Some Factors affecting salinity stress On some soil algae

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HANAN ABD-ALLAH SAID
B.Sc. in Botany

Supervised by

Dr.Refaat Mohamed Ali
Assit. Prof.of plant physiology
Botany Department. Faculty Of Science,
Cairo University, Fayoum Branch

Dr.Mahmoud Hafez Mahmoud
Assist.Prof.of phycology
Botany Department - Faculty Of Science
Fayoum Branch

Dr.Fatma El Zahraa Tawfic
Assist.Prof.of phycology
Bot.Dep. Fac. Of Sc. Cairo University

Cairo university
Faculty of Science-Botany Department
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SUMMARY

Salinity still remains one of the world's most serious environmental problems. Water stress induced by salinity in general could be regarded as one of the major environmental factors that exert considerable alternations on plant growth and metabolism. Soil salinity is a condition that results from the accumulation of soluble salts in the soil. The response of soil algae to salt accumulation in saline soils represents one of the most challenging problems for algoligists. Organisms are not just slaves to physical environment; they adapt themselves and modify according to changes in the physical environment so as to mitigate the stress effects of environmental factors.

To overcome the problems arised from salinity stress on plant growth intensive efforts have been directed by many investigators towards developing techniques that could mitigate the drastic effects of water stress on plants. The interactive treatments of water stress and vitamins is one of the techniques recommended in alleviating the adverse effects of water stress on plant growth.

So, in this investigation, the changes that might take place in growth and some related physiological activities of two soil unicellular non motile green algae, namely Chlorella vulgaris (Beijer) and Chlorococcum humicola (Nag.) after being subjected to the following treatments, salt stress, addition of vitamins (ascorbic acid and riboflavin) or KNO3, and to combination of both. A field work was also carried out to study the frequency and existence of algal taxa inhabiting three selected different ecological soil sites along Fayoum Governorate together with the chemical analysis of these soils.

Therefore, the work could be divided into three parts:

Part one:

Is concerned with field work and the results obtained could be summarized as follows:

1- The algal biomass and distribution could be mainly correlated to alternations in soil type.

2- The pH values of the investigated soil samples were generally on the alkaline side during the study period.

3. During the whole investigation, the maximum value of organic carbon was recorded at site III in spring and autumn while minimum value at site I in winter.

4- The exchangeable cations in the investigated soil samples had the

following order Ca+2> Mg+> K+> Na+.

5. The three most abundant groups of soil algae at all the sites surveyed

Were Chlorophyta, Bacillariophyta and Cyanophyta.

6- Euglenophyta were recorded only in the soil samples collected from

station III during all the seasons.

7- Twenty eight genera (42 species) of algae were isolated from the three various soil samples throughout the investigation periods. Out of these: seven genera (10 species) belong to Chlorophyta, eleven genera (14 species) to Cyanophyta, eight genera (16 species) to Bacillariophyta and two genera (2 species) to Euglenophyta.

8- Among the predominate genera of green algae throughout the

investigation period were Chlorella vulgaris and Chlorococcum humicola.

Part two:

The experiments of this part were carried out mainly to study the effect of variable salinization, vitamins (ascorbic acid or riboflavin) or KNO3 on growth parameters (optical density, cell number, relative growth rate, generation time, mean growth rate and number of recycling) of Chlorella vulgaris and Chlorococcum humicola. All the experiments carried out in this part were cultured for 14 days and the growth parameters were measured daily. The results obtained could be summarized as follows:

1- Values of growth parameters for Chlorella vulgaris were generally stimulated at lower and moderate levels of salinization, while for Chlorococcum humicola these values were generally lowered by increasing salinity level.

2- Chlorella vulgaris is considered to be an euryhaline organism.

3- The application of ascorbic acid or riboflavin led to a significant increase in the level of growth parameters for both tested algae.

4. Increase fertility of culture medium with different concentrations of KNO_3 caused promotion in the growth parameters of both organisms.

5- The degree of stimulation due to vitamin or KNO_3 additives differed

according to the type and concentration of the additive used, the type of the organism tested and duration of culture period.

Part three:

This part was conducted to study the effect of some exogenously added vitamin (ascorbic acid and riboflavin) or KNO_3 on variously salinized Chlorella vulgaris and Chlorococcum humicola. It was in to test whether these mentioned exogenous

additives can count adverse effects of salinity on growth parameters, synth photosynthetic pigment and on the contents of some metabolites namely, carbohydrate, proteins, proline and other free amino acids. However, all the experiments of this part were conducted for 7 days after which the analyses of these parameters were measured. The results obtained could be summarized as follows:

1- Application of the two vitamins (ascorbic acid or riboflavin) or KNO_3, led to a significant increase in the values of growth parameters at low and moderate salt stressed Chlorella vulgaris and Chlorococcum humicola cells and the adverse effects of high levels of salinity, in some cases, were partially alleviated when compared to the reference control.

2- Ascorbic acid in most cases was more effective in alleviating the stress effects of salinization than riboflavin and KNO_3 was the less effective than both vitamins.

3- The interactive effects of salinity and vitamins of KNO_3 on the growth parameters of both Chlorella vulgaris and Chlorococcum humicola depend mainly on the degree of salinization, type of the organism tested, the type and concentration of exogenous additives and duration of the culture period.

4- The biosynthesis of the photosynthetic pigment fractions (chlorophyll a chlorophyll b and carotenoids) were markedly lowered with the rise of NaCl concentration as compared with the unsalinized cells.

5. Vitamins or KNO_3 treatments, in most cases, did not only alleviate the inhibitory effect of NaCl salinization on the biosynthesis of photosynthetic pigments, but also induced a significant stimulatory effect greater than that estimated in control plants, a response which may contribute directly to the

effectiveness of photosynthetic apparatus and in some way can alter plant Productivity.

6- Considerable decrease in the contents of carbohydrate fractions in the test algal organism was induced by salinity stress. However, a gradual decrease in the content of insoluble sugar fraction and a gradual increase in the contents of soluble one by increasing salinization level was recorded in both tested organisms.

7- Vitamins or KNO_3 treatments exhibited a general increase in the contents of soluble, insoluhl and consequently total carbohydrates whatever the organism analyzed.

8- Raising NaCl, level was reflected in lowering the contents of protein fractions irrespective of the organism tested. Vitamins or KNO_3 treatments partially or completely alleviated the inhibitory effects of salinity on the accumulation of protein fractions in both tested organisms.

9- Raising NaCl, level forced the tested organisms to synthesis proline and other free amino acids. However, treatments of both organisms with vitamins or KNO3 considerably lowered the contents of proline and other free amino acids, a response which was, generally, accompanied by the biosynthesis of proteins and inhibition of protein dissimilation.

The overall experiments conducted in this work should be tried in the field to test on a large scale and normal environments, whether these positive results of exogenously applied vitamins or inorganic nitrogen can increase the productivity of algal communities under normal conditions and can also mitigate the adverse effects of soil salinity on algal biomass since these exogenous additives are water-soluble and environmentally safe.