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DISTRIBUTION OF SOIL PROTOZOA IN ASSOCIATION WITH NITROGEN FIXING BACTERIA.

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ABSTRACT

Relationship between protozoa and different types of nitrogen fixing bacteria observed in the alluvial soil samples from the rhizosphere of pulse and jute crops of West Dinajpur District of West Bengal is recordcd. High population of *Paramoeba* sp. in the jute soil may be due to presence of *Azotobacter* which influenced the growth of the species.

INTRODUCTION

The microbial fauna of soil consists mainly of bacteria, protozoa, algae and fungi. Bacteria has a major role in bringing biological and chemical changes in soil as they grow vigorously. Soil protozoa and bacteria form a predator/prey relationship.

Cutler *et al.* (1922) showed the occurrence of amoebae, flagellates and ciliates in large numbers in normal soil both in active and cystic conditions. Singh (1964) indicated that fluctuations in the population of active and noncystic stages of amoeba, on the whole is inversely proportional to that of bacterial numbers. It has been observed that the presence of protozoa boost up the population of *Azotobacter* which helps the fixation of soil nitrogen. It has been shown that the lysate of protozoa can stimulate the population of *Azotobacter*. However, Singh (1964) observed that the strains of *Rhizobium* are generally not accepted to amoeba. Geltzer (1963) investigated the relationship of soil amoebae with the rhizospheres of plants and observed that protozoa are more in number and diverse in the plant rhizosphere than in the surrounding soil. This he explained due to bacteria finds favourable environment for development at rhizosphere which ultimately helps to built up the protozoan population.

The work on the relationship of nitrogen fixing bacteria and protozoa in natural soil has so far not been attempted. Obsenation presented here rela es to the relationship between protozoa and different types of N-fixing bacteria.

MATERIAL AND METHODS

Alluvial soil samples were colleeted from the rhizosphere of the pulse and jute crops of West Dinajpur district of West Bengal. Samples were cultured in the laboratory in (i) hay infution non nutrient agar (ii) soil extract non nutrient agar. Tne hay infusion medium is made up as follows ;

50 gm. of chopped hay and 100(ml. of

distilled water boiled gently, filtered and the liquid is made up to 1000ml. Hay infusion agar (1.5%) is made by adding agar and sterilizing at 15 lb pressure for fifteen minutes. For soil extract agar medium, 200 gm. of fertile soil and 500 ml. of tap water boiled gently for one hour, filtered and the liquid is made up to 500 ml in similar manner as

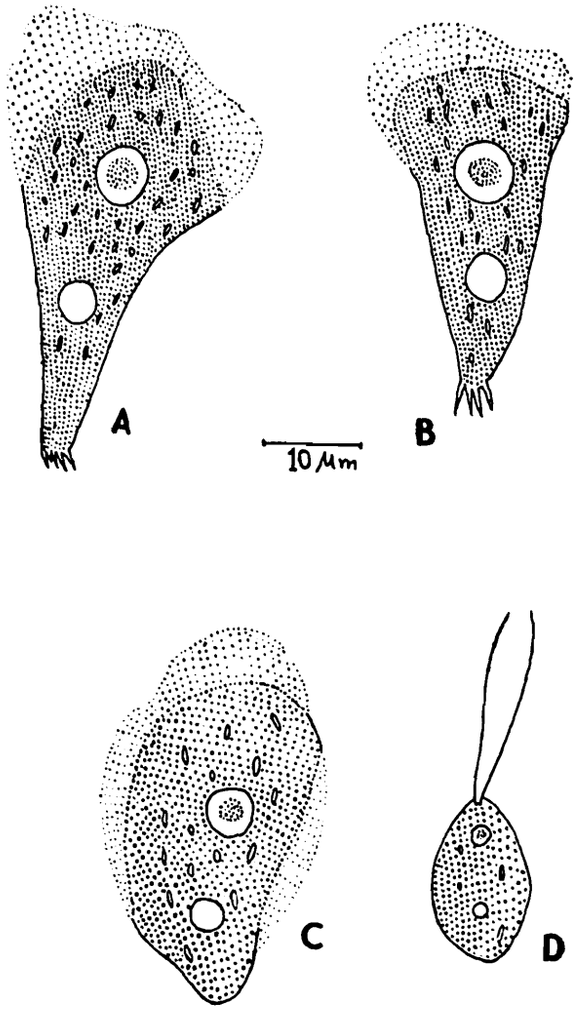

Fig. 1. *Naegleria* sp. A, B, C—Trophic forms ; D-Flagellate stage.

in hay infusion agar method. Soil extract and hay infusion agars are poured in petri-dishes separately. Inoculation of samples were made 10^{-3} dilution and 10 replicates of culture were considered. The same soil samples repeated for five times. pH of the culture medium was maintained at 7.00. The room temperature recorded was 31°-33°C during the period of experiment. From time to time the culture plates were moistened with sterile distilled weter. At 72 hours, after inoculation, the protozoan population reaches maximum growth. During observation the agar of the culture plates were scooped from different parts of the plate and washed in distilled water. Observations were made under oil immersion lens (10×100) after fixing the material in carnoy and staining the same with Feulgen.

Observations

The soil samples were collected from pulse and jute fields where agricultural factors were identical other than the crop. Each culture was made and maintained for a month. The results are as follows :

In the pulse field where the *Rhizobium* bacteria are present in large numbers, a succession of three ciliates were found. In lst 10 days the species belonging to genera *Oxytricha*, *Colpoda* (Pl. V. A & B) and *Dileptus* were found and later on they were replaced by *Amoeba*, *Hartmanella* (Fig, 2) and *Naeglaria* (Fig. 1). Jute soil culture reveals the presence of only one species of genus *Paramoeba* (Pl. V, C) in high density. In pulse soil the species belonging to genus *Colpoda* constitue the 80% of the total population of protozoans in the lst 5 days. The different ciliate species are common in occurrence are found in all types of soils.

Discussion

The result shows that the protozoa particularly the amoeba present in the soil in high density where the *Azotobacter* is present in large numbers. The relation of free living amoebae to various types of bacteria indicates the complicated nature of these problems. Though in the begining it appears to be a clear case of relationship between predator

and prey. The amoeba are selective in feeding of the bacteria.

The reasons underlying the apparent selection of bacteria as food by protozo are by no means clear, The production of certain types of toxic pigments and exotoxins by certain bacteria are the main cause of non acep able by amoeba to these bacteria (Singh, 1941)

The presence of high population of a species of the genus *Paramoeba* in the jute soil may be due to the presence of *Azotabacter* which influenced the growth of the species. The presence of small numbers of amoeba in the pulse field may be explained due to the presence of *Rhizobium* bacteria which is non acceptable to amoeba. As the amoeba stimulate the population of *Azotobacter* which in turn helps in fixation of nitrogen. So it may be possible by inoculating pure culture of such amoeba in the soil to influence the growth of *Azotobactor.*

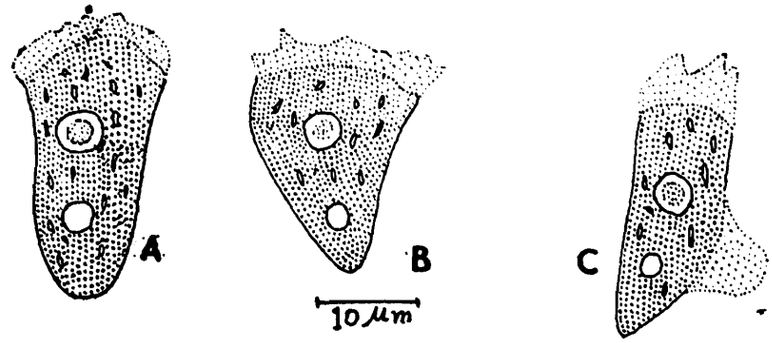

Fig. 2. *Hartmannella* sp. A, B, C—Trophic forms.

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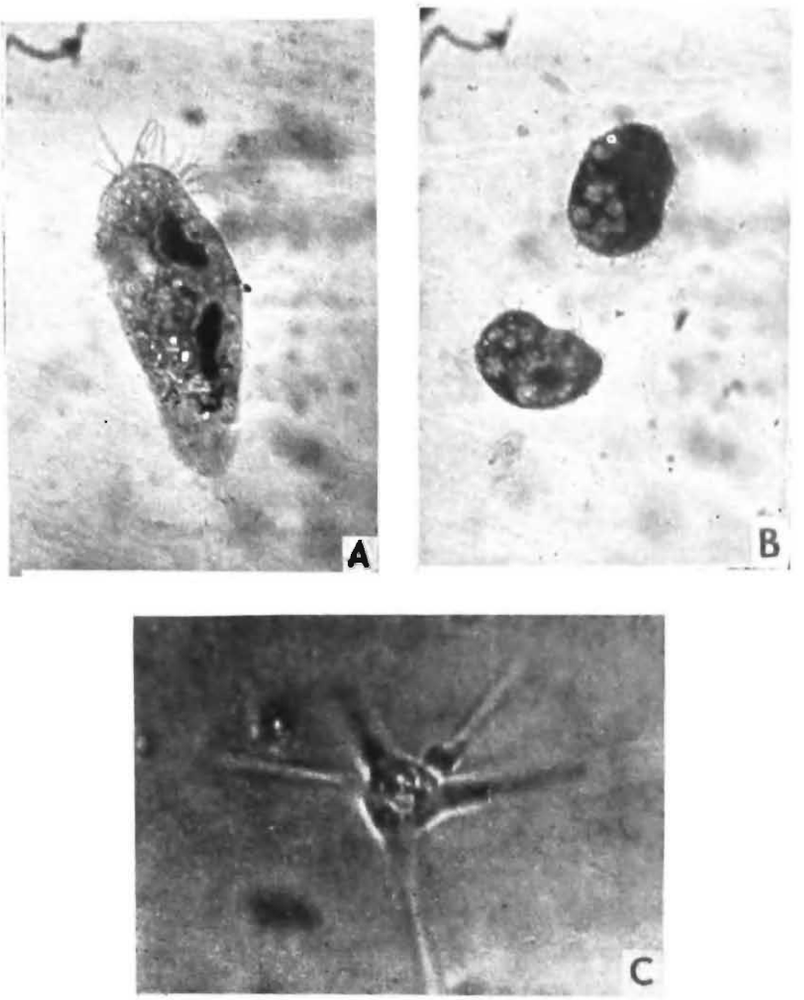
PLATE V



A. *Oxytricha* sp., B. *Colpoda* sp. C. *Paramoeba* sp.