

# ***E manual***

**For**

**TDC (Sc.) CBCS 1<sup>st</sup> Semester**

**(Major: Zoology)**

**Department of Zoology**

**B.N. College, Dhubri**

## **Practical Paper II : Principles of Ecology**

**Practical No. 3.** Study of an aquatic ecosystem: Phytoplankton and zooplankton

**and**

## **Practical Paper I : Non-chordates I: Protists to Pseudocoelomates**

**Practical No. 2 :** Examination of pond water collected from different places for diversity in protista

**Aim of the experiment -** To study the diversity of Phyto and Zooplankton/Protists in the water samples collected from different places of the pond-water.

### **Requirements -**

- a) Plankton-net with handle
- b) Test tubes (5 nos.)
- c) Test tube rack
- d) Rubber guarder
- e) Dropper
- f) Diethyl Ether
- g) Microscopic slide
- h) Cover-slip
- i) Haemocytometer
- j) Binocular Microscope

### **Working procedure–**

- a) One test tube is attaches to the plankton net with the help of a strong rubber guarder.
- b) With the help of the plankton net plankton samples from five different spots of the pond/beal/bog/river are collected.
- c) Five separate test tubes are used in each case of collection.
- d) Test tubes with collected plankton samples are detached from the net and kept in a test tube rack
- e) To drops of diethyl ether are added to the water samples to narcotinize the collected zoo-planktons.
- f) Few drops of water from the bottom of the test tubes, where the zoo-planktons settle down in the test tubes after few minutes of adding diethyl

ether are collected and taken on five different microscopic slides to study the diversity of the Planktons/ Protists.

- g) The slides are placed on a binocular microscope and only the Plankton/ Protist are studied (When only Protists are studied other Zoo-Plankton and Phytoplankton are ignored).

**Observations and findings-** On microscopic observation Phyto and Zoo Planktons/Protists may be identified following-

- a) Checklist of Commonly Occurring Phytoplankton and Zooplankton Genera of Urban and Rural Ponds of Raipur, Chhattisgarh.<sup>1</sup>  
b) Indian Fresh Water Zooplankton: A Review.<sup>2</sup>



Fig- Phytoplankton

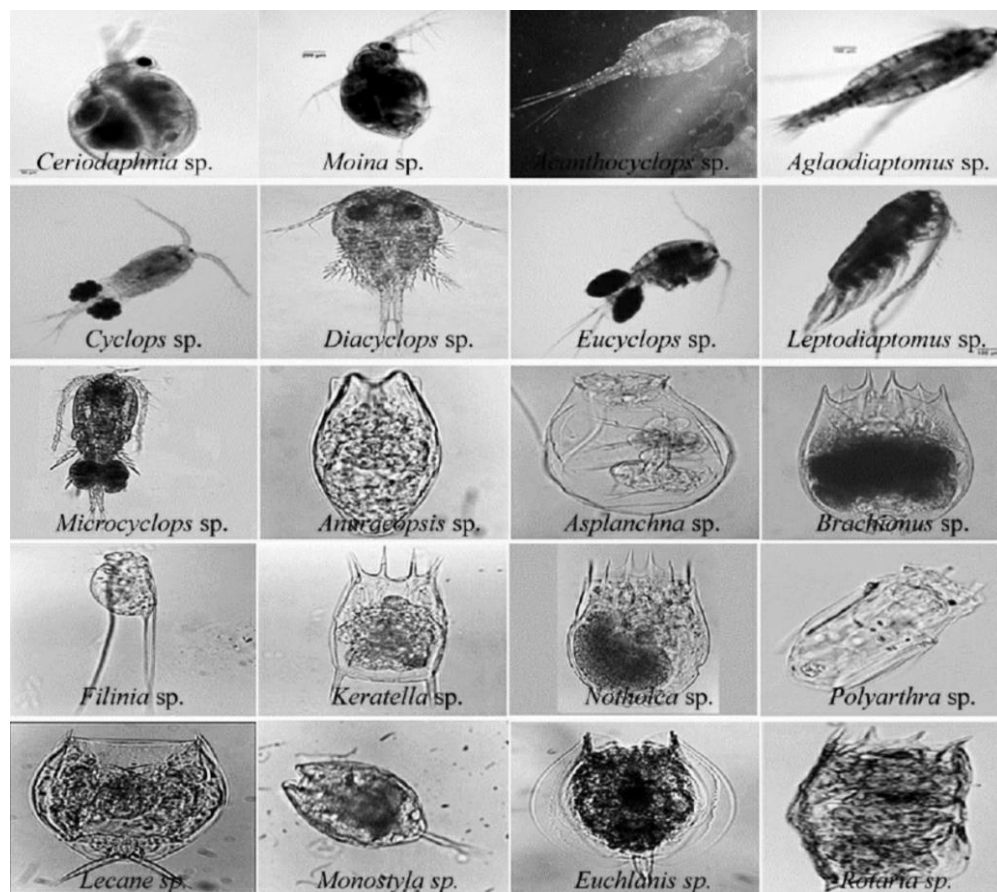


Fig 4. Zooplankton

## Reference-

1. Roy, K. Gupta, S., Nandi, S. K. (2016) *Int. J. Res. Biol. Sci.* **6** (1):1-6
2. Aneesh E. M., Fathibi, K. and Ambalaparambil, V. S. (2017) *Int. J. Recent Sci. Res.* **8** (10) : 20999-21015; available at- <https://www.researchgate.net/publication/321025466> Indian Fresh Water Zooplankton A Review Int J Recent Sci Res 810 pp 20999-21015

## Paper :- Principles of Ecology

**Experiment No. 2 :** Determination of population density in a natural/hypothetical community by quadrat method

**Aim of the experiment** :- To study the community by quadrat method by determining frequency, density and abundance of different species present in the community.

**Introduction** :- One can study the population of an area by collecting all animals and counting them according to their species. But this is a tough and time consuming process. A simple and easy method of study is random sampling. Random sampling is done by taking definite sized quadrats. In the study area, several quadrats are taken and from quadrat different organisms are counted according to their species. And these data helps a person to calculate the frequency-percentage, density and abundance of different species.

**Procedure** :- With the help of string and nails 10 quadrats of 40 x 25 cm size were selected in the study area randomly. Different species present in each quadrat were noted and also counted the total number of individuals of each species.

**Observation and Calculation** :- Recorded data's are tabulated in a data-sheet and from the data the frequency, density and abundance of different species are counted with the help of following equations :-

$$\text{a) Percentage frequency} = \frac{\text{Total number of quadrats in which species} \times 100}{\text{Total number of quadrats studied}}$$

$$\text{b) Density} = \frac{\text{Total number of individuals of the species}}{\text{Total number of quadrats studied}}$$

$$\text{c) Abundance} = \frac{\text{Total number of individuals of the species}}{\text{Total number of quadrates in which species occurs}}$$

All the basis of percent frequency values of various species can be distributed into five frequency classes as follows :-

<u>Frequency %</u>	-	<u>Frequency Class</u>
0 – 20	-	A
21 – 40	-	B
41 – 60	-	C
61 – 80	-	D
81 – 100	-	E

Data obtained from the study of the quadrates are tabulated in the following data-sheet :-

Sl No	Name of the species	No. of Quadrates studied										Total No. of individuals of species	Total Quadrates of occurrence	Density	Abundance	Percentage frequency	ClassFrequency
		I	II	III	IV	V	VI	VII	VIII	IX	X						
1	Big Red Ant	5	4	3	3	5	5	-	6	4	5	40	9	4.0	4.4	90	E
2	Big Black Ant	2	3	-	-	5	-	2	3	-	-	15	5	1.5	3	50	C
3	Medium Black Ant (Fast moving)	5	6	4	10	8	7	10	5	15	1	80	10	8.0	8	100	E
4	Medium Black Ant (Slow moving)	2	-	2	1	-	-	2	2	-	-	9	5	0.9	1.8	50	C
5	Small Red Ant	1	1	8	10	5	10	5	12	10	1	95	10	9.5	9.5	100	E
6	Grass Hopper	5	1	3	10	5	12	8	10	15	1	88	10	8.8	8.8	100	E
7	Small Spider	5	-	-	-	-	-	4	6	-	-	15	3	1.5	5	30	B
8	Big Spider	4	-	-	-	6	-	-	-	-	-	10	2	1.0	5	20	A
9	Snails	2	3	-	-	5	-	-	-	2	-	12	4	1.2	3	40	B
10	Earthworm	5	1	-	10	7	8	-	4	10	6	60	8	6.0	7.5	80	D
11	Caterpillars	5	-	-	-	-	-	4	6	-	-	15	3	1.5	5	30	B
12	Beetles	2	2	-	-	3	1	1	-	-	1	10	6	1.0	1.7	60	C

**So, Total number of species in a frequency class :-**

$$A = 1, B = 3, C = 3, D = 1, E = 4$$

We know, percentage of each class =  $\frac{x}{h} \times 100$

Where, n = number of species belonging to a frequency class.

Thus, % age of occurrence of :-

$$A = \left(\frac{1}{12}\right) \times 100 = 8.33\%$$

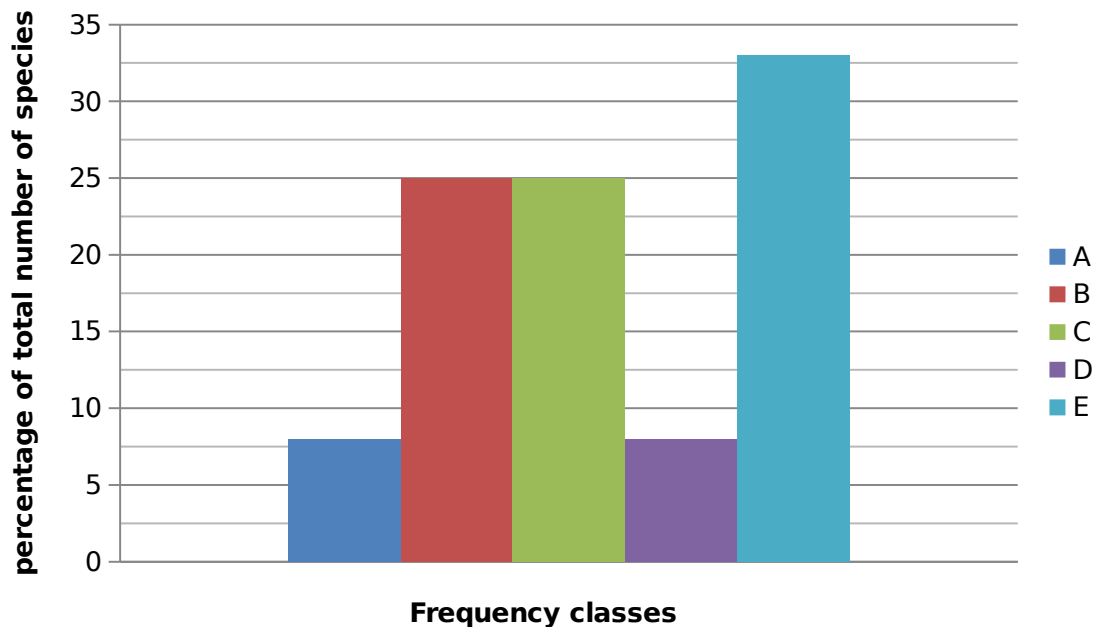
$$B = \left(\frac{3}{12}\right) \times 100 = 25\%$$

$$C = \left(\frac{3}{12}\right) \times 100 = 25\%$$

$$D = \left(\frac{1}{12}\right) \times 100 = 8.33\%$$

$$E = \left(\frac{4}{12}\right) \times 100 = 33.33\%$$

Now, the values are put in a bar-graph. The percentage of occurrence is plotted on “y” – axis against the frequency class on “x” – axis. This gives a frequency diagram.





**Aim: Study of adult *Fasciola hepatica*, and their life cycles (Slides/micro-photographs):** (Core Course I, Practical, Unit - 6)

**Adult (*Fasciola hepatica*):**

*Fasciola hepatica* is a small, unsegmented flatworm. It is a parasite of vertebrates. It is commonly known as fluke because of the flatness of its body. It is unsegmented flatworm. Its body is soft, oval, dorsoventrally flattened and leaf like. The body is generally pinkish having its margins black or brown. The anterior end is broader than the posterior end. Anterior end is distinguishable in to a conical projection (oral or cephalic cone). It has two suckers: the anterior or oral sucker and posterior or ventral sucker also known as acetabulum. There is a gonopore or genital opening present a little in front of the acetabulum.



**Life Cycle of *Fasciola hepatica*:**

The life history of *Fasciola hepatica* is digenetic that means its life cycle is completed within two hosts. Sheep (may be goat, human, dog, elephant also) is the primary host or definitive where the adult fluke lives and snail is the intermediate host in which various larval stages pass. The sheep is the final or definitive host. The sheep is infected by grazing on water plants where the final larval forms i.e. metacercariae are present. The metacercaria cysts enter the host intestine where the cyst is dissolved and the larva is liberated. The liberated larva penetrates the host's intestinal wall and reaches the liver after 3 days of infection. It feeds on liver tissue and settles in the bile duct.



### **Miracidium larva:**

It is the first larval stage hatched in water and is free swimming. It is ciliated, small conical creature with the anterior end broader than the posterior. It has well developed locomotory organs, sense organs, body cavity and cellular epidermis and hence more advanced than the adult.

### **Sporocyst Larva:**

The miracidium larva sheds the epidermal cells and cilia. The advanced characters degenerate. Sporocyst is a living cyst moving about in the tissue of the host and absorbs nourishment from it. The germ cells in it multiply and undergo blastulation and gastrulation to give rise to Redia larva. In some flukes sporocyst undergoes fission and gives rise to daughter sporocysts.

### **Redia larva:**

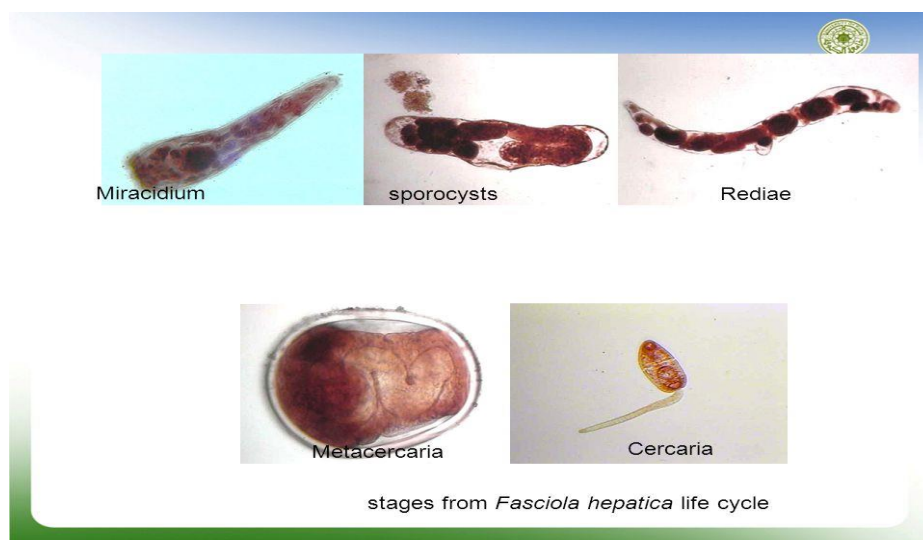
A single sporocyst may give rise to 5-8 redia larvae. The sporocyst is ruptured and rediae come out and migrate to liver or digestive glands of the snail. They feed on host tissues. The larva possesses germ balls that get multiplied in summer months and give rise to second and more generations of rediae. In winter months the germ balls multiply and pass through blastula, morula and gastrula stages to give rise to the next larval stage, Cercaria larva.

### **Cercaria larva:**

About 14-20 cercariae are released from one redia through the birthpore. It is oval or rounded and having a long simple tail. It has rudiments of adult organs like, anterior mouth encircled by oral sucker, pharynx, oesophagus, posterior sucker or acetabulum and inverted U-shaped intestine.

### **Metacercaria larva:**

It is rounded and encysted larva having structural similarity with that of cercaria expect the absence of the tail and the cystogenous glands. It is in fact the juvenile fluke which is ready to infect the primary host i.e sheep, man etc.



**Ref:**[https://www.google.com/search?q=fasciola+hepatica+larval+forms&rlz=1C1CHBD\\_enIN890IN890&source=lnms&tbm=isch&sa=X&ved=2ahUKewi\\_xP6o0\\_vnAhWNe30KHfrZA4MQ\\_AUoAXoECA0QAw&biw=1366&bih=608#imgrc=GPsD0YZbiTUVRM](https://www.google.com/search?q=fasciola+hepatica+larval+forms&rlz=1C1CHBD_enIN890IN890&source=lnms&tbm=isch&sa=X&ved=2ahUKewi_xP6o0_vnAhWNe30KHfrZA4MQ_AUoAXoECA0QAw&biw=1366&bih=608#imgrc=GPsD0YZbiTUVRM)

**Courtesy:** Biodidac, Houseman University, Ottawa