NITROGEN FIXING CYANOBACTERIA - REGULATORS OF NITROGEN CONTENT

Sergiu DOBROJAN[1], Gheorghe JIGĂU[1], Galina DOBROJAN[1]
[1]*State University from Moldova, Chișinău, Republic of Moldova*

Cyanobacteria have a primary role in the biogenic migration of nitrogen on the Earth's surface, a fact that contributes to the maintenance of life on earth. Due to the ability to biologically fix atmospheric nitrogen, cyanobacteria occupy a basic position in the structural-functional organization of ecosystems in various natural regions. Atmospheric nitrogen fixed by cyanobacteria is important for ecosystems, and thanks to this process, about four times more nitrogen accumulates in the

environment than the amount arrived from atmospheric deposits. It is now well known that cyanobacteria contribute to nitrogen accumulation in terrestrial and aquatic ecosystems, largely due to their ability to biologically fix atmospheric nitrogen. However, it is not established whether these organisms contribute to maintaining the nitrogen balance in aquatic and terrestrial environments and whether they can be considered as self-regulators of this element. Thus, we present the results of research that highlighted the fact that some nitrogen-fixing cyanobacteria have the property of quantitative self-regulation of nitrogen in terrestrial and aquatic environments and maintaining its balance. In order to establish and verify the mentioned hypothesis, experiments were carried out in laboratory conditions (on a nitrogen-free liquid nutrient medium) and on the ground (in greenhouse conditions when growing crops and in open fields on agricultural land). During the experiments, the cyanobacteria strains Nostoc gelatinosum Schousboe ex Bornet & Flahault, Nostoc flagelliforme Harvey ex Molinari, Calvo-Pérez & Guiry and Nostoc punctiforme Hariot were trained. During the experiments, the quantitative changes in the forms of nitrogen in the soil, water and the amount of nitrogen fixed and eliminated by the cyanobacterial population were monitored. As a result of the experiments they established that the amount of NH4+ ions in the nutrient environments for the cultivation of cyanobacteria showed oscillations characterized by increases in concentration (up to maximum values of 3,3-3,9 mg/l) followed by decreases (up to 0,4-0,5 mg/l) and vice versa. Respectively, we find that the tested cyanobacteria have the property both to fix atmospheric nitrogen in the form of ammonium ions, within the limits of what is needed by the algal population, and to consume them, in the event that there is a surplus in the nutrient environment. Nitrate ions accumulated in the nutrient medium up to a certain limit after which they were consumed by the cyanobacterial population, a process that was repeated continuously. During the experiments, no nitrite ions were detected in the nutrient environment. This fact indicates that cyanobacteria can quantitatively regulate nitrogen in the aqueous environment and maintain it within the necessary limits. The analysis of the changes in atmospheric nitrogen fixed and removed in the nutrient environment for cultivating the researched cyanobacteria clearly shows the tendency of its fixation and consumption. This property is common to all researched cyanobacteria, but the period of its manifestation differs depending on the species. The same oscillations, characterized by the elimination of atmospheric nitrogen and its consumption, can also be seen in the case of the nitrogen eliminated in the nutrient environment for the cultivation of

cyanobacteria. The results of research carried out under greenhouse conditions, when administering the biomass of cyanobacteria investigated in the cultivation of tomatoes and cucumbers, highlighted the same legitimacy. The amount of atmospheric nitrogen accumulated in the soil differs depending on the administered species, the cultivated plants and the period of administration, but it is certain that they fix nitrogen up to a certain amount (which varies according to several factors) after which, if this amount is sufficient for the ecosystem, its consumption mechanism is triggered, and if it is deficient, nitrogen from the atmosphere is fixed. To verify if the identified legitimacy functions under open conditions, the biomass of experimented cyanobacteria was applied during the cultivation of sunflowers in an open field. The obtained results allow us to observe that the same principle of "quantitative self-regulation of nitrogen in the soil" performed by the experimented nitrogen-fixing cyanobacteria is respected, as well as the maintenance of nitrogen balance in the soil ecosystem. In the context of the mentioned, we can conclude that the nitrogen-fixing cyanobacteria N. gelatinosum, N. flagelliforme and N. punctiforme have the property of quantitative self-regulation of nitrogen in soil and water and probably have a primary role in ensuring the edaphic and aquatic climax.