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Plankton diversity and density in Pandey Taal of Gonda district, Uttar Pradesh, India

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Abstract
The importance of the plankton is well recognized as these have vital part in food chain and play a key role in cycling of organic matter in the aquatic ecosystem. The inadequate knowledge of plankton and their dynamics is a major drawback for the better understanding of the life process of fresh water bodies. In the present investigation, total 23 species of phytoplankton and 22 species of zooplankton were also recorded. Bimodal pattern of seasonal variation of plankton was observed with a primary peak in the month of July and secondary peak in January. The physico-chemical and biological conditions were found suitable for fish culture and agriculture.

Keywords: Plankton, diversity, density, Pandey Taal

Introduction
Plankton is usually at the base of aquatic food web and is the most important factor for production of organic matter in aquatic ecosystem. The interplay of physical, chemical and biological properties of water most often lead to the production of phytoplankton, while their assemblage (composition, distribution, diversity and abundance) is also structured by these factors.

Population density and diversity of plankton in a water body are of great importance in imposing sustainable management policies as they vary from location to location and aquatic systems within the same location. The inadequate knowledge of plankton and their dynamics is a major drawback for the better understanding of the life process of fresh water bodies.

The density and diversity of plankton in a water body have a great importance for imposing sustainable environmental management policies like Environmental Impact Assessment (EPA). These are the main food for fishes; almost all the fishes at their larval stages depend on them.

Some of plankton species gives a reliable information about pollution status of aquatic bodies. So, these are called good indicator of water quality. These studies and monitoring are useful for control of the physico-chemical and biological conditions of the water.

The importance of plankton in tropical reservoir ecosystems include its use in estimating potential fish yield. The scale of socio-economic activities, urbanization, industrialization and hydropower generation have a major impact on wetlands. The impact of these activities affected water quality and aquatic biodiversity.

Though numerous works on plankton diversity have already been reported from different parts of India but there is scarcity of report from freshwater bodies of different parts of eastern Uttar Pradesh except some worth mentioning of Prakash and Ansari (2000) [1]; Prakash (2001) [4]; Prakash *et al*., (2002, 2015a and 2015b) [6, 7, 8]; Ranjan and Prakash (2020) [9], Verma and Prakash (2020) [15], Verma (2020) [15]; Verma *et al*., (2016a, 2016b) [13, 14], Sugumaran *et al*. (2020) [12] and Verma and Prakash (2020) [15]. So, the present study was an attempt for reporting plankton diversity and density of Pandey Taal of Gonda district of eastern Uttar Pradesh, India.

Material and methods
The Pandey Taal under exploration is a natural wetland situated in Gonda district of Davipatan division of Uttar Pradesh. The Taal is situated in city of Gonda more than 2 km away from Gonda railway station. It is situated between the latitude 27.40374^0N- 81.9535^0E.

Fig 1: Pandey Taal of Gonda District of Davipatan Division of U.P.

The Taal is enriched with several type of vegetation. The water of Taal is used for fish culture. The margin of the Taal is heavily infested by aquatic weeds and the organic deposition causes sedimentation of the Taal.

Plankton samples were collected fortnightly with plankton net of bolting no. 25 with a mesh size 25µ attached with a collection tube at the base of net throughout the year, between 9.00 and 10.00 am. Approx. 50 liter of surface water was sieved through the plankton net and sample was collected inside the collection tube. The sample was transferred to plastic bottle and preserved. Plankton productivity was measured by using Sedge Wick Rafter plankton counting cell and quantities are expressed here as units per liter of the taal water. The diversity of plankton was studied under light microscope with magnification 10X initially and followed by 40X. Plankton were identified with the help of a book entitled "A guide to the study of fresh water biology" written by Needham and Needham (1962) [3], Sharma and Sharma (2008) [10] and other standard literature.

Results and discussion

In the present study, twenty five species of phytoplankton were found (Table). Out of these 23 genera, 8 belong to Chlorophyceae (*Pediastrum, Ankistrodesmus, Coelastrum Scenedesmus, Botryococus, Colosterum, Crucigenia* and *Chlorella*); 7 to Bacillariophyceae (*Synedra, Navicula, Cymbella, Fragillaria, Melosira, Pinnularia* and *Nitzschia*); 6 to Cyanophyceae (*Anabaena, Spirulina, Microcystis, Raphidiopsis, Merismopedia,* and *Oscillatoria*) and 2 to Euglenophyceae (*Euglena* and *Phacus*). Apart from this 22 species, species of zooplankton were also seen. Of these 7 species belong to Rotifers (*Brachinous, Keratella, Notomate, Notholca, Rotaria, Asplanchna,* and *Lecane*); 8 to Cladocerans (*Diaphnosoma, Daphnia, Simocephalus, Chydorus, Bosmina, Bosminopsis, Sida* and *Macrothrix*), 5 to Copepods (*Cyclops, Mesocyclops, Diaptomus, Heleodiaptomus* and *Nauplius* larva) and 2 Ciliates (*Paramecium* and *Vorticella*). Presence of these species was reported in fresh water bodies of eastern Uttar Pradesh (Prakash, 2001a, Prakash *et al*., 2002 and Sinha *et al*., 2002) [4, 6, 11]. Presence of 23 species of phytoplankton and 22 species of zooplankton shows that the Taal is rich in planktonic diversity.

The annual periodicity of phytoplankton shows that Cyanophyceae dominated and constituted 38.73% of the total phytoplankton followed by Chlorophyceae (31.07%), Bacillariophyceae (24.13%) and Euglenophyceae (6.05%). In the present study the maximum density of phytoplankton was recorded in July (4021 unit/litre) and minimum in the month of April (968 unit/Litre). The annual productivity of zooplankton shows that Rotifers dominated and constituted 32.75% of the total zooplankton followed by Copepods (24.47%), Cladocerans (22.27%) and Ciliates (17.43%). In the present study the maximum density of zooplankton was recorded in July (5849 unit/litre) and minimum in December (1371 unit/litre). Similar observation was made by Ansari and Prakash (2000) [1], Prakash (2001a) [4] and Sinha *et al.* (2002) [11]. The plankton density in the Pandey Taal shows is highly productive.

Table 2: Monthly fluctuations in Plankton Population of Pandey Taal, Gonda

Month	Phytoplankton Group density (Units / Litre)					Zooplankton Group density (Units / Litre)					Total
	Chlorophyceae	Cyanophyceae	Bacillariophyceae	Euglenophyceae	Total	Rotifera	Cladocera	Copepods	Ciliates	Total	
Jul.	1186	1464	1020	351	4021	1735	1551	1511	1051	5849	9870
Aug.	764	742	384	137	2027	803	484	325	215	1828	3855
Sep.	542	510	420	171	1643	700	400	291	120	1501	3154
Oct.	486	476	339	100	1401	652	377	251	98	1378	2779
Nov.	294	385	240	45	962	352	485	251	284	1372	2336
Dec.	322	542	280	57	1202	433	393	263	271	1371	2663
Jan.	886	1175	920	127	3108	1052	1165	851	895	3963	7071
Feb.	502	422	318	32	1274	876	817	873	273	2839	4113
Mar.	373	353	220	22	968	744	700	751	386	2581	3549
Apr.	254	653	273	73	1253	541	465	406	273	1685	2938
May.	298	658	273	69	1298	505	485	409	298	1697	2995
Jun.	842	1042	831	203	2918	921	996	1029	793	3739	6657
Total/Av.	6749/562	8413/701	5243/437	1316/110	21721/1810	9314/776	6334/528	6958/583	4957/413	28432/2369	50152/4179
% age	31.07 %	38.73 %	24.13 %	6.05 %	-	32.75 %	22,27 %	24.47 %	17.43 %	-	-

In the present study bimodal pattern of seasonal variation of plankton was observed, with a primary peak in the month of July and secondary peak in January (Table). Similar pattern of plankton distribution were reported in the fresh water bodies of U.P. by Khan and Siddiqui (1974), Ansari and Prakash (2000) [11] and Prakash (2001a) [4].

Conclusions

The importance of the plankton is well recognized as these have vital part in food chain and play a key role in cycling of organic matter in the aquatic ecosystem. The present study exhibit that on Pandey Taal is rich in density and diversity of both phyto and zooplanktons and it reveals that this taal is suitable for aquaculture as rotifers are known to be the best food for the fish larvae. Authors found that among the zooplankton, rotifers were dominant group which are the indicators of eutrophication. Therefore, measures must be taken to minimize the water pollution by regulating human activities in watershed areas. Thus, keeping in view the importance of the study, steps should be taken for the conservation and maintenance of the freshwater wetland.

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