

## EFFECT OF GIBBERELIC ACID ON HETEROCYST FORMATION FREQUENCY AND TOTAL NITROGEN CONTENT OF TWO NOSTOC SPECIES.

M. G. Battah

Department of Botany, Faculty of Science, Benha branch,  
Zagazig University - Egypt

### ABSTRACT

The effect of the growth regulator gibberellic acid (GA<sub>3</sub>) on the growth and heterocyst formation frequency by *Nostoc carneum* and *Nostoc muscorum* was studied. These two organisms were isolated from a rice field at Qalyoubia governorate. They were treated with different concentrations of gibberellic acid. On applying the concentration 1.0 ppm of GA<sub>3</sub> chlorophyll a content in *Nostoc carneum* increased after three days of incubation but then decreased. For *Nostoc muscorum* chlorophyll a content increased after 10 days of incubation on applying the concentrations 0.01 and 0.1 ppm, while on applying the concentrations 1.0 and 10 ppm chlorophyll a content was significantly high after 3 days of incubation.

In the first days of incubation heterocyst formation frequency in *Nostoc carneum* treated with GA<sub>3</sub> was similar to that of control, except for the concentration 0.01 ppm of GA<sub>3</sub>, which exerted a stimulatory effect, where the number of heterocyst increased. Moreover after 8 days of incubation all used concentrations exerted different negative effects. On the other hand heterocyst formation frequency in *Nostoc muscorum* treated by GA<sub>3</sub> was highly increased after 3 days of incubation using 1.0 and 10.0 ppm, and this increase was prolonged throughout the whole experiment.

Applying the growth regulator GA<sub>3</sub> for the two *Nostoc* species, their dry weight increased through the first days of incubation, yet it later exhibited different negative effects. The total nitrogen content of the cells of both species of *Nostoc* increased, except for the concentration 10 ppm which was inhibitory for *Nostoc carneum*.

### INTRODUCTION

Heterocysts of blue-green algae are easily distinguished from vegetative cells by their hyaline protoplast which is often yellowish and devoid of granular reserve materials and gas-vacuoles<sup>(1)</sup>. The production of heterocysts by blue-green algae is greatly stimulated by medium deficiency of combined nitrogen<sup>(2)</sup>.

Heterocystous blue-green algae are of paramount importance in aquatic habitats due to their property of diazotrophy. Heterocystous algae are prokaryotes endowed with the twin virtues of photosynthesis and nitrogen fixation. Their significant effect appears mainly on the nitrogen content of soil<sup>(3)</sup>. It has been accepted that IAA promotes growth of N<sub>2</sub>-fixing Cyanobacteria,<sup>(4-6)</sup> Most of these reports were based upon the determination of growth yield after application of exogenous IAA. Fernández-Valiente et al.,<sup>(7)</sup> reported that concentrations of IAA ranging from 0.01 to 3 µg/ml. cause neither stimulation nor inhibition of growth, monitored by the change in either dry weight or contents of nucleic acid or proteins in non N<sub>2</sub>-fixing *Anacystis montana*.

This different behaviour of Cyanobacteria in response to IAA, depends on whether they fix N<sub>2</sub> or not, as well as the fact that synthetic auxins enhance

nitrogen fixation and frequency of formation of heterocysts in different species of N<sub>2</sub>-fixing cyanobacteria<sup>(8&9)</sup>. These authors suggest that auxins may play a role in the process of N<sub>2</sub>-fixation by cyanobacteria, through the formation of heterocysts. Moreover,<sup>(10)</sup> reported that photosynthesis plays an important role in heterocyst formation. Strautton and Corke,<sup>(11)</sup> concluded that inhibition of heterocyst formation might be due to metal impaired photosynthesis. The studies carried out by Chaporkar and Gangawane<sup>(12)</sup> indicated that growth and nitrogen fixation by *Nostoc hatei* decreased with the increase of the applied concentration of IAA and kinetin, while gibberellic acid stimulated both processes, except at high concentrations. Giriappanavar and Bharati<sup>(13)</sup> applied different concentrations (5, 10 and 15 ppm) of 3-indole butyric acid to *Nostoc rivulare* and *Hapalosiphon stuhlmannii* for 40 days, and they found that fresh weight and heterocyst formation increased in conjointly with total nitrogen fixation at all levels of the applied concentrations. Dhar et al.<sup>(14)</sup> studied the influence of indole 3-acetic acid on growth and nitrogen fixation by *Anabaena Azollae* and *Anabaena variabilis*, where they found that IAA stimulated growth (chlorophyll content), while the effect on nitrogen fixation was variable for each organism.