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Structure of edaphic algoflora on agricultural land cultivated with vineyards and orchards in the southern districts of the Republic of Moldova

Eugeniu Ciobanu

Abstract. This article addresses the problem related to edaphic algoflora characteristic of vineyards and orchards in the southern districts of the Republic of Moldova. On the basis of the taxonomic structure of some dominant species of algae we can determine the accumulation capacity of nutrients in the soil and, respectively, fertility, due to the fact that algae, due to the metabolic processes, eliminate in the environment a number of bioactive substances, which stimulate the development of crop plants. Thus, the study of edaphic algoflora on agricultural lands is of great interest for Agriculture.
Keywords: edaphic algae, algoflora, phylum, class, fertility.

Structura algoflorei edafice pe terenuri agricole cultivate cu vii și livezi din raioanele de sud ale Republicii Moldova

Rezumat. În articolul dat este abordată problema ce ține de algoflora edafică caracteristică viilor și livezilor din raioanele de sud ale Republii Moldova. În baza structurii taxonomice a unor specii dominante de alge putem determina capacitatea de acumulare a elementelor nutritive din sol și respectiv fertilitatea, datorită faptului că algele în urma proceselor metabolice eleimină în mediul înconjorător un șir de substanțe bioactive, care stimulează dezvoltarea plantelor de cultură. Astfel, studierea algoflorei edafice de pe terenurile agricole prezintă un interes mare pentru agricultură.
Cuvinte cheie: alge edafice, algoflură, filum, clasă, fertilitate.

1. Introduction

Algae represent a good part of the edaphic microorganisms that multilaterally influence different processes occurring in soil, contributing directly or indirectly to the modification of its physicochemical properties [1].

A very important partcularity of the soil biota is represented by edaphic algae, being some of the most representative indicator organizations of the environmental state. Based on the taxonomic structure and the number of dominant species, we can appreciate the soil ability to naturally accumulate nutrients that makes it possible to determine soil fertility [2]. Algae also play a special role in soil self-cleaning, rain prevention and wind

erosion [3]. Some cyanobacteria have the ability to fix atmospheric nitrogen in the soil, mobilize many chemical elements, depolute soils polluted with herbicides, insecticides, etc., thus contributing to the increase of crops [8]. In addition, algae that do not have the capacity to fix atmospheric nitrogen include in their biomass an important amount of biologically active substances which, after the decomposition of algal biomass, get into the soil and play an important role in the efficient development of pedogenetic processes with a stimulating effect on vegetation [4].

The development and spread of algae in soils depends not only on climatic factors such as temperature, humidity, lighting level, etc.and the work done on it. Rational soil processing increases its fertility and activates biological processes, contributing to the creation of favorable conditions for the entire soil biota [6]. Selectively absorbing salts, algae contribute to the biogenic distribution of elements in the soil [5].

According to literature data, the role of algae in the soil formation process is more commonly analyzed at the early stages of pedogenesis. Thus, algae are assigned the role of the main source of organic matter necessary for microbial functioning. The latest research has shown that along with the pedogenetic evolution of soil, the role of algae in it also increases. Thus, the direct participation of algae in the biochemical and physical processes in soil was demonstrated as: accumulation of organic substances and fixation of atmospheric nitrogen, primary and secondary decomposition of minerals and accumulation of biophilic elements and aggregates[11].

In the process of soil recultivation there is an increase in the number and diversity of bacteria, actinomycetes and other organisms as well as edaphic algae in the soil. At the same time, other physicochemical processes caused by algae are established, such as their contribution to the modification of gas and water regimes in the soil [6].

2. Materials and methods

Research in the field of algae distribution in different soil types occupied with various agricultural crops was carried out based on soil samples collected from Cimişlia district. The collection of samples and their analysis was carried out according to the methods widely applied in edaphic Algology. The analyzed soil samples represent a mixed soil sample consisting of 10 individual samples with a volume of 5 cm^3 each, collected from an area equal to 100 m^2. The distance between individual samples was not less than 5 m. The collected soil was stored in a pre-sterilized “Craft” hard paper package, after which they were transported to the laboratory and inoculated in Petri dishes with glass blades, where in the laboratory conditions were created for the growth and development of algae from the samples under study[7;9]. The species were determined according to

derminators "Определитель пресноводных водорослей" вып. 1-14; "Визначник прісноводных водоростей УССР" (1968б 1976б 1979б 1984); " Определитель протококковых водорослей Средней Азии" (1979а,б); В. М. Андреева " Род Chlorella" (1975) A. Pascher "Die Susswaserflora Deutschlands", Osterreichs und der Schweiz (1914, 1915, 1925); H. Ettl "Susswasserflora von Mitteleuropa" (1978); K. Starmach "Flora sladkovodna Polski" (1963, 1966, 1968, 1971); H. Skuja "Taxonomiedes phytoplanctons einige Seen in Uppland, Schweden" (1948); F Hindak "Studies the chlorococcal alga (Chlorococcophyceae)" (1980, 1984, 1988);.... Bold "Phycological studies" The university of Texas publication v. 5, v.6, v.7, v.8, v.9, v.10, v.11 (1964, 1966 a,b, 1969 a,b, 1970a,b.

3. Results and discussion

The investigations carried out open up great perspectives for the use of edaphic algae as biological indicators of the state of soil, in part, and of the environment, in whole [10]. The information regarding the peculiarities of distribution and formation of algal communities depending on the nature of biological and ecological peculiarities of crop plants allows us with a higher probability to assume the presence of certain species of algae in these soils. This greatly facilitates the process of selecting some strains of algae as biotechnological objects.

As a result of the research of soil samples collected from the orchards in Cimişlia Ciucur Minjir village there were highlighted 83 species and varieties of algae that refer to 37 genera, 23 families, 9 orders that refer to four phylums: Cyanophyta – 33, Xanthophyta – 23, Chlorophyta – 21, Bacillariophyta – 6 (tab. 1; fig 1).

Table 1. Taxonomic structure of edaphic algae communities in the soils occupied with orchards

Phylum	Cyanophyta	Xanthophyta	Chlorophyta	Bacillariophyta	Total
Order	2	3	3	1	9
Families	5	7	8	3	23
Generas	9	13	12	3	37
Species	33	23	21	6	83

Following the analysis of soil samples collected from the areas occupied by vineyards in Cimislia Ciucur Minjir village, 42 species and varieties of edaphic algae from 25 genera, 18 families and 9 orders referring to four phylums were highlighted: Cyanophyta – 10, Xanthophyta – 16, Chlorophyta – 13, Bacillariophyta – 3 (tab. 2; fig. 2).

Table 2. Taxonomic structure of edaphic algae communities in soils occupied with vineyards

Phylum	Cyanophyta	Xanthophyta	Chlorophyta	Bacillariophyta	Total
Order	2	3	3	1	9
Families	3	7	6	2	18
Generas	5	10	8	2	25
Species	10	16	13	3	42

Following the analysis of the data obtained from the samples collected in the fields occupied by orchards, 83 species of algae were identified, of which cyanophytes - 33, xanthophytes - 23, chlorophytes - 21, bacillariophytes - 6. It has been established that the dominant species belong to the first three phylums. They actively participate in the process of pedogenesis, as well as nitrogen fixation and accumulation of microelements in the soil.

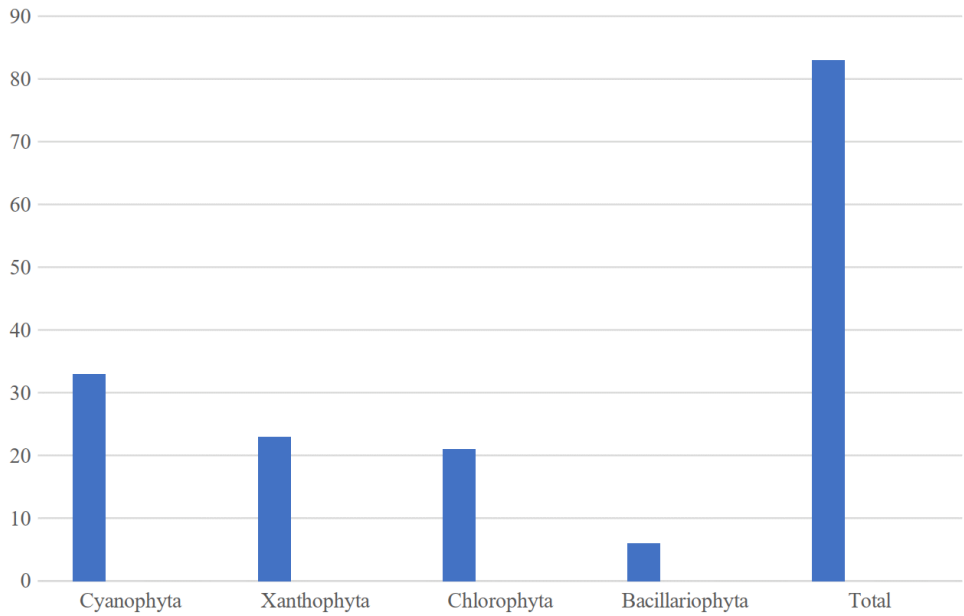

Figure 1. Numerical distribution of edaphic algae species in the ecosystem planted with orchards

The most abundant species of those identified are: *Nostoc pruniforme Born. et Flah., Anabaena variabilis Kütz., Oscillatoria brevis Kütz. ex Gom. Phormidium ambiguum Gom. ex Gom., Phormidium tenue (Ag. ex Gom.) Anagn. et Kom., Nostoc commune*

f. sphaericum (Vauch.) Elenk., Gloeocapsa magma (Bréb.) Kütz., *Phormidium terebriforme (Ag. ex Gom.) Anagn. et Kom., Oscillatoria chalybea Mert. ex Gom.* from cyanophytes, *Chlorococcum infusionum (Schrank) Menegh* from chlorophytes , *Chloridella feruginosum Pasch* from xantophytes *Hantzschia amphioxys (Ehrb.) Grun. in Cl. et Grun.* from bacillariophytes.

The fields cultivated with vineyards are very poor in algae species, here being identified only 42 species of which cyanophytes - 10, xanthophytes - 16, chlorophytes - 13, bacillariophytes-3; dominant being those of the first three phylums.

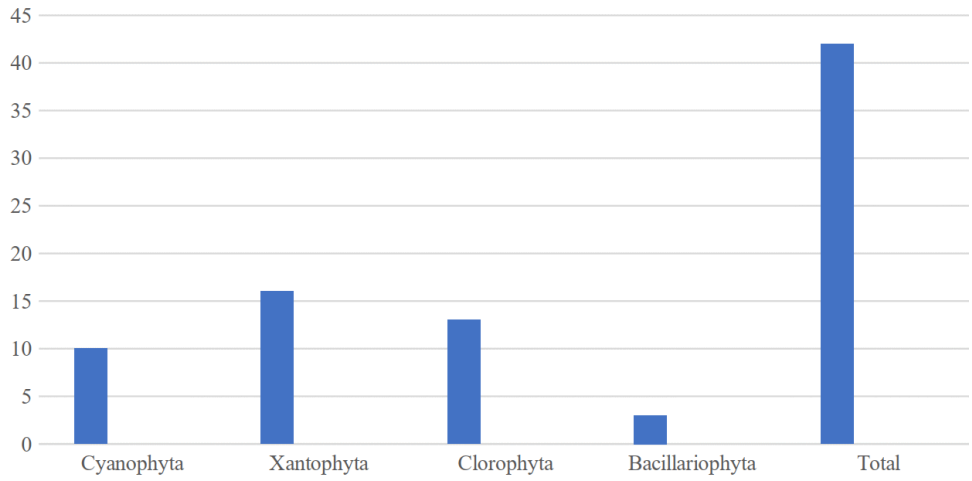

Figure 2. Numerical distribution of edaphic algae species in the ecosystem planted with vineyards

The most frequently encountered species of those identified are: *Phormidium ambiguum, Phormidium tenue, Gleocapsa minor, Gleocapsa magma* from cyanophytes, *Chloorococum infusionum, Chloorococum gelatinosum* from chlorophytes, *Chloridella feruginosum, Chloridella simplex Pasch* from chlorophytes, *Hantzschia amphioxis* from bacillariophytes.

4. Conclusions

Generalizing the presented data, we can identify the taxonomic structure of edaphic algoflora and the principles of algoflora formation in vineyards and orchards. Analyzing the data from Table 1 and Table 2, we identify four dominant phylums: Cyanophyta, Xanthophyta, Chlorophyta and Bacillariophyta of which the most numerous are the algae from the first three phylums. However, the results show a smaller number of species

compared to the cultivated lands with annual or biennial crops due to the specific conditions that are formed in these habitats. On the fields cultivated with vineyards algoflora is very poor due to their processing with copper sulfate (bordolese juice) which also has a negative effect on algae. However, we can identify genera and species of algae that are specific to vineyards and orchards, and may have application in biotechnology.

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(Ciobanu Eugeniu) "Ion Creangă" State Pedagogical University of Chișinău, Republic of Moldova