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Protozoa from Some Sri Lankan Paddy-Fields and Their Distribution

by

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Free-living protozoa are to be found almost everywhere in the terrestrial ecosystem. Their general ecological role has been well reviewed by Kitching (1957) whilst Singh (1966, 1968) has indicated their possible relationship to the fertility of water-logged paddy-field soils. Since 1973 we have conducted and extensive investigation into certain aspects of the microbial ecology of some Sri Lankan paddy soils and this preliminary report is on the protozoa found and on their distribution.

Material and Methods:

Four paddy-fields were selected for study, one in the Dry zone of the Island and three in the Wet zone, one of these being in the Wet Highlands, one in the Wet Lowlands and the third in the very wet Lowlands with 16.76 inches rainfall per month as against 9.60 inches rainfall per month characteristic of the Wet Lowlands.

A series of 4 samples (of supernatant water and of soil at 0, 10 and 20 cms. below the soil surface) was collected, at each of 2 stations in each field, into sterile bottles with dust-proof ground-glass stoppers, all the usual precautions being taken to avoid contamination. Protozoa in each sample were studied and numbers estimated (in 10-1 to 10-3 dilutions) using suitable modifications of Stout's dilution culture technique (1962). Cultures were maintained at room temperature (28° to 31° C) and examined regularly at 24 hour intervals. Axenic cultures were obtained from these isolates and maintained in defined media (*J. Protozool,* 5 (1) 1958) at best growth temperatures. Temperature, pH and moisture content of the soil were also estimated for each sample. At least, 7 samples were collected from each station.

Results and Discussions

Twelve different protozoans were isolated 3 being Sarcodina, 5 Ciliata and 4 Fagellata; P1 = *Acanthamoeba sp.:* P2 = *Naeglaria* sp.; P3 = *Arcella* sp.; P4 = *Colpoda* sp.; P5 = *Halteria* sp.; P6 = *Paramaceum* sp.; P7 = *Stylonichia* sp.; P8 = *Vorticella* sp.; P9 = *Bodo* sp.; P10 = *Euglena* sp.; P11 = *Astasia* sp.; P12 = *Peranema sp.*;

Station	Protozoan types												Ecological factors		
	Sarcodina			Ciliata					Flagellata				pH	Te-mp. °C	
	P1	P 2	P 3	P 4	P 5	P 6	P 7	P 8	P 9	P10	P11	P12			
I. Wet zone Lowland (typical)	✓	x	x	✓	✓	x	✓	x	✓	✓	x	x	5.9 to 6.0	24.5	
II. Wet zone lowland high rain fall	✓	x	x	✓	✓	✓	x	x	✓	✓	x	✓	7.2 to 7.6	23.7 to 25.3	
III. Wet zone highland	✓	x	x	✓	x	x	x	x	x	x	x	x	5.3 to 5.6	24.7 to 25.4	
IV. Dry zone	✓	x	x	✓	✓	x	x	x	x	x	x	x	7.5 to 7.8	25.0 to 26.5	

✓ =present
x =absent

TABLE I - In supernatant water

Station	Protozoan types												Ecological factors		
	Sarcodina			Ciliata					Flagellata				pH.	Te-mp. °C	% Mois-ture
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12			
I. Wet zone lowland (typical)	✓	✓	x	✓	x	x	✓	✓	✓	✓	✓	✓	6.1 to 6.4	24.7	55.31 to 56.35
II. Wet zone lowland (high rain fall)	✓	✓	x	✓	x	✓	x	✓	✓	✓	✓	x	7.3 to 7.6	24.8 to 25.1	60.25 to 63.39
III. Wet zone highland	✓	✓	x	✓	✓	x	x	x	✓	✓	x	x	5.6 to 5.8	24.2 to 25.7	50.92 to 56.0
IV. Dry zone	✓	x	✓	✓	x	x	✓	x	x	x	x	x	7.2 to 7.5	24.3 to 24.7	36.43 to 38.23

✓ = present
x = absent

Table II - In surface soil

Station	Protozoan types												Ecological Factors		
	Sarcodina			Ciliata					Flagellata				pH.	Te-mp. °C	Mois-ture %
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12			
I. Wet zone lowland (typical)	✓	✓	x	✓	x	x	x	x	✓	x	✓	x	5.8 to 5.9	25.7	47.09 to 48.65
II. Wet zone lowland (high rain fall)	✓	✓	x	✓	x	x	x	x	✓	x	x	x	7.6 to 7.9	24.9 to 25.8	54.36 to 56.64
III. Wet zone highland	✓	✓	x	✓	x	x	x	x	✓	x	x	x	5.4 to 5.8	25.2 to 27.6	39.40 to 46.40
IV. Dry zone	✓	x	x	✓	x	x	x	x	x	x	x	x	7.1 to 7.2	25.9 to 26.8	45.01 to 48.04

✓ = present
x = absent

TABLE III - 10 cms. depth from surface soil

Station	Protozoan types												Ecological factors		
	Sarcodina			Ciliata					Flagellata				pH.	Te-mp. °C	% Mois-ture
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12			
I. Wet zone lowland (typical)	✓	✓	x	✓	x	x	x	x	x	x	x	x	5.2 to 5.7	25.8	35.39 to 39.25
II. Wet zone lowland (high rain fall)	✓	x	x	✓	x	x	x	x	x	x	x	x	7.5 to 7.7	25.1 to 26.5	37.87 to 39.54
III. Wet zone highland	✓	x	x	x	x	x	x	x	x	x	x	x	5.7 to 5.8	25.6 to 27.8	19.30 to 28.52
IV. Dry zone	✓	x	x	✓	x	x	x	x	x	x	x	x	7.2 to 7.5	26.2 to 27.1	28.41 to 32.99

✓ = present
x = absent

TABLE IV - 20 cms. depth from surface soil

Of the Sarcodina *Acanthamoeba sp.* is the most widespread, being found in all 4 soil environments studied (Dry Lowland, Wet Highland, Wet Lowland and very Wet Lowland) and in each of these environments from the supernatant water down to the deepest (20 cms.) soil sampled. It is also the most abundant species, not only of the Sarcodina but also of all paddy-soil protozoa (comparative density figures will be published in a subsequent report). *Naeglaria sp.* on the other hand is essentially a Wet zone form, and lives not in the supernatant water but in the soil itself of the paddy-field, ranging down to depths of about 10 cms. except in the Wet Lowland field where it was found at 20 cms. as well. *Arcella sp.* by contrast with other two species of Sarcodina is very restricted in its distribution, being found only on the soil surface and that too in Dry zone paddy soil alone.

Of the five Ciliata *Colpoda sp.* is the most ubiquitous being found in all 4 types of paddy-fields studied, both in the overlying water and in soil from surface down to the greatest depths (20 cms.) sampled-except in the case of the field in the Wet Highland zone where it did not penetrate much below 10 cms. *Halteria sp.* seems to be confined to the supernatant water where it was found in all the fields studied except that in the Wet Highlands. Strangely enough it was in this very field that its only association with the soil (the surface only) was detected. *Paramaceum sp.* was even more restricted in its distribution being found in the overlying water of the paddy-field in the very Wet Lowland alone. *Stylonichia sp.* and *Vorticella sp.* seem to be inhabitants of the soil surface, *Vorticella sp.* of the Wet and very Wet Lowlands alone, *Stylonichia sp.* of both Wet and Dry Lowland fields. This latter species was also recorded from the overlying water of the Wet Lowland field.

Bodo sp. was the commonest of the Flagellata, and seems to range from the supernatant water down to soil as deep as 10 cms. in the Wet zone fields. However it was not detected in the supernatant water of the Wet Highland field nor anywhere in the Dry zone field. *Euglena* sp. inhabits the soil surface and the overlying water in the Wet and very Wet Lowland fields. *Astasia* sp. and *Peranima* sp. were very restricted in their distribution, the former to soil, from surface down to 10 cms., of the Wet Lowland field; the latter to the soil surface of the Dry zone field, and to the overlying water of the very Wet Lowland field.

Bamforth (1971) from a study of litter at 23 sites in temperate and sub tropical forests (coniferous and deciduous) and grasslands had concluded that moisture favours numerical dominance of certain species and that several species may dominate in any particular habitat. *Colpoda* sp. he found was among the dominant species in almost all the soil litters he studied. Stout (1962) found very much the same thing in the litter of temperate forests in New Zealand; and Varga (1957) found that in the microfauna of the soil litter of four Hungarian deciduous forests, Ciliate numbers approached and sometimes exceeded those of Flagellates. Our study shows a completely different picture for the paddy soil. The predominant type a Sarcodine, *Acanthamoeba* sp., the Ciliate *Colpoda* sp. and the Flagellate *Bodo* sp. coming well behind. Nor is this picture greatly affected by differences in the moisture content of the soil. It is probable that its special facility for encystment are responsible for this dominant position of *Acanthmoeba* sp.

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