

STUDIES ON THE CYANOPHYTA OF CERTAIN DISTRICTS OF WEST BENGAL CORRELATED WITH PHYSICO-CHEMICAL PROPERTIES OF THE SOILS

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Abstract

The paddy fields of West Bengal are in abundance of Blue green algae and the seasonal change have an impact on the BGA flora. The area under survey showed the presence of 56 strains of which ten strains are reported for the first time in West Bengal. High incidences of diazotrophic BGA in the soils with high C : N ratio were observed. The saline soils of Namkhana also showed abundance of BGA. Physico-chemical studies revealed that the low nitrogen content of West Bengal paddy soils favour the growth of diazotrophic BGA.

Introduction

The present inclination to utilise biological potentials for increased agricultural output has been directed towards exploiting diazotrophs for nitrogen requirement of crops. Quite naturally the wide distribution of the diazotrophic Cyanobacteria in the various rice fields of India gained tremendous importance. Before implementation of Cyanobacterial technology in the rice field, survival and multiplication of these organisms in any soil are to be considered, which depends on several factors, particularly those of physical characteristic, nutritional status of the soil along with the availability of water and multitude of organisms inhabiting the soil. It is evident from the works of Sinha and Mukherjee (1975 a, b), Mukhopadhyay and Chatterjee (1981) and Chatterjee and Chatterjee (1983) that the paddy soils of West Bengal are in abundance with Cyanobacteria. But even now many of the districts of West Bengal remained unexplored. Moreover, the improvisation of Cyanobacterial technology in West Bengal has not been successfully implemented. With this in view, the present investigation is an attempt to study the physiochemical nature of rice soils inhabiting the autochthonous Cyanobacteria of 24 Parganas, Hoogly, Nadia, and Midnapore districts in West Bengal.

Material and method

Physico-chemical properties of soil—The soil samples were collected from the paddy fields at a depth of 20 cms and were air dried under shed, powdered and sieved through a 25 mesh sieve, then analysed for Physico chemical properties. The pH of the soil was measured by the method of Jackson (1958) by a sensitive pH meter with a glass electrode, soil conductivity were determined by electrical conductance (Jackson, 1958), Organic carbon was estimated by Walkley and Black's rapid titration method (Piper, 1942), total soil nitrogen (Piper, 1942), available soil phosphate was determined by the method Jack Olsen (Jackson, 1958), available K_2O of soils was estimated by 1N $NH_4 OAc$ method of Jackson, 1958). The rating of the nutritional status and soil conductivity like low, medium low, medium, high, neutral or acid in soil pH were based on the standard described by Muhr *et al.*, 1965.

Identification of Cyanobacterial strains were mainly carried out with the help of the monograph on Cyanophyceae by Desikachary (1959).

Result

The physico-chemical properties of the paddy soils surveyed showed a wide diversification (Table 1). All the soils showed normal pH except those of Hooghly and Tamluk,

Table 1—Physico-chemical properties of different paddy field soils of West Bengal

Soil samples	District	Locality	pH	Conductivity in mill mhos/cm	% of Organic carbon	% of Total Nitrogen	C : N	Available P ₂ O ₅ /kg/ha	Available K ₂ O/kg/ha
S ₁	24	Mathurapur	7.4	0.20	0.56	0.06	9.33	86	367
S ₂		Bishnupur	7.1	0.53	0.85	0.10	8.50	120	237
S ₃	P	Diamond Harbour	7.8	0.53	0.68	0.08	8.50	115	367
S ₄	R	Habra	7.2	0.17	0.45	0.05	9.00	74	333
S ₅	G	Amtala	7.7	0.25	0.70	0.06	10.76	76	333
S ₆	A	South Barasat	7.8	0.40	0.63	0.06	10.50	65	215
S ₇	N	Bashirhat	7.2	0.20	0.51	0.06	8.50	110	333
S ₈	A	Kakdwip	8.1	0.94	0.46	0.05	9.18	80	633
S ₉	S	Namkhana	8.0	2.80	0.62	0.06	10.33	96	333
S ₁₀		Canning	7.5	0.20	0.63	0.06	10.50	78	410
S ₁₁		Subhashgram	7.2	0.20	0.58	0.05	11.60	67	210
S ₁₂		Lakshmikantpur	7.5	0.20	0.54	0.06	9.00	110	240
S ₁₃		Mahisadal	6.5	0.80	0.52	0.06	8.66	77	330
S ₁₄		Panskura	7.0	0.70	0.45	0.05	9.00	75	415
S ₁₅		Tamluk	6.2	0.36	0.52	0.04	10.40	70	245
S ₁₆		Krishnanagar	6.8	0.10	0.42	0.05	8.40	78	335
S ₁₇		Haringhata	7.6	0.18	0.39	0.04	9.75	90	356
S ₁₈		Chakdah	7.7	20.7	0.63	0.06	10.50	115	452
S ₁₉		Chinsurah	7.8	0.31	0.63	0.06	10.39	80	237
S ₂₀		Arambagh	6.7	0.14	0.33	0.04	8.90	50	633
S ₂₁		Hooghly	6.2	0.40	0.68	0.06	10.33	74	215

where the pH was slightly lower. The soil of Namkhana (2.8 mill m hos/cm) was found to be saline. The organic carbon of the soils were low to medium low and the C:N ratio varied within the range of 8.5:1 to 11.6:1. The total nitrogen content of the soil samples were low to medium in most of the cases. The area under survey showed the presence of 56 strains of Cyanobacteria of which 29 strains were diazotrophs and 10 strains were recorded for the first time from West Bengal were marked in asterisks. The dominating Cyanobacterial strains were *Aphanothece*, *Oscillatoria*, *Nostoc*, *Anabaena*, *Aulosira* and *Phormidium*. Periodical survey revealed that *Aphanothece* and *Oscillatoria* were predominant in the early stage of cultivation (June-July) and were later replaced by the strains of *Nostoc*, *Anabaena* and *Aulosira*. In the winter (Nov.-Feb.) the rice fields of West Bengal were in abundance with the strains of *Phormidium*, *Microcoleus* and *Scytonema*.

Cyanobacteria of 24 Parganas 'Nadia, Hooghly and Midnapore

Aphanocapsa biformis A.Br (Subashgram, Namkhana), **A. grevillei* (Hass) Rabenh. (Kakdwip, Mathurapur), **Aphanothece conferta* Richter (Bishnupur, Krishnanagar, Diamondharbour), *A. stagnina* (Spreng) A. Br (Mathurapur, Habra, Tamluk, Namkhana), **Chroococcus minor* (Kütz.) Nag. (Krishnanagar), *C. minutus* (Kütz.) Nag. Krishnanagar, *C. pallidus* Nag. (Chakdaha, Panskura, Arambag) *Gloeocapsa decorticans* (A. Br) Richter (Krishnanagar), *G. polydermaticus* Kütz. (Krishnanagar), *Microcystis flos-aquae* (Wittr.) Kirchner (Hooghly, Namkhana, D.H.), **M. protocystis* Crow (Kakdwip, South Barasat). **Synechococcus aeruginosus* (Nag.) (Bashirhat, Canning), *Anabaena fertilissima* Rao, C. B. (Bishnupur, Namkhana), *A. Tyengarii* Bharadwaja var. *unispora* Singh. (D. H., Mahisadal), *A. naviculoides* Fritsch (D.H. Kakdwip), *A. orientalis* Dixit (Kakdwip, Arambag), *A. oryza* Fritsch (Chinsurah, Chakdaha), *A. oscillarioides* Bory ex Born et Flah. (Habra, Bashirhat, Bishnupur), **A. variabilis* var. *ellipsospora* Fritsch (D.H., Namkhana), *Aulosira fertilissima* Ghose (Kakdwip, Namkhana), *A. fertilissima* var. *tenuis* Rao, C.B. (Kakdwip), *A. implexa* Bornet et Flahault (D.H., Kakdwip), *A. prolifica* (Arambag, Amtala, Namkhana), *Calothrix braunii* (A. Br) Born et Flah (Mathurapur), *C. brevissima* West. G.S. (Haringhata) *C. fusca* (Kütz.) Born et Flah. (Amtala). *Cylindrospermum muscicola* Kütz. ex Bornet (Bishnupur), *Lynghya hieronymusii* Lemm. (Arambag, Bishnupur), *L. major* Manegh ex Gomont (Panskura, Chakdaha), *L. spiralis* Geitler (Mahisadal, South Barasat, Canning), *L. stagnina* Kütz. (Tamluk, Lakshmikantapur), *Microcoleus chthonoplastes* Thuret, ex Gomont (Arambag, Habra), *Nostoc* sp (Panskura), *N. calcicola* Brebisson ex Born et Flah (D.H.), *N. commune* Vaucher ex Born. et Flah (Arambag, Mahisadal), *N. linckia* (Roth) Bornet ex Born et Flah (Kakdwip), *N. muscorum* Ag ex. Born et Flah. (D.H.), *N. piscinale* Kutzing ex Born et. Flah (Bashirhat, Mathurapur), *Oscillatoria anguina* (Bory) Gomont, *O. obscura* Bruhl et Biswas (Kakdwip), *O. princeps* Vaucher ex Gomont (Subashgram), *O. subbrevis* Schmidle, **Phormidium incrustatum* (Nag.) Gomont (Kakdwip, Mathurapur) *P. molle* (Kütz.) Gom. (Bashirhat, Bishnupur) *P. stagnina* Rao, C.B. (Arambag), *P. tenue* (Manegh) Gomont, *Scytonema hoffmanni* Ag. ex Born et Flah (Subashgram), **S. schmidlei* J. De. Toni (Mathurapur, Bishnupur), *S. simplex* Bharadwaja (Krishnanagar), **Spirulina Labyrinthiformis* (Manegh) Gomont, *S. major* Kute. ex Gomont (Krishnanagar) A species of **Fischerella*, *Hapalosiphon intricatus* Wet. G. S. West (Reported for the first time from West Bengal paddy soil).

Discussion

Certain localities like Kakdwip, Namkhana, South Barasat and Diamond Harbour had the high incidence of *Aulosira* or rather the alkaline soils show preponderance of dia-

zotrophs particularly of *Aulosira*, where as acid soils had particularly no diazotrophic algal population. High C:N ratio also shows a high rate of diazotrophic flora as are found in Subashgram, Canning, South Barasat, Amtala, Chakdaha, Tamluk, Chinsura. It is likely that the high pH and high C:N ratio favours the propagation of diazotrophic Cyanobacteria in the saline soils of Namkhana. The abundance of diazotrophic Cyanobacteria in the West Bengal paddy fields may account to the low nitrogen content of the soils.

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