Indian J.Sci.Res. 4 (2): 241-246, 2013 ISSN: 0976-2876 (Print)
ISSN: 2250-0138(Online)

SURVEY OF CYANOBACTERIA AT THREE IMPORTANT POINTS OF SITAMARHI DISTRICT AND DETERMINATION OF REJUVENILE POTENCY AND RELATIVE SPECTRUM FREQUENCY OF THE MEMBERS ISOLATED

R.K. GUPTA[a1], MEENAKSHI PRIYADARSHNI[b] AND RAMJI SINGH[c]

[ac]Department of Botany, S R K G College, Sitamarhi, India
[b]PG Department of Botany, B.R.A.B.U, Muzaffarpur, India

ABSTRACT

Members of blue-green (Cyanobacteria) play an important role in the reduction of atmospheric Nitrogen. They also play an important role in aquatic ecosystem. Sitamarhi, Bairginia and Janakpur Road are important sites where different members of Cyanobacteria are dwelling, but not identified. In the present study, soil samples, colonies visible to naked eyes were collected and cultured in the laboratory conditions. Field survey was done in different season's viz., March-May-July-Sept and November of the year. Based on the emergence of the colonies in the culture plates the genera were identified and accordingly the Rejuvenile potency and Relative Spectrum were determined. A great deal of variations have been observed for different genera at the above three sites. Out of the genera identified a few only revealed consistency at all the three places in all the periods of collections. This was correlated with the adaptive ability of the genera. Similarly, presence similar species indicated similarly of the soil and water with respect to nutrition composition.

KEYWORDS: Cyanobacteria, Rejuvenile Potency, Relative Spectrum Frequency, Colonies, Aquatic ecosystem

Different members of Cyanobacteria play an important role in the Nitrogen economy of the soil and water. Horne and Fogg (1970) indirectly estimated that benthic blue-green in fresh water may fix 0.8 t of Nitrogen annually. Fixation rates of 320 mg Nitrogen / meter square/ year have been measured for gelatinous *Nostoc* colonies living in the bottom of certain Californian Streams (Horne & Carmiggelt (1975)). Blue green algae have soil and sand binding capabilities. However, there is no report about the members present in different sites of Sitamarhi district which consists several water bodies as well as paddy fields where the members of blue green algae flourish. We get that general survey of a particular point has been done by few workers such as Goel 1982; Das 1989; and Jha and Kar Gupta 2001. But we have no report about the RP and RSF of the blue green taxa of the area. Therefore, in the present work seasonal collections of the samples, soil as well as the visible colonies was done and they were cultured in the laboratory. The colonies were identified and RP and RSF were calculated by applying the formula as mentioned in the chapter Materials and Methods. Information regarding the presence of the above genera is of great significance both with respect to further studies and for its conservation.

MATERIALS AND METHODS

For the determination of the spectrum, Rejuvenile potency and Relative Spectrum Frequency two sites of the districts were selected. The soil samples of these sites were collected; from a depth not exceeding 5 cm. Soil was collected from the cultivated as well as non cultivated land. After proper mixing 10 g of soil was placed in a pre-sterilized petri plates and was gently irrigated with Bristol's inorganic solution, whose pH was adjusted at 6.5. (Nichols and Bold, 1965). Above Petri plates were incubated in the culture room at 26 ± 12^0C and 14 h cycle of light and 10 h darkness. Well grown colonies were selected for identification with the help fo standard literature as described by Desikachari (1959). Samples from the water logged fields were also collected and studied for identification. Some species where district morphological features are known such as *Nostoc*, *Rivularia*, *Gloeotrichis* were collected from the water bodies and studied for the identification and population densely, distribution and occurrence. Based on the above studies, the spectrum, (S), Rejuvenile Potency (RP) and Relative Spectrum Frequency (RSF) were determined.

Rejuvenile Potency (RP)

The identified genus was inoculated in the Petri plates containing culture modicum. These plates were incubated in the culture room under controlled temperature and light. Observation was made weekly for the emergence of the genus inoculated, After four weeks the RP of each genus was calculated by the following formula.

$$\text{Rejuvenile Potency RP} = \frac{Rx}{K} \times 100$$

[1]Corresponding author

Where,

Rx = Sum total of the genus that emerged in the culture.

K = No. of replica of weekly observations.

Relative Spectrum Frequency RSF

This was determined by the emerged genus in the culture. Here inoculation was made for dormant species, the sample taken from different areas viz., Sitamarhi, Bairginia, and Janakpur Road.

$$RSF = \frac{Rn}{R} \times \frac{1}{S} \times 100.$$

Where,

Rn = Sum total of replicate in which a taxon under consideration emerged.

S = Number of taxea observed in the respective month.

R = Sum total of Replicates taken for respective sampling zone.

RESULT

Periodical observations on the Rejuvenile Potency (RP) of Cyanobacterial taxa recorded at each of the three sampling fields were made and the data scored have been summarized in the table 1a, b and C.

Table 1: Sitamarhi
Periodical values of Rejuvenile Potency

S.N.	Name of the Taxa	Jan 10	March 10	May 10	July 10	Sept 10	Nov 10
1	*Anabaena laxa*	91.70	0.00	0.00	83.30	91.70	66.70
2	*Anabaena oryzae*	100.0	0.00	0.00	41.70	91.70	75.00
3	*Arthrospira gomontiana*	91.70	8.30	0.00	0.00	83.30	50.00
4	*Anabaena variabilis*	33.30	0.00	0.00	41.70	75.00	66.70
5	*Chlorogloea fritschii*	100.0	0.00	0.00	25.00	75.00	100.00
6	*Gloeotrichia longicauda*	91.70	0.00	0.00	0.00	0.00	50.00
7	*Oscillatoria willei*	91.70	100.00	41.70	100.00	100.00	100.0
8	*Oscillatoria tenuis*	41.70	0.00	0.00	0.00	0.00	50.0
9	*Nostoc linckia*	100.0	100.0	25.00	66.70	91.70	91.70
10	*Nostoc ellipsosporum*	83.30	75.00	0.00	41.70	91.70	75.00
11	*Nostoc calcicola*	91.70	0.00	0.00	33.30	0.00	93.30
12	*Plectonema tomasimianum*	41.70	0.00	0.00	0.00	0.00	25.00
13	*Scytonema simplex*	91.70	0.00	0.00	58.30	91.70	83.70
14	*Synechocystis aquatilis*	91.70	0.00	16.70	66.70	83.30	91.70

Table 2: Bairgania
Periodical values of Rejuvenile Potency

S.N.	Name of the Taxa	Jan 10	March 10	May 10	July 10	Sept 10	Nov 10
1	*Anabaena laxa*	75.0	16.70	0.00	16.70	91.70	83.30
2	*Anabaena oryzae*	91.70	8.30	25.00	83.30	91.70	91.70
3	*Anabaena variabilis*	83.30	0.00	0.00	75.00	83.30	75.00
4	*Arthrospira gomontiana*	91.70	16.70	0.00	0.00	58.30	75.70
5	*Chlorogloea fritschii*	100.0	0.00	0.00	16.70	83.30	91.70
6	*Gloeotrichia longicauda*	75.0	0.00	0.00	0.00	0.00	50.00
7	*Oscillatoria willei*	100.0	91.70	33.30	100.00	100.00	91.70
8	*Oscillatoria tenuis*	50.0	0.00	0.00	8.30	0.00	33.00
9	*Nostoc linckia*	83.30	100.0	25.00	66.70	91.70	91.70
10	*Nostoc ellipsosporum*	91.70	83.30	0.00	58.30	91.70	83.30
11	*Nostoc calcicola*	58.30	0.00	0.00	25.00	0.00	66.70
12	*Plectonema tomasimianum*	66.70	0.00	0.00	0.00	0.00	75.00
13	*Scytonema simplex*	91.70	0.00	0.00	16.70	83.30	50.00
14	*Synechocystis aquatilis*	91.70	41.70	33.30	58.30	58.30	83.30

Table 3: Janakpur Road
Periodical values of Rejuvenile Potency

S.N.	Name of the Taxa	Jan 10	March 10	May 10	July 10	Sept 10	Nov 10
1	*Anabaena laxa*	66.70	8.30	0.00	33.30	0.00	83.30
2	*Anabaena oryzae*	83.30	0.00	0.00	66.70	83.30	83.30
3	*Anabaena variabilis*	83.30	0.00	0.00	75.00	83.30	75.00
4	*Arthrospira gomontiana*	91.70	66.70	0.00	0.00	8.30	50.00
5	*Chlorogloea fritschii*	53.30	0.00	0.00	50.00	91.70	100.00
6	*Gloeotrichia longicauda*	66.70	0.00	0.00	0.00	0.00	50.00
7	*Oscillatoria willei*	100.00	100.00	50.00	100.00	100.00	91.70
8	*Oscillatoria tenuis*	58.30	0.00	00.00	16.70	00.00	41.70
9	*Nostoc linckia*	83.30	100.00	50.00	83.30	91.70	75.00
10	*Nostoc ellipsosporum*	83.30	50.00	0.00	33.30	0.00	83.30
11	*Nostoc calcicola*	66.70	0.00	0.00	16.70	0.00	66.70
12	*Plectonema tomasimianum*	83.30	0.00	0.00	0.00	0.00	100.00
13	*Scytonema simplex*	75.00	0.00	0.00	25.00	91.70	83.30
14	*Synechocystis aquatilis*	91.70	41.70	33.30	58.30	58.30	83.30

From the tables it is apparent from the tables that the RP of each taxa varied with respect to the months of observations and sampling fields both. It may be noted from the above tables that *Oscillatoria willei* and *Nostoc linckia* were constant at all the three sampling fields, where as *Anabaena oryzae* was consistent at Bairgania only. Rest of the taxa were inconsistent wherever they were present. Similarly *O. willei* and *N. linckia* were consistently high in all the sampling fields. *Synechocystis aquatilis* was inconsistent at Sitamarhi, Consistently high at Bairgania and moderately high at Janakpur Road. On the other hand *A. oryzae* was found in consistant at Sitamarhi and Janakpur Road but consistently high at Bairginia.

Oscillatoria willei, *Anabaena oryzae* at all the three sampling zones; *Anabaena laxa* at Sitamarhi, *Nostoc ellipsosporum* at Bairgania, *Nostoc linckia* and *Scytonema simplex* at Sitamarhi and Bairgania; *Anabaena variabilis* at Bairgania and Janakpur Road were found with RP inflated during July- September and November-March either in the form of two discrete peaks or as contiguous broad peak if it is read in sequence starting from May being stack month physiologically for Cyanobacteria. Thus *Oscillatoria tenuis*, *Nostoc calcicola*, Plectonema tomasianianum and *Goloeocapsa longicuda* at all the three sampling zones, *Nostoc linckia*, *N.* ellipsoporum, *Anabaena laxa* at Janakpur Road; have been noted with November-March peak relatively more pronounced than that of July-September. Reverse to above be noted for *Nostoc ellipsosporum* and *Anabaena variabilis* at Sitamarhi; *Anabaena laxa* at Sitamarhi and Scytonema simplex at Janakpur, which were relatively more dominant during July-September.

Relative Spectrum Frequency

Along with RP, RSP of each taxa were also ascertained. The data obtanined for RSF have been presented in the tables 4-6.

Table 4: Sitamarhi
Periodical values of Relative Spectrum Frequency

S.N.	Name of the Taxa	Jan 10	March 10	May 10	July 10	Sept 10	Nov 10
1	*Anabaena laxa*	5.39	0.00	0.00	2.22	6.54	3.33
2	*Anabaena oryzae*	5.88	0.00	0.00	2.77	6.54	3.77
3	*Anabaena variabilis*	1.96	0.00	0.00	2.77	5.35	3.33
4	*Arthrospira gomontiana*	5.39	1.19	0.00	0.00	5.95	2.50
5	*Chlorogloea fritschii*	5.88	0.00	0.00	1.66	5.35	5.00
6	*Gloeotrichia longicauda*	5.39	0.00	0.00	0.00	0.00	2.50
7	*Oscillatoria willei*	5.39	14.28	10.41	6.60	7.14	5.00
8	*Oscillatoria tenuis*	2.45	0.00	0.00	0.00	0.00	2.50
9	*Nostoc linckia*	5.88	14.28	6.25	4.40	6.54	4.58
10	*Nostoc ellipsosporum*	4.90	10.71	0.00	2.77	6.54	3.73
11	*Nostoc* calicoal	5.39	0.00	0.00	2.22	0.00	4.16
12	*Plectonema tomasimianum*	2.45	0.00	0.00	0.00	0.00	1.25
13	*Scytonema simplex*	5.39	0.00	0.00	3.88	6.54	4.16
14	*Synechocystis aquatilis*	5.39	0.00	4.16	4.40	5.95	4.58

Table 5: Bairgania
Periodical values of Relative Spectrum Frequency

S.N.	Name of the Taxa	Jan 10	March 10	May 10	July 10	Sept 10	Nov 10
1	*Anabaena laxa*	4.41	1.85	0.00	1.19	6.54	4.38
2	*Anabaena oryzae*	5.39	0.92	5.00	5.95	6.54	4.82
3	*Arthrospira gomontiana*	5.39	1.85	0.00	0.00	4.16	3.94
4	*Chlorogloea fritschii*	5.88	0.00	0.00	1.19	5.95	4.82
5	*Gloeotrichia longicauda*	4.41	0.00	0.00	0.00	0.00	2.63
6	*Oscillatoria tenuis*	2.94	0.00	0.00	0.59	0.00	1.75
7	*Oscillatoria willei*	5.88	10.00	6.66	7.14	7.14	4.82
8	*Nostoc linckia*	4.90	11.11	5.00	4.76	6.54	4.82
9	*Nostoc ellipsosporum*	5.39	9.25	0.00	4.16	6.54	4.38
10	*Nostoc* calicoal	3.43	0.00	0.00	1.78	0.00	3.50
11	*Plectonema tomasimianum*	3.92	0.00	0.00	0.00	0.00	3.94
12	*Scytonema simplex*	5.39	0.00	0.00	1.19	5.95	2.63
13	*Synechocystis aquatilis*	5.39	4.62	6.66	4.16	4.16	4.38
14	*Anabaena variabilis*	4.90	0.00	0.00	5.39	5.95	3.49

Table 6: Janakpur Road
Periodical values of Relative Spectrum Frequency

S.N.	Name of the Taxa	Jan 10	March 10	May 10	July 10	Sept 10	Nov 10
1	*Anabaena laxa*	3.30	0.92	0.00	2.08	0.00	4.16
2	*Anabaena oryzae*	4.16	0.00	0.00	4.16	7.57	4.16
3	*Anabaena variabilis*	4.16	0.00	0.00	2.08	7.57	4.16
4	*Arthrospira gomontiana*	4.58	7.40	0.00	0.00	0.75	2.50
5	*Chlorogloea fritschii*	4.16	0.00	0.00	3.12	8.33	5.00
6	*Gloeotrichia longicauda*	3.92	0.00	0.00	0.00	0.00	2.50
7	*Oscillatoria tenuis*	2.91	0.00	0.00	1.04	0.00	2.08
8	*Oscillatoria willei*	5.00	11.11	12.50	6.25	9.09	4.58
9	*Nostoc linckia*	4.16	11.11	12.50	5.20	8.33	3.75
10	*Nostoc ellipsosporum*	4.16	5.55	0.00	2.08	0.00	4.16
11	*Nostoc calcicola*	3.33	0.00	0.00	1.04	0.00	3.33
12	*Plectonema tomasimianum*	4.16	0.00	0.00	0.00	0.00	5.00
13	*Scytonema simplex*	4.14	0.00	0.00	1.56	8.33	4.16
14	*Synechocystis aquatilis*	3.30	3.70	12.50	3.12	6.81	4.16

Amongst the 14 taxa recorded, the RSF of *Oscillatoria willei* and *Nostoc linckia* were noted consistently high at all the three sampling fields; It was noted moderately high of Synechocystis aquatilis at Bairgania and Janakpur Road, while moderately low of *Anabaena oryzae* at Janakpur Road and Bairgania respectively.

Like RP, RSF of each taxa varied during the months of observations and amongst the different sampling fields. Thus, while the taxa *Synechocystis aquatilis*, *Anabaena laxa* at Sitamarhi; *Anabaena variabilis* at Bairgania; *Chlorogloea fritschiz*, *Anabaena oryzae*, *Scytonema simplex* at Sitamarhi and Bairgania were observed with two descrete or a broad contiguous peak during July-September and November-March; *Oscillatoria willei*, O. tenuis, *Nostoc linckia*, *N. ellipsosporum*, *N. calcicola*, *Plectonema tomasinianum*, *Gloeotrichia longicauda* at all the three sampling zones; *Synechocystis aquatilis* at Bairgania, *Anabaena laxa* at Janakpur Road, had much RP.

DISCUSSION

Present study was aimed to explore the members of Cyanobacteria at Sitamarhi district with reference to RP and RSP. The explorations of soil algae has also been made by (Marthe, 1960, Aiyer 1965; Kamat and Patel 1973; Bharti nad Bongale 1975; Sinha and Mukherjee (1975a, 1975b; Prasad and Mehrotra 1976; Thirukkanasan et al;1977; Kanniyan 1978; Sarma et al; 1978; Anand 1980; Bongale 1981; Mukhopadhyay and Chatterjee 1981; Sardesh pande nad Goyal 1981; Goyal et al; 1984) but only with reference to the simple spectrum at a given time.

The methods have been evolved for ascertaining population density as well as distribution pattern of algal taxa in the aquatic environment. (Anand 1976, 1979, Mohanti 1984) Verma and Dattamumshi, 1987. In the present studies, an attempt has been made for computing physiological status (RD) nad level of distribution RSF of soil algal. All the taxa collected from three different zones in different months, but all the taxa were never seen constituting spectrum of any one of the sampling fields.

It is further evident from the tables that *Anabaena laxa*, *A. oryzea, A. variabilis*, *Chlorogloea fritschii, Gloeotrichia longicauda*, *Nostoc linckia*, *N. ellipsosporum, N. calcicola, Plectonema tomasinianum, Scytonema simplex* were most common forms being constituents of the spectra acertained for all the three fields under study. Presence of all the above genera at all the sampling sites suggests some sort of similarities in the physio-chemical conditions of the soil developed at nutritional level.

Oscillatoria willei and *Nostoc linckia* revealed consistently high RP and RSF, at all the three sampling zones during each sampling months. Therefore, either they have high adaptability or the existing conditions were congenient for them at the year round so they were dominating species. Taxa showing in consistent RP and RSF may be regarded as less adaptive. Similarly taxa having equal peak during Rabi and Kharif season, may be regarded to have a wide range of adaptability against those having either Rabi peak or Kharif peak relatively more pronounced. RP and RSF have been noted to vary concomitantly during different months of a year in general, but in case of *Oscillatoria willei*, *Nostoc linckia* while RP was recorded very high, RSP was very low during July – September, Showing thereby that the prevailing factors were favourable for the emergence or rejuvenation of the protoplasts but not for its furtherance. Reverse to it may be concluded for *Synechocystis aquatitis* in which case RP came down very low and RSF increased appreciably in May.

ACKNOWLEDGEMENT

The authors are thankful to the Head Department of Botany, and the Principal, SRKG College, Sitamarhi for granting permission to utilize library and laboratory facilities.

REFERENCES

Aiyer, R.S. (1965): Comparative algological studies in rice fields in Kerala State. *Agri. Res. J.* 3: 110-115.

Anand, V.K., (1976): A preliminary list of cyanophyceae of Saruinsar lake Jammu. *Geobios*. 3. 132-133.

Anand, V.K. (1979): Blue-Green algae of Gadigarh stream (Miran Sahib, Jammu) – I. *Phy Kos*. 19. (1&2): 21-24.

Anand, N. (1980): Studies on blue-green algal populations of rice field. *National workshop on Algal System Proceeding*, pp. 52-54.

Bharti, S.G. nad Bongale, U.D. (1975): Studies on soils and soil algae of Karnataka State Part-1, *Soils and soil algae of Dharwad. Karnataka Univ. J. Sci*. 20: 142-150.

Bongale, U.D. (1981): On the soil algae from paddy fields of Punjab (Goa) and Chikkamanchali (Raichur District, Karnataka). *J. Indian Bot. Soc*. 60:329-330.

Desikachary. T.V. (1959): Cyanophya. Pub. *Indian Council of Agr. Res.*, New Delhi, pp. 686.

Goyal, S.K. (1982): Algal flora of silent valley. *Phykos* 21: 119-121.

Horne. A.J. and Fogg G.E. (1970): Nitrogen fixation in some English lakes. *Proceedings of the Royal society. B*. 175: 351-366.

Horne A.J. nad Carmiggelt, J.W. (1975): Algal Nitrogen Fixation in Californian Streams Seasonal Cycles. *Fresh Water Biology*. 5: 461-470.

Jha, Sampoornnanand and A.N. Kargupta (2001): Cyanobacterial flora of Eastern Koshi Basin, Nepal, *Ecoprint*. 8: (1): 37-43.

Kamat, N.D. and Patel, M.Z. (1973): Soil algae of rice fields at different depths. *Botanique (Indian)*4(2): 101-106.

Kannaiyan, S. (1978): Effect of certain insecticides on the growth of blue-green algae. *All India Symp. On Pesticide Residues in the Environment,* November 7-10, pp. 492-495.

Marathe, K.V. (1960): Studies on soil algae of India II. Soil algae from cultivated fields of Jalgaon. *J. Univ. Bombay* 38: 69-72.

Mohanti, R.C. (1984): Blue-green algae of Bhubaneshwar and its adjoining regions.- III. *Phykos* 23(1&2): 90-95.

Prasad, B.N. and Mehrotra, R.K. (1976): *Nostoc* citrisporum sp. Nov. from paddy field soil. *Phykos* 15: 65-657.

Sinha, J.P. and Mukherjee, D. (1975a): On blue-green algae from the paddy fields of Bankura district of W. Bengal-II, *Phykos* 14: 117-118.

Sinha, J.P. and Mukherjee, D. (1975b): On blue-green algae from the paddy fields of Bankura district of W. Bengal-II, *Phykos* 14: 119-120.

Sarma, T.A., Swarnkanta and Sumita (1978): Algal flora of Patiala and its environs cyanophyceae II. *Phykos* 18(1&2): 13-19.

Thirukkanasn, A., Kulasooriya, S.A. and Thivendirarjah, K. (1977): A periodic survey of blue-green found abundantly during the monsoon period (September-January) in a paddy field near Jaffna campus at Vaddakodal and a general survey of blue-green algae in the Jaffna peninsula during the same period. *Proc.* 33rd *Ann. Session of the SLAAS*: 50-51.

Verma, P.K. nad Dattamunshi, J. (1987): Plankton sommunity structure of Badua Reservoir, Bhagalpur (Bihar), *Trop. Ecol*. 28: 200-207.