Biospectra : ISSN: 0973-7057, Vol. 19(2), September, 2024, pp. 47-50

An International Biannual Refereed Journal of Life Sciences

Animal Science

ISSN : 0973-7057

Diversity and abundance of protozoa in paddy field of Madhepura District

Pritam Kumari & Arun Kumar*

University Department of Zoology, B.N. Mandal University, Madhepura, Bihar, India

Received : 13th May, 2024 ; Revised : 14th June, 2024

DOI:-https://doi.org/10.5281/zenodo.15080610

Abstract- In the present study, diversity and abundance of protozoa in two paddy field was examined. One of the paddy field was moist and other flooded. It was observed that the abundance of protozoa was lower in flooded field. Abundance of protozoa in surface soil of flooded field was recorded as 27 ind./g soil while abundance in moist paddy field was recorded as 44 ind./g soil. Abundance of protozoa was also recorded in deep soil up to depth of 10cm where abundance of protozoa in flooded paddy field recorded as 23 ind./g soil and in moist paddy field at 10cm depth abundance of protozoa was recorded as 25 ind./g soil. Altogether 11 genera of protozoa were recorded from both paddy fields. Physicochemical parameters of soil were also studied. pH value of soil in moist paddy field was observed as 7.2 while in flooded field pH was slightly acidic (5.8). Nitrogen content of flooded field was also low (52.34%) in comparison to moist field where N_2 content was recorded as 55.58%.

Keywords: Protozoa, Abundance, Diversity, rhizosphere, paddy field.

INTRODUCTION

Soil protozoa represent an important group of microbial community which play vital ecological role in respect to nutrient cycling and accelerating turnover of soil Bacterial biomass.[1] Protozoa regulate the composition of soil bacterial community, stimulate ammonification and nitrification.[2] By regulating growth of bacteria and smaller protists they maintain ecological stability.[3] Protozoa control bacterial abundance in soil by grazing on bacteria.[4] Bacteriovores protozoa graze on both PGPR and pathogenic bacteria. By grazing on PGPR they release nitrogen, growth hormones, vitamins, etc. produced by PGPR and make them available to growing crops. Mycovore protozoa graze on fungal pathogens and protect cops from fungal diseases. Presence of protozoa in rhizosphere of crops increases plant biomass up to 30-80%.[5] In soil 39% ciliate protozoa feed on bacteria and 34% are mainly predaceous while 20% are omnivorous and some of them are mycovores. Physiochemical parameters of soil influence the abundance of protozoa in soil. Further, upper surface of soil is rich in abundance of protozoa while number of protozoa decreases in lower layer of soil.

*Corresponding author :
Phone : 9006991000
E-mail : gpritamg@gmail.com

MATERIAL & METHODS

In the present study diversity and abundance of protozoa was investigated in two paddy fields of Bihariganj under Madhepura district. One of the paddy field was flooded while other contained moist soil. Soil samples were collected with the help of PVC pipe with 2cm diameter. The pipe was inserted in soil up to 15cm deep and the soil sample was recovered. From each field soil samples were collected from three different spots. Soil samples were

brought to the laboratory in PVC pipe. Soil block from PVC pipe was separated with the help of a sterile rod. Length of soil block was measured by centimeter scale and cut into pieces of equal size. Each soil segment was weighed and dissolved in 100ml distilled water. Physicochemical analysis of soil was performed for the parameters- pH, organic carbon, nitrogen, available phosphorus and potassium.

Identification of Protozoa: One drop of soil suspension was taken on Haemocytometer and viewed under microscope. Morphology and dimension of protozoa were noted and identified on the basis of Key of Patterson and Hedley (1992).

Abundance of Protozoa: Number of individual protozoan was counted on Haemocytometer. Procedure was repeated five times and average number of individual protozoan was noted. Total number of protozoa was calculated for per gram of soil.

RESULTS

Physicochemical analysis of soil was examined for pH, organic carbon, nitrogen, available phosphorus and potassium. pH in moist field was observed as 5.58 and in flooded field pH-6.2. OC (%) 0.58% in moist field and 0.55% in flooded field, available phosphorus 15.53kg/h in moist field and 13.14kg/h in flooded field, potassium 210kg/h in moist field and 208.3kg/h in flooded field. Result is mentioned in Table 1.

Table 1- Physicochemical analysis of soil

Parameter	Paddy field	
	Moist	Flooded
pH	7.2	5.8
OC	0.58%	0.55%
N	55.58%	52.34%
P	15.53kg/h	13.14kg/h
K	210kg/h	208.3kg/h

Three spots in each field were selected for sample collection. Each spot was assigned a code which is mentioned in Table 2. Soil block from each spot was cut in 3 fragments of equal size.

Table 2- List of code assigned to the selected spot.

Paddy field	Spot code
Moist field	AM
Flooded field	AF

Table 3- Diversity of protozoa in moist paddy field.

Protozoa	Spot								
	AM			BM			CM		
	1	2	3	1	2	3	1	2	3
Colpoda	3	0	0	4	2	0	5	2	0
Tachysoma	3	0	0	-	-	-	-	-	-
Oxytricha	5	2	0	7	4	-	1	-	-
Vorticella	-	-	-	-	-	-	-	-	-
Stylorlichia	2	-	-	-	-	-	3	-	-
Deleptus	6	-	-	3	-	-	2	-	-
Spathidium	2	-	-	-	-	-	3	-	-
Litonotus	3	1	-	2	-	-	-	-	-
Uroleptus	5	-	-	8	-	-	2	1	-
Euplotes	8	-	-	9	-	-	6	4	-
Microthorax	7	4	-	5	3	-	4	2	-

Table 4-Diversity of protozoa in flooded paddy field.

Protozoa	Spot								
	AF			BF			CF		
	1	2	3	1	2	3	1	2	3
Colpoda	-	-	-	3	-	2	2	-	-
Tachysoma	2	1	-	-	-	-	3	1	-
Oxytricha	4	2	-	3	1	-	5	3	-
Vorticella	3	1	-	4	2	-	3	1	-
Stylorlichia	5	3	-	-	4	-	2	-	-
Deleptus	7	4	-	5	-	-	3	1	-
Spathidium	-	-	-	-	-	-	-	-	-
Litonotus	-	-	-	4	2	-	-	-	-
Uroleptus	-	-	-	-	3	-	2	1	-
Euplotes	3	2	-	2	3	2	-	-	-
Microthorax	4	1	-	6	-	-	3	2	-

Abundance of protozoa in surface soil at each spot of moist paddy field and flooded paddy field is mentioned in fig.1 and 2.

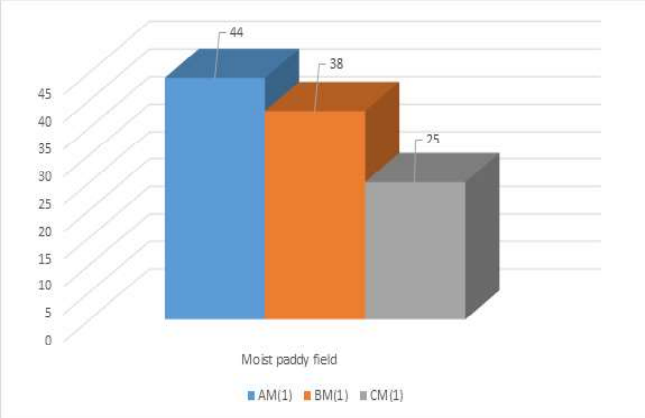

Fig. 1- Abundance of protozoa in surface soil of moist paddy field

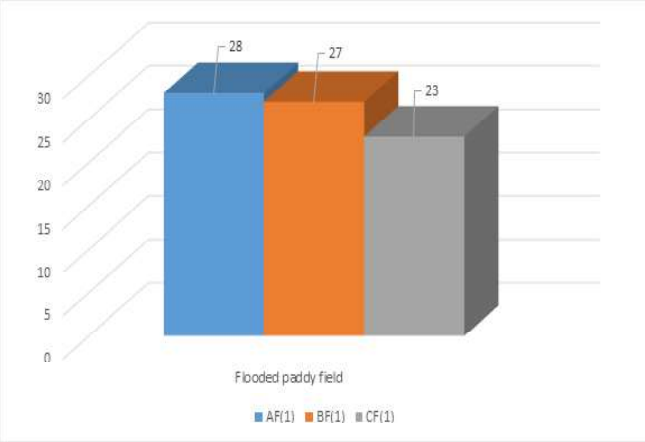

Fig. 2- Abundance of protozoa in surface soil of flooded paddy field

Altogether 11 genera of protozoa were recorded in paddy field. In moist paddy field maximum no. of protozoa were recorded from the genera Euplotes while Microthorax dominated in flooded field. Abundance of protozoa at three spots AM, BM and CM of moist paddy field were recorded as 38 ind./g soil, 44 ind./g soil and 25 ind./g soil respectively. In flooded field, abundance at 3 spots AF, BF and CF were recorded as 27 ind./g soil, 28 ind./g soi and 23 ind./g soil respectively.

DISCUSSION

In the present study, it was observed that pH of soil in flooded field was slightly acidic (5.8). Yoshinaga (2003)[6] also reported that pH of flooded soil in paddy field is slightly acidic. N_2 content of flooded paddy field was also lower in comparison to moist field. Physicochemical condition of soil determines the diversity and abundance of microbes in soil. In present study, it was observed that abundance of protozoa in flooded field was lower in comparison to moist field. In moist field, abundance of protozoa at 3 spots were recorded as 38 ind./g soil, 44 ind./g soil and 25 ind./g soil while in flooded field abundance was recorded as 27 ind./g soil, 28 ind./g soil and 23 ind./g soil.

Foissner (1997)[7] reported 10 different types of protozoa in anoxic soil. Schwarz and Frenzel (2003)[8] reported 2-3 taxa of ciliates in paddy soil. In our study, 11 taxa were observed in paddy field. Schwarz and Frenzel (2003)[8] reported a decline in population size of protozoa after flooding paddy field. In the present study also it was observed that population size of protozoa decreased in flooded paddy field. Fenchel and Finlay (1995)[9] also reported decrease of protozoa population in flooded paddy soil. The upper surface of soil contain high amount of organic carbon and nutrients. Therefore, population of protozoa in upper surface of soil remain higher. In present study also it was observed that upper surface of soil contain high abundance of protozoa in comparison to deep soil.

CONCLUSION

Two paddy fields of Madhepura district was selected for the study of diversity and abundance of protozoa. One of the field was moist while other paddy field was flooded. Altogether 11 genera of protozoa were recorded from paddy fields. Population density of protozoa was higher in moist paddy field. Further, it was observed that the surface soil in both field contained more population of protozoa. Abundance of protozoa was examined in both fields, at surface soil, middle layer and 10cm deep layer. Abundance of protozoa in surface soil, middle layer and 10cm deep layer was recorded as 44 ind./g soil, 38 ind./g soil and 25 ind./g soil respectively in surface soil, middle layer and 10 cm deep layer of moist paddy field. In flooded paddy field abundance of protozoa was recorded as 28 ind./g soil, 27 ind./g soil and 23 ind./g soil respectively.

Physicochemical analysis of soil from both field was performed. pH of flooded soil was slightly acidic (pH-5.8). Nitrogen content of flooded soil was also low (0.55%) while pH of moist field recorded as 7.2 and Nitrogen as 0.58%.

REFERENCES

1. **Acosta-Mercado D., Lynn D. H. 2004.** Soil ciliate richness and abundance associated with the rhizosphere of different subtropical plant species. *J. Eukaryot. Microbiol.* **51:** 582-588.

2. **Li J., Liao M. G., Yang J., Ai Y., Xu R. I. 2010.** Community characteristics of soil ciliates at Baiyun Mountain, Guangzhou. China. *Zool Stud.* **49:** 713-723.

3. **Geisen S., Mitchell E. A. D., Adl S., Bonkowski M., Dunthom M., Ekelund F., Fernandez L. D., Jousset A., Krashevska V., Singer D., Spiegel F. W., Walochnik J., Lara E. 2018.** Soil protists: a fertile frontier in soil biology research. *FEMS Microbiol Rev.* **42:** 293-323.

4. **Finlay B. J., Black H. I. J., Brown S., Clarke K. J., Esteban G. F., Hindle R. M., Olmo J. L., Rollett A., and Vickerman K. 2000.** Estimating the growth potential of the Soil Protozoan Community. *Protists*. **151:** 69-80.

5. **Bonkowski M., Alphei J., Cheng W., Griffiths B. S. and Scheu S. 2000.** Microbial-faunal interactions in the rhizosphere and effects on plant growth. *European Journal of Soil Biology.* **36(3-4):** 135-147.

6. **Yoshinaga I., Feng Y. W., Hitomi T., Shiratani E. and Hasebe H. 2003.** Nitrogen removal functions of paddy field in a circular irrigation system. 7th Int. Conf. Diffuse Pollut. *Basin mange.* **4:** 43-48.

7. **Foissner W. 1997.** Protozoa as bioindicators in agro-ecosystems with emphasis on farming practices, biocides and biodiversity. *Agric. Ecosyst. Environ.*. **62:** 93-103.

8. **Schwarz M. V. J. and Frenzel P. 2003.** Population dynamics and ecology of ciliates (Protozoa, ciliophora) in an anoxic rice field soils. *Biol. Fertil. Soils.*. **38:** 245-252.

9. **Fenchel T. and Finlay B. J. 1995.** Ecology and evolution in anoxic worlds. Oxford University Press. *Ann. Rev. Microbiol.* **36:** 27-28.

***