

TAXONOMIC AND ECOLOGICAL STRUCTURE OF THE EDAPHIC ALGAE FLORA FROM CERTAIN AGROCENOSSES OF THE REPUBLIC OF MOLDOVA

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The most part of territory of the Republic Moldova is covered by agro-ecosystems in which the algae play a fundamental role as they are considered indicators of soil quality. Soil samples were taken from different regions of the country on which are cultivated wheat, rape, potatoes and chick-pea and were analyzed within the Scientific Research Laboratory „Algaeology”, of the State University of Moldova during 2007 – 2010. All in all, in the taken samples there were found 100 species and intraspecific varieties: *Cyanophyta* – 82 species, *Bacillariophyta* – 8, *Xanthophyta* – 3, *Euglenophyta* – 2, *Chlorophyta* – 5. The richest diversity was found in the soils cultivated with wheat - 42 species and intra-specific varieties.

Keywords: *algae flora, agro-ecosystems, cereal crops, ecological groups, eco-bimorphs.*

STRUCTURA TAXONOMICĂ ȘI ECOLOGICĂ A ALGOFLOREI EDAFICE DIN UNELE AGROCENOZE DIN REPUBLICA MOLDOVA

În Republica Moldova cea mai mare parte din teritoriu este ocupată de agroecosisteme, în care algele joacă un rol primordial în calitate de indicatori ai calității solului. Studiul algelor ca parte componentă a oricărui tip de sol și vegetație are o însemnătate atât teoretică, cât și practică. Releveele de sol au fost colectate pe parcursul anilor 2007–2010 din diferite regiuni ale țării pe care se cultivă grâu, rapiță, cartof și năut și analizate în laboratorul „Algologie” al USM. În total, în aceste probe au fost evidențiate 100 de specii și varietăți intraspecifice: *Cyanophyta* – 82 specii, *Bacillariophyta* – 8, *Xanthophyta* – 3, *Euglenophyta* – 2, *Chlorophyta* – 5 specii. Cea mai mare diversitate a fost depistată în solurile ocupate de cultura de grâu – 42 de specii și varietăți intraspecifice.

Cuvinte-cheie: *algofloră, agroecosisteme, culturi agricole, grupe ecologice, ecobiomorfe.*

Introduction

The edaphic algae represent an important component of the agrophytocenoses with a particular role for biological processes from the soil. Certain species have the capacity to fix the atmospheric nitrogen and in such a way it stimulates soil fertility [14]. The algae is an erosion-preventive barrier [11] participating to energy and material flow in the soil [2] and represent a feed source for animal edaphic organisms [6]. The active biological compounds produced by algae can positively influence the activity of the microorganisms from the soil and of the vascular plants [4].

The edaphic algae communities are less analyzed as compared to the aquatic algae flora. Research of the edaphic algae flora demonstrates the fact that the most different algae communities are those from the cultivated soils with different cereal crops [15].

The goal of the present research is to study the algae taxonomic structure and vital forms from the agro-ecosystems cultivated with different cereal crops.

Materials and methods

In order to achieve the goal of the present research there were examined the agricultural fields cultivated with wheat (autumn and spring), rape, potatoes and chick-pea from different localities (Briceni town, Râșcani town, Balasinești village, Cimișlia town, Gradiște village, Bogdanovca village and Ermoclia village). The soil samples were processed and analyzed during 2007 – 2010 within the Scientific Research Laboratory „Algaeology”, of the State University of Moldova according to the methodology used for research of the edaphic algae flora. The taxonomic affiliation of the algae was performed with the help of Kruss microscope and the catalogue for determining the species [7,8,9,10,12,13].

Results and discussions

The samples collected according to the laboratory cultivation method were found 100 of species and intraspecific varieties of edaphic algae out of which predominate the representatives of the *Cyanophyta* phylum and namely species from *Oscillatoriaceae* family. The most frequent found species were *Phormidium foveolarum*, *Phormidium sp.*, *Ph. angustisimus*, *Lyngbya sp.* etc.

Generally, the ecological structure of the algae communities from the analyzed cultivated fields is formed of ecological groups of algae.

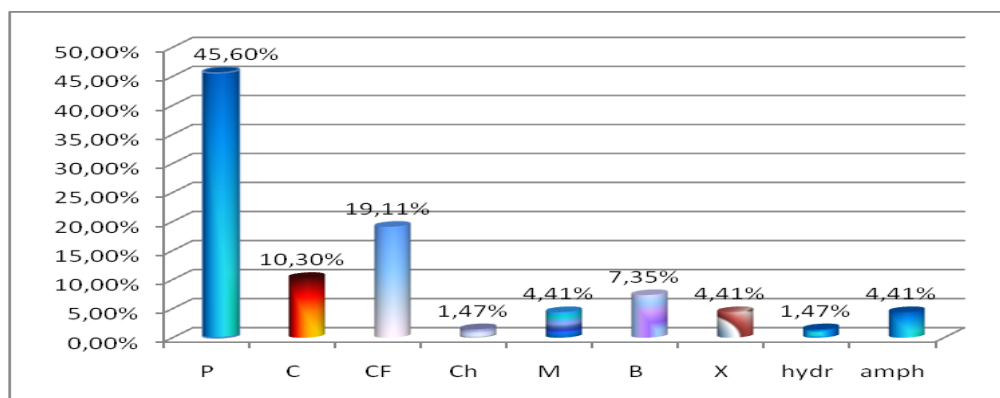


Fig.1. Ecological structure of the algae communities from different Agroecosystems.

As it can be noticed from fig. 1, most of the species are of the vital form **P** – 45,6%. To this group belong filamentous cyanophyta resistant to unfavorable environment factors, inclusively anthropic ones and mainly species from the genders *Phormidium*, *Oscillatoria*, *Lyngbya*. On the second place are species of the subgroup **CF** – 19, 11%, representing nitrogen fixing algae from genders *Nostoc*, *Cylindrospermum*, *Anabaena*. A less important role within these communities play ecobiomorphs algae from groups **Ch** and **hydrophilic** that were met episodically.

The most diversified algae species was found in the soils cultivated with autumn and spring wheat.

According to chart no.1, within these agrophytocenosis predominate the representatives of *Cyanophyta* phylum, with 37 species belonging to 3 classes, 4 orders, 6 families and 10 genders out of which a more abundant development is characteristic to species from *Oscillatoriales* and *Nostocales* orders. This high diversity of taxons is attained mostly due to the genders *Phormidium* represented by 12 species, gender *Nostoc* by 6 species and *Oscillatoria* represented by 4 species. The most spread species within taken soil samples were *Phormidium faveolarum* and *Phormidium sp.*, found in all analyzed samples. The species of the *Phormidium* gender formed a crust on the soil inhibiting in such a way development of the other algae taxons and because of this the specific diversity is reduced.

Chart 1

Taxonomic structure of the edaphic algae communities from wheat phytocenoses

Phylums	Classes	Orders	Families	Genders	Species
<i>Cyanophyta</i>	3	4	6	10	37
<i>Bacillaryophyta</i>	2	2	2	2	2
<i>Xanthophyta</i>	1	1	2	3	3
Total	6	7	10	15	42

The *Bacillaryophyta* phylum in the soils cultivated with wheat is represented by two species: *Hantzschia amphioxys* and *Cyclotella meneghiniana*. Though these diatom algae have an insignificant role in creation of the algaecenoses from the agro-ecosystems, these are biological indicators of the soil condition. So, *Hantzschia amphioxys* indicates high pollution and was practically found in all analyzed wheat agro-fitocenoses, *Cyclotella meneghiniana* was found only in the soils from the Northern part of the country and also indicates a high anthropogenic pollution. It can be mentioned that in the Northern region of the country the soils are organically more polluted.

In the samples subject to analysis were identified 3 xanthophyta species found quite seldom, these belonging to 3 genders, 2 families, one order and one class.

According to the eco-biomorphs among the wheat fields algaecenoses predominates algae from group **P** (21 species) – representing the filamentous cyanophyta which prefer salty soils. This fact proves high mineralization of the soils in the regions subject to researches. These are followed by nitrogen fixing algae

from group CF - 10 species. These species play a fundamental role for natural fertility of the soil due to their capacity to fix the atmospheric nitrogen.

Certain nitrogen fixing species as for example *Cylindrospermum licheniforme* var. *alatosporum*, *Anabaena propinqua*, *Nostoc gelatinosum* were selected in pure cultures and involved in laboratory conditions in different experiences to develop their importance over the soil fertility enhancement [1,3,5].

In the soils cultivated with potatoes was found a reduced diversity of the algae (27 species). And in this case, too, a major dominance is attributed to cyanophyta algae – 21 species (chart 2.). Representatively for these soils are species from genders *Phormidium*, *Lyngbya*, *Oscillatoria*, *Nostoc*, *Anabaena* and *Cylindrospermum*. The common point between the taxonomic structure of the fields cultivated with wheat and potatoes consists in the high development of the species from *Oscillatoriales* order.

Chart 2

Taxonic structure of the edaphic algae communities from fields cultivated with potatoes

Phylums	Classes	Orders	Families	Genders	Species
<i>Cyanophyta</i>	1	2	3	6	21
<i>Bacillaryophyta</i>	1	2	2	3	3
<i>Chlorophyta</i>	1	1	2	2	2
<i>Euglenophyta</i>	1	1	1	1	1
Total	4	6	8	12	27

Also, there were identified 3 species of diatoms – *Navicula perpusila*, *Hantzschia amphioxys* and *Nitzschia sp.*, and two species of green algae – *Tetraedron incus*, *Scenedesmus obtusum*. The *Euglenophyta* phylum is represented by a single species from gender *Trachelomonas*.

As in the case of the soils cultivated with wheat, in these agrofitocinoses have predominated algae with life form P – 63% out of the total number of species found in these soils.

The taxonomic structure of the edaphic algae communities from soils cultivated with rape consists of 6 classes, 8 orders, 10 families, 13 genders and respectively 16 species (chart 3). Most of the mentioned species belong to the *Cyanophyta* kingdom (11 species), followed by two species of diatom and chlorophyta and one species of euglena. In comparison to the fields cultivated with wheat and potatoes, in the soils cultivated with rape has developed abundantly the euglena species (*Euglena viridis*) which have created here and there green clusters. At the same time in these soils also develop abundantly species of *Phormidium* gender.

Chart 3

Taxonic structure of the edaphic algae communities from the rape agrofitocinoses

Phylums	Classes	Orders	Families	Genders	Species
<i>Cyanophyta</i>	2	3	6	8	11
<i>Bacillaryophyta</i>	1	1	1	2	2
<i>Chlorophyta</i>	2	2	2	2	2
<i>Euglenophyta</i>	1	1	1	1	1
Total	6	7	10	13	16

Soils cultivated with chick-pea are also characterized by a poor taxonomic diversity. The taxonomic structure is represented by 15 species, belonging to 4 classes, 4 orders, 6 families and 8 genders (chart 4). The diversity picture of the algae in these soils is as follows: *Cyanophyta* phylum – 13 species and intraspecific varieties, followed by a single species from *Bacillaryophyta* phylum (*Hantzschia amphioxys*) and from the *Chlorophyta* kingdom. We would like to point out that the *Scenedesmus obliquus* species was frequently found in these soils.

Chart 4

Taxonic structure of the edaphic algae communities from the chick-pea agrofitocinoses

Phylums	Classes	Orders	Families	Genders	Species
<i>Cyanophyta</i>	1	2	4	6	13
<i>Bacillaryophyta</i>	1	1	1	1	1
<i>Chlorophyta</i>	1	1	1	1	1
Total	3	4	6	8	15

In the soils cultivated with rape and chick-pea predominates algae from ecobiomorph **P** – 5 and respectively 9 species. A secondary role in these communities play **hydrophilic** and **amphibian** species.

The list of edaphic algae detected in studied agro-phytocenosis: *Synechocystis parvula* Perf., *Dactylococcopsis* sp., *Microcystis* sp., *Gloeocapsa magna* (Bréb.) Kütz., *Gloeocapsa rupestris* Kütz., *Gl. chroococcoides* Novaček., *Gl. lithophila* (Erceg.) Hallerb., *Gl. crepidinum* Thur., *Gloeocapsa* sp., *Pleurocapsa minor* Hansg. emend. Geitl., *Nostoc Linkia* (Roth.) Born. et Flah., *N. linkia* f. *piscinale* (Kütz.) Elenk., *N. Linkia* f. *muscorum* (Ag.) Elenk., *N. sphaericum* Vauch., *N. coeruleum* (Lyngb.) Elenk., *N. commune* Vauch., *N. gelatinosum* (Schousb.) Elenk., *Nostoc* sp., *Anabaena* sp., *A. variabilis* Kütz., *A. contorta* Bachm., *A. propinqua* Scatchell. et Gardn., *A. circinalis* (Kütz.) Hansg., *Cylindrospermum licheniforme* (Bory.) Kütz., *C. licheniforme* f. *alatosporum* Kondrat., *Cylindrospermum* sp., *Anabaenopsis raciborskii* Wołosz., *A. arnoldii* Aptek., *Anabaenopsis* sp., *Oscillatoria brevis* (Kütz.) Gom., *O. lacustris* (Kleb.) Geitl., *O. chlorina* (Kütz.) Gom., *O. planctonica* Wołosz., *O. granulata* Gardner., *O. pseudogeminata* G. Schmid., *O. amoena* (Kütz.) Gom., *O. chalybea* (Mert.) Gom., *O. formosa* Bory., *O. animalis* Ag., *O. splendida* Grev., *O. Boryana* (Ag.) Bory., *Phormidium Paulsenianum* B. - Peters., *Ph. frigidum* F.E. Fritsch., *Ph. foveolarum* (Mont.) Gom., *Ph. tenue* (Menegh.) Gom., *Ph. angustissimum* W. et. G.S. West., *Ph. molle* (Kütz.) Gom., *Ph. ambiguum* Gom., *Ph. fragile* (Menegh.) Gom., *Ph. Henningsii* Lemm., *Ph. Bohneri* Schmidle., *Ph. subfuscum* (Ag.) Kütz., *Ph. dimorphum* Lemm., *Ph. crustaceum* Woronich., *Ph. inundatum* Kütz., *Ph. Jadinianum* Gom., *Ph. Woronichinianum* (Woronich.) Elenk., *Ph. pavlovskoënsë* Elenk., *Ph. corium* (Ag.) Gom., *Ph. bijugatum* Kongiss., *Ph. uncinatum* (Ag.) Gom., *Ph. autumnale* (Ag.) Gom., *Ph. subcapitatum* B. - Peters., *Ph. papyraceum* (Ag.) Gom., *Ph. viride* (Vauch.) Lemm., *Phormidium* sp., *Symploca muscorum* (Ag.) Gom., *Lyngbya Diguetii* Gom., *L. lutea* (Ag.) Gom., *L. Lagerhemii* (Möb.) Gom., *L. lagerhemii* f. *edaphica* (Hollerb.) Elenk., *L. intermedia* Gardn., *L. aerugineo-coerulea* (Kütz.) Gom., *L. Martensiana* Menegh., *L. attenuata* F.E. Fritsch., *Lyngbya* sp., *Schizothrix* sp., *Schizothrix lacustris* A.Br., *Sch. fragilis* (Kütz.) Gom., *Plectonema tenue* Thur., *Pl. notatum* Schmidle., *Plectonema* sp., *Cyclotella meneghiniana* Kütz., *Achnanthes conspicua* A. Mayer., *Navicula perpusilla* Grun., *N. pupula* Kütz., *N. rhynchocephala* Kütz., *Hantzschia amphioxys* (Ehr.) Grun., *Nitzschia dubia* W. Sm., *Nitzschia* sp., *Trachelomonas* sp., *Euglena viridis* Perty., *Chlamydomonas Reinhardii* Dang., *Tetraedron incus* (Teil.) G.M. Smith., *Scenedesmus obliquus* (Turp.) Kütz., *Sc. obtusus* Meyen., *Scenedesmus* sp., *Pleurochloris pyrenoidosa* Pasch., *Botryochloris minima* Pasch., *Chlorellidium tetrabotrys* Visch. et Pasch.

Conclusions

As a result of the performed research we may conclude the following:

- In the fields subject to analyses were found 100 species of edaphic algae out of which is to be mentioned *Cyanophyta* – with 82 species, *Bacillariophyta* – 8 species, *Xanthophyta* – 3 species, *Euglenophyta* – 2 species and *Chlorophyta* – with 5 species.
- The biggest algae diversity was found in the soils cultivated with wheat (autumn and spring) - 42 species and intraspecific varieties of edaphic algae belonging to three phylums: *Cyanophyta* – 37, *Bacillariophyta* - 2, *Xanthophyta* – 3. According to the numeric diversity of species, from cyanophyta predominates gender *Phormidium* - 12 taxons, followed by gender *Nostoc* – 6.
- In the soil samples from fields cultivated with rape were found 16 algae taxons where the most abundant and dominant species of algae are also those from genders *Phormidium*, *Nostoc*, *Cylindrospermum*, which are largely nitrogen fixing.
- In the soils samples from fields cultivated with potatoes were found 27 species and intraspecific varieties of algae. Most active from the algae community of this type of culture are cyanophyta algae with predomination of the species from the *Oscillatoriaceae* family and largely, representatives from gender *Phormidium*. Chlorophyta, diatoms, euglenophyta variety is quite reduced.
- In the soils cultivated with chick-pea were found 15 species where predominate cyanophyta like in the previous soils.

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