

## Short Communications

J Indian bot Soc Vol 73 (1994) 155-156

# STUDY OF EFFECT OF OPIUM EFFLUENT ON HETEROCYST FREQUENCY OF SOME N<sub>2</sub> - FIXING CYANOBACTERIA

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Key words : Opium effluent, heterocyst, cyanobacteria

Present study deals with the effect of graded concentrations of liquid opium effluent on heterocyst frequency of three N<sub>2</sub>-fixing cyanobacteria viz., *Nostoc muscorum*, *Anabaena ambigua* and *A. doliolum* isolated from effluent polluted habitats. Heterocyst frequency of all the test cyanobacteria was found to increase gradually when they were incubated in 1-15% (v/v) effluent prepared in basal medium. Incubation of cultures in effluent above 15% concentration level resulted in a gradual decrease in heterocyst frequency. Heterocyst disappeared completely when cultures were grown in absolute effluent for 10 days.

The increasing industrial activities are causing complex changes in the different natural communities. Many scientists have used algae as test system for evaluating toxicity of industrial wastes (Shehata and Whitton, 1981, Maneesha and Trehan, 1987; Gupta, 1991). As compared to other plants the cyanobacteria are more resistant to pollution (Kumar, 1979). They utilize various forms of nitrogen for their growth. All the heterocystous and some non-heterocystous cyanobacteria are known to fix atmospheric nitrogen. The present investigation deals with the effect of graded concentrations of liquid opium effluent prepared in basal medium on heterocyst frequency of heterocystous cyanobacteria isolated from effluent polluted habitats.

Three heterocystous cyanobacteria viz., *Nostoc muscorum*, *Anabaena ambigua* and *A. doliolum* isolated from effluent affected habitats were grown in unicyanobacterial cultures and used as test cyanobacterium in the present investigation. All the test cyanobacteria were grown in Allen and Arnon's medium (Allen and Arnon, 1955) as modified by Arnon et al. (1974). The desired effluent volumes of the effluent to a constant volume of the distilled water or vice-versa. Heterocyst frequency was expressed as

the number of heterocysts present per millimeter filament length (H/MFL).

Cultures of *Nostoc muscorum*, *Anabaena ambigua* and *A. doliolum* grown in basal medium showed healthy filaments with distinct heterocysts. In general, cultures growing in lower concentrations of effluent, containing growth medium ranging from 1-15% (v/v) showed slight increase in heterocyst frequency. A gradual decrease in heterocyst frequency was observed when cultures were grown in higher concentrations of effluent i.e. above 15% (Table 1). Above 15% effluent concentration, heterocyst frequency gradually decreased in each of the cyanobacterium, under experiment.

In heterocystous cyanobacteria the heterocysts are the main sites of N<sub>2</sub>-fixation because a definite correlation exists between the capacity for N<sub>2</sub>-fixation and number of heterocysts (Fay *et al.*, 1968). As evident in present investigation heterocyst frequency remained unaffected and increased up to the level of 1-15% effluent concentration. Increase in the number of heterocysts was directly related to the increase in rate of N<sub>2</sub>-fixation. Jha and Gupta (1990) reported increase in nitrogenase of *Nostoc muscorum* isolated from opium effluent in lower dilutions 1-15% of the effluent prepared in basal medium. They also reported a rapid decrease in the enzyme activity in the cultures incubated above 15% effluent concentrations. The addition of a combined nitrogen source to the cultures suppressed heterocyst formation and in turn the nitrogen biosynthesis (Brill, 1975; Rippka and Stanier, 1978). Luxuriant growth of heterocystous test cyanobacteria in lower concentrations of effluent revealed that the different forms of nitrogen contents in the effluent viz., nitrate nitrogen, ammonium nitrogen (Jha and Gupta, 1991) do not act as limiting factor.

We are grateful to the University Grants Commis-



Table 1: Effect of opium effluent on heterocyst frequency of test cyanobacteria.

| Concentrations        | Heterocyst frequency (H/MFL) |     |                         |      |                          |     |
|-----------------------|------------------------------|-----|-------------------------|------|--------------------------|-----|
|                       | <i>Nostoc muscorum</i>       |     | <i>Anabaena ambigua</i> |      | <i>Anabaena doliolum</i> |     |
|                       | No. of Days                  |     |                         |      |                          |     |
|                       | 10                           | 20  | 10                      | 20   | 10                       | 20  |
| BM                    | 4.2                          | 4.6 | 4.65                    | 4.85 | 5.0                      | 5.2 |
| OE undiluted          | 2.0                          | 0.0 | 1.3                     | 0.0  | 2.5                      | 0.0 |
| BM+OE1%               | 4.3                          | 4.2 | 4.5                     | 4.8  | 4.9                      | 5.0 |
| BM + (Control) 1%     | 3.9                          | 3.4 | 4.45                    | 4.65 | 4.75                     | 4.7 |
| BM + OE 5%            | 4.39                         | 4.6 | 4.7                     | 5.0  | 4.85                     | 5.1 |
| BM + DW (Control) 5%  | 3.75                         | 3.2 | 4.43                    | 4.5  | 4.7                      | 3.7 |
| BM + OE 10%           | 4.6                          | 4.3 | 4.8                     | 5.0  | 5.15                     | 5.8 |
| BM + DW (Control) 10% | 3.7                          | 3.1 | 4.2                     | 3.6  | 4.5                      | 3.0 |
| BM + OE 15%           | 5.0                          | 4.7 | 5.0                     | 5.1  | 5.8                      | 7.0 |
| BM + DW (Control) 15% | 3.5                          | 3.0 | 4.0                     | 3.2  | 4.3                      | 2.3 |
| BM + OE 20%           | 4.8                          | 4.4 | 4.9                     | 3.3  | 5.6                      | 6.6 |
| BM + DW (Control) 20% | 3.3                          | 2.7 | 3.7                     | 2.5  | 3.9                      | 2.1 |
| BM + OE 25%           | 3.8                          | 2.3 | 4.2                     | 2.7  | 5.7                      | 6.0 |
| BM + DW (Control) 25% | 3.0                          | 2.0 | 3.0                     | 1.8  | 3.3                      | 1.6 |
| BM + OE 50%           | 3.0                          | 0.3 | 2.4                     | 0.0  | 2.7                      | 0.0 |
| BM + DW (Control) 50% | 3.2                          | 0.9 | 2.5                     | 0.5  | 3.1                      | 1.2 |

BM = Basal medium (Allen and Arnon's medium)

DW = Distilled water

OE = Opium effluent

sion, New Delhi for providing financial assistance to the present research work.

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