Ankistrodesmus* were encountered only during summer season while *Meridion* and *Pandorina* were encountered during the winter season only (Fig. 3 and 4). With regards to species composition Zygnematophyceae consisting of 10 genera were the most diversified although they form the third most dominant group among the phytoplankton.

Phytoplankton is useful in biomonitoring the ecological disturbance caused by a number of physico-chemical factors, sewage pollutants and other anthropogenic factors.[10-12] The dominance of Chlorophyceae and Bacillariophyceae was observed in oligotrophic reservoirs whereas in eutrophic reservoirs, dominance of Cyanophyceae was observed.[13] Many algal species such as *Euglena*, *Oscillatoria*, *Scenedesmus*, *Navicula*, *Nitzschia* and *Microcystis* belonging to Chlorophyceae, Cyanophyceae, Euglenophyceae and Bacillariophyceae usually inhabit organically polluted waters and are used as indicators of water quality.[14,15] It has also been reported that *Microcystis*

Table 1 | List of phytoplankton of Serlui 'B' dam.

No	Phytoplankton	Summer			Winter				Spring			Total
		July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	
1	**Cyanophyceae**											
	a) Nostocales											
	Rivularia	143	237	98	100	130	5	20	17	22	29	801
	Nostoc	33	3	1	2	0	35	0	0	0	0	74
	Anabaena	6	0	2	3	2	6	1	0	0	0	20
	b) Chroococcales											
	Microcystis	3	0	0	0	0	1	0	0	0	0	4
	c) Oscillatoriales											
	Oscillatoria	5	0	0	0	0	1	0	2	0	0	8
	d) Spirulinales											
	Spirulina	3	0	0	0	0	0	0	0	0	0	3
2	**Bacillariophyceae**											
	a) Naviculales											
	Pinnularia	6	0	1	0	0	2	0	0	0	0	9
	Navicula	4	6	1	0	0	0	17	6	6	5	45
	Stauroneis	1	1	1	0	0	0	5	0	0	2	10
	b) Pennales											
	Diatoma	18	7	5	4	3	9	26	7	12	21	112
	c) Tabellariales											
	Meridion	0	0	0	0	0	1	0	0	0	0	1
3	**Ulvophyceae**											
	a) Ulotrichales											
	Ulothrix	4	8	0	2	3	2	5	3	3	6	36
4	**Zygnematophyceae**											
	a) Desmidiales											
	Cosmarium	6	1	1	0	2	1	0	0	0	0	11
	Docidium	6	0	0	0	0	0	0	2	2	1	11
	Gonatozygon	1	0	0	0	0	0	0	0	0	0	1
	Desmidium	0	0	13	7	3	0	3	0	0	0	26
	Closterium	0	0	0	0	0	0	0	2	0	1	3
	b) Zygnematales											
	Spirogyra	2	5	0	0	0	2	4	4	2	8	27
	Mougeotia	5	2	1	7	8	5	3	2	3	7	43
	Zygnema	0	2	0	1	2	0	0	0	0	0	5
	Sirogonium	0	0	0	1	0	0	0	0	0	0	1
	Cylindrocystis	0	0	0	1	0	0	0	0	0	0	1
5	**Chlorophyceae**											
	a) Oedogoniales											
	Oedogonium	10	2	3	3	13	2	11	7	5	1	57
	b) Sphaeropleales											
	Ankistrodesmus	2	0	0	0	0	0	0	0	0	0	2
	c) Microsporales											
	Microspora	5	0	0	3	18	3	0	0	0	0	29
	d) Volvocales											
	Pandorina	0	0	0	0	4	3	8	6	0	0	21
6	**Xanthophyceae**											
	a) Mischococcales											
	Ophiocytium	0	0	0	0	0	0	0	0	6	0	6
	Total	**263**	**274**	**127**	**134**	**188**	**78**	**103**	**56**	**61**	**80**	**1364**

Table 2 | List of zooplankton of Serlui 'B' dam.

No	Zooplankton	Summer				Winter				Spring		Total
		July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	
1	**Maxillopoda (Copepoda)**											
	a) Cyclopoida											
	Nauplius	0	0	0	0	3	0	0	2	5	5	15
	Cyclops	8	2	6	5	11	4	0	5	4	6	51
	b) Calanoida											
	Calanoid	5	0	1	2	36	1	2	13	8	3	71
	Diaptomus	0	0	0	0	5	0	0	0	1	0	6
2	**Tubulinea**											
	a) Arcellinida											
	Arcella	1	3	0	0	2	0	0	0	0	1	7
3	**Eurotatoria (Rotifera)**											
	a) Ploima											
	Keratella	1	0	0	0	0	0	0	0	0	1	2
4	Branchiopoda											
	a) Cladocera											
	Alona	3	0	2	7	2	0	0	12	2	0	28
	Bosmina	0	0	0	0	0	0	0	2	4	0	6
	Acroperus	0	0	0	1	0	0	0	0	0	0	1
	b) Anostraca											
	Eubranchipus	0	0	0	1	0	0	0	8	0	0	9
	c) Diplostraca											
	Chydorus	0	0	0	0	0	1	0	0	0	0	1
	Sida	0	1	0	0	0	0	0	0	0	0	1
	Total	**18**	**6**	**9**	**16**	**59**	**6**	**2**	**42**	**24**	**16**	**198**

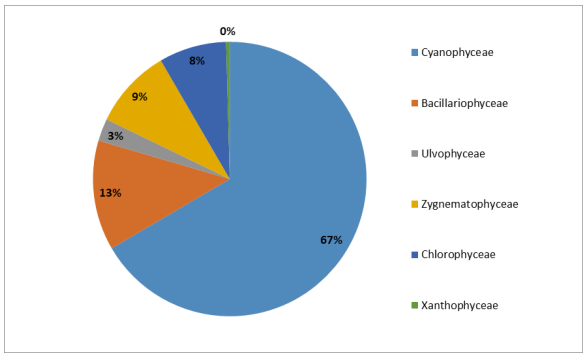

Fig. 2 | Seasonal distribution of phytoplankton in Serlui 'B' dam.

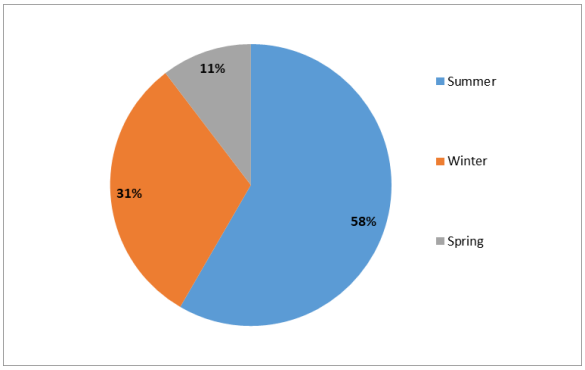

Fig. 3 | Phytoplanktons of Serlui 'B' dam.

aeruginosa was associated with the highest degree of civic pollution and was used as the best single indicator of pollution.[16] The present investigation recorded the occurrence of *Microcystis* along with *Oscillatoria* and *Navicula* from the study site thereby indicating that the dam is organically polluted. Serlui 'B'dam is subjected to pollution due to addition of fertilizers from agricultural lands and domestic sewage. Progressive enrichment of water with nutrients leads to mass production of algae, which in turn leads to the increased productivity and other undesirable biotic changes. The nutrient status, age, morphometry and other locational factors of differ-

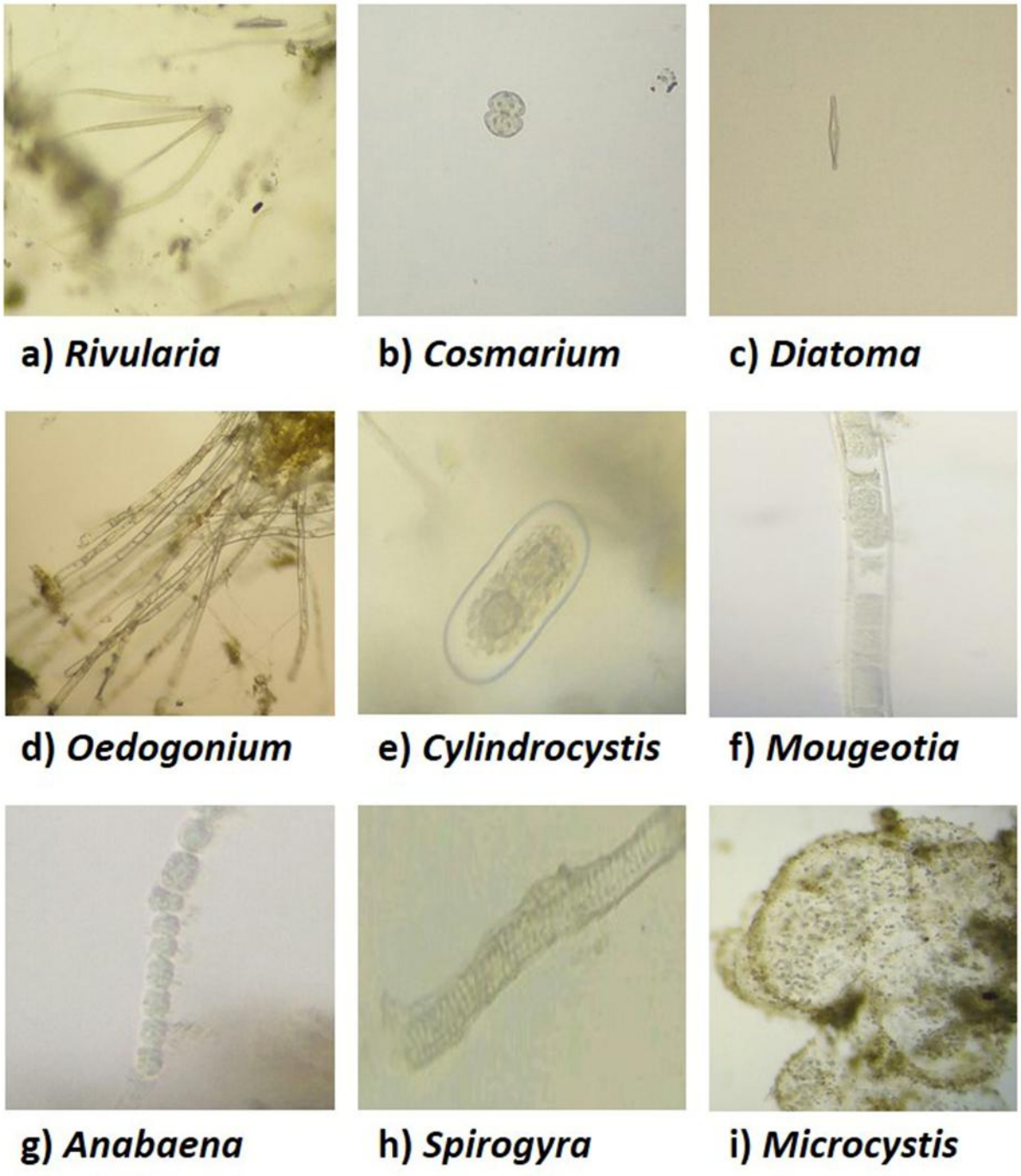

Fig. 3 | Phytoplanktons of Serlui 'B' dam.

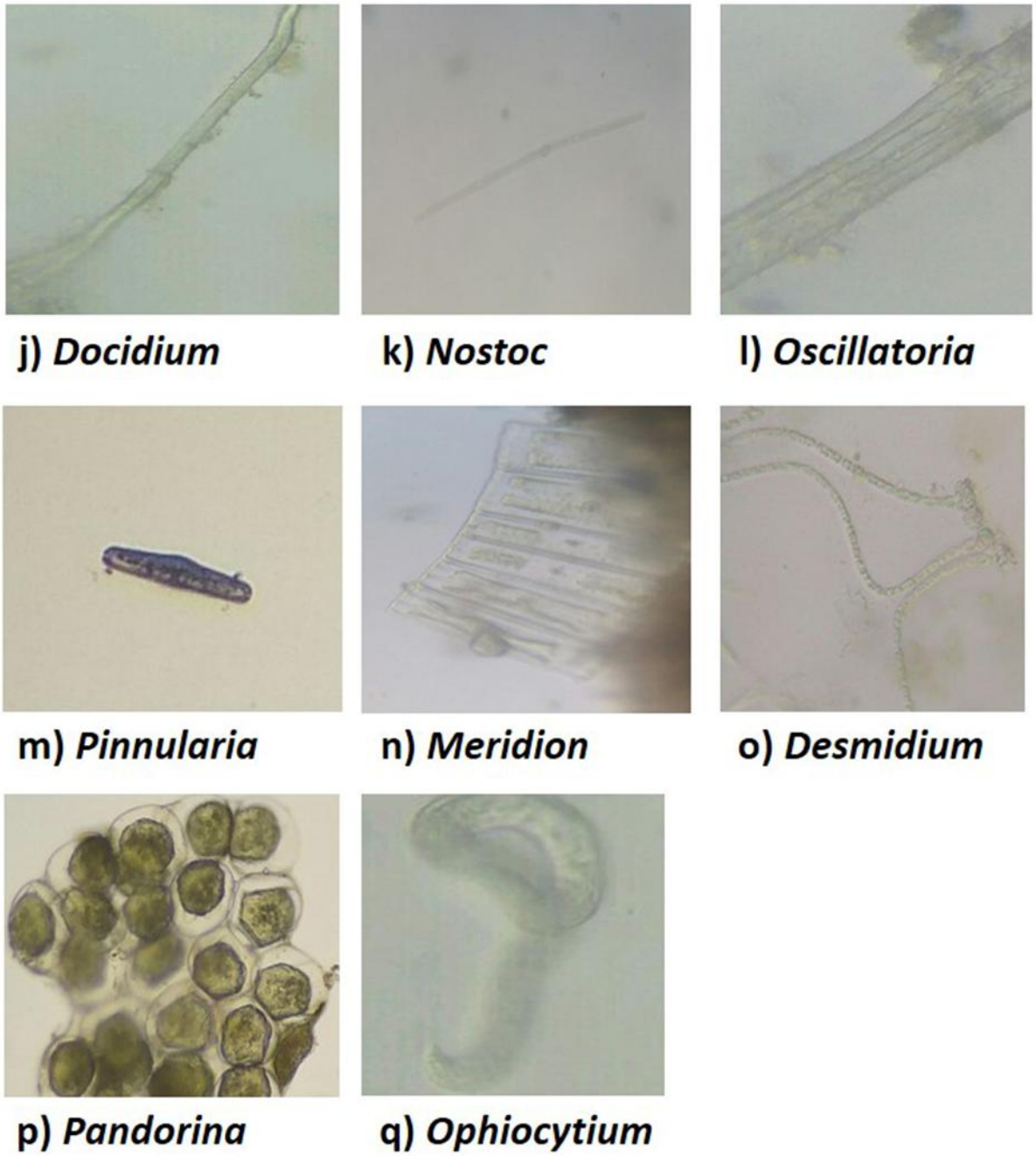

Fig. 4 | Phytoplanktons of Serlui 'B' dam.

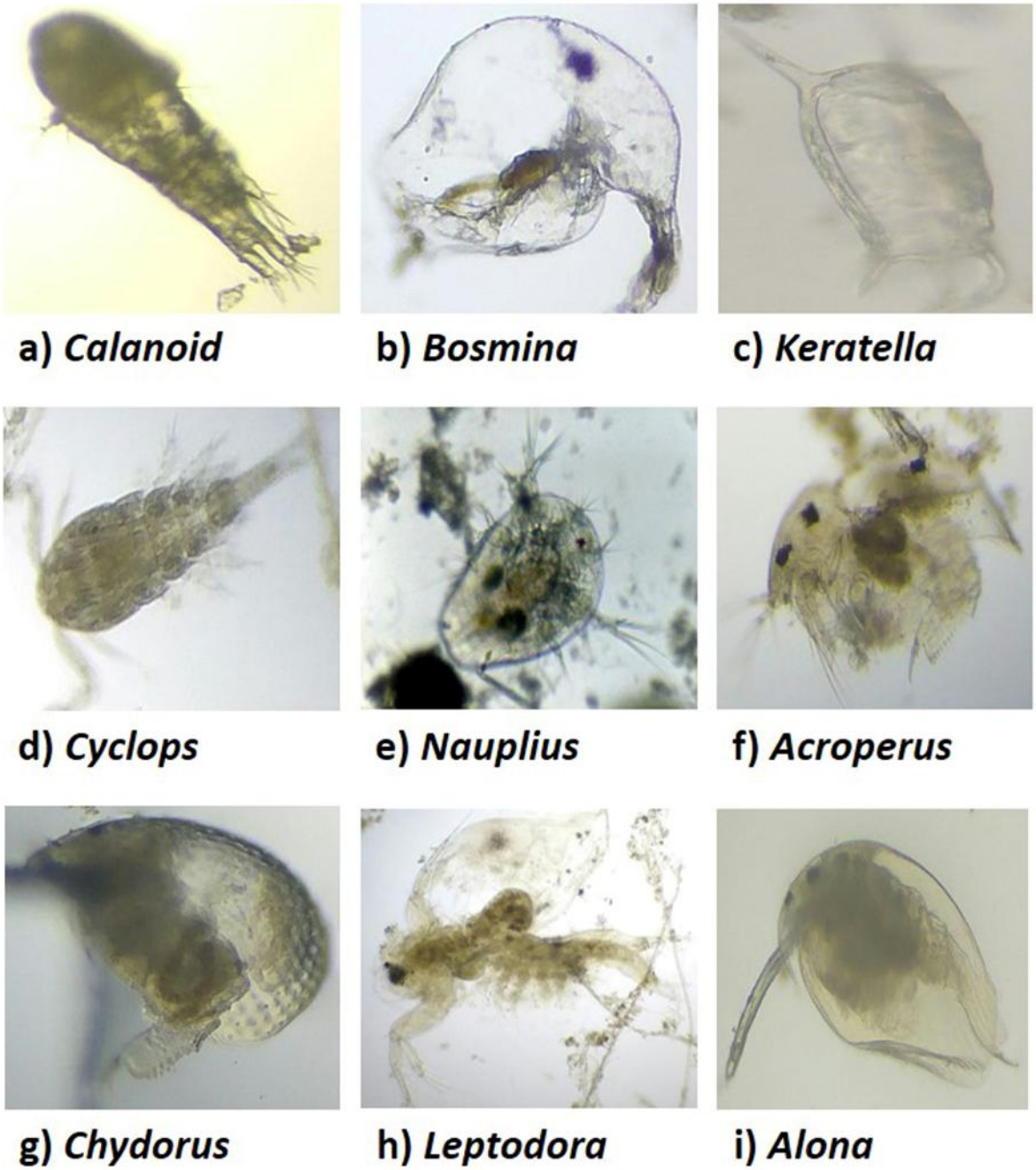

Fig. 7 | Zooplanktons of Serlui 'B' dam.

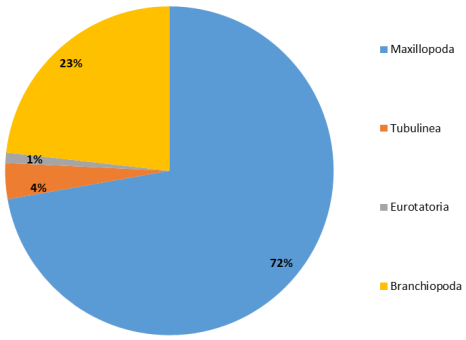

Fig. 5 | Overall group distribution of zooplankton in Serlui 'B' dam.

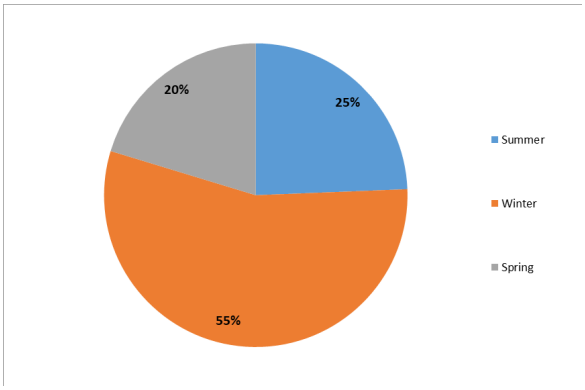

Fig. 6 | Seasonal distribution of zooplankton in Serlui 'B' dam.

ent water bodies determines the dominant phytoplankton, their seasonality and variability.[17]

A total of 12 genera of zooplanktons belonging to 7 orders and 4 groups were encountered during the sampling period (Table 2). The zooplankton groups consisted of Maxillopoda, Tubulinea, Eurotatoria and Branchiopoda (Fig. 5). Of these, the class Maxillopoda (Copepoda) was the predominant component of zooplankton in Serlui 'B' dam during all season in terms of numerical abundance. They account for 72% of the total group encountered during the study period and consisted of 4 genera *viz. Nauplius*, *Cyclops*, *Calanoid* and *Diaptomus*. Among the most dominant Copepoda was Calanoid belonging to order Calanoida constituting 50% of the group and 36% of the total zooplankton population. Branchipoda (Cladocera) formed the second most dominant group comprising about 23% of the total zooplankton count. The cladocerans were mostly represented by *Alona* which constitutes 61% of the group and 14% of the total zooplankton. Overall, winter season harbors maximum number of zooplankton where 55% of the total zooplankton was encountered (Fig. 6). Zooplankton showed a minimum peak during spring comprising only 20% of the total zooplankton population. However the same groups and genera were dominant, although they were present in smaller numbers. The least dominant group among the zooplankton was Eurotatoria constituting only 1% of the total zooplankton population. In winter, the Copepods dominated the zooplankton community accounting for 80% of the total zooplankton population. *Acroperus* and *Sida* were reported only during the summer season while *Chydorus* was reported during winter season only (Fig. 7). Branchiopoda, the second-most dominant group comprising of 6 genera were the most diversified among the zooplankton encountered during the sampling period.

The high population of Copepods (Maxillopoda) from the study site may be attributed to the moderately rich nutrient nature of the Serlui 'B' dam which supplies them with bacteria serving as a food source for small crustaceans or early stages of small crustaceans.[18] Unlike the phytoplankton where summer season harbored maximum number of individuals, the zooplankton are found most abundantly during the winter season (Fig. 6). This is in accordance with earlier work done by Pachuau *et al.*[19] on Khawiva reservoir where maximum zooplanktons were reported during December and minimum during the month of May.Lalhmingliani *et al.*[20] also reported maximum zooplanktons during winter from Tamdil, Mizoram.

Conclusion

The findings of the present study showed that Serlui 'B' dam is rich in a wide variety of planktons indicating that it is a good, nutrient

rich ecosystem, able to support culture fishery and sustain tremendous diversity of flora and fauna. However the short sampling duration is not sufficient to reflect the real status of the dam with respect to plankton diversity. The physiochemical property of the water determines the density and diversity of the planktonic community. Thus overall planktonic composition and abundance is expected to show changes with respect to seasons. This study provides preliminary report of planktons of Serlui 'B' dam.

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