STUDY INTERACTION OF PLANTS AND FUNGI IN DRAINED BED OF ARAL SEA IN KAZAKHSTAN

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ИЗУЧЕНИЕ ОТНОШЕНИЙ РАСТЕНИЙ И ГРИБОВ НА ОСУШЕННОМ ДНЕ АРАЛЬСКОГО МОРЯ В КАЗАХСТАНЕ

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В статье представлены результаты исследования взаимодействия растений и грибов. Данная работа была проведена впервые в осушенном дна Аральского моря (ОДАМ) в Казахстане. Были взяты образцы почвы, вегетативные части растений и корни в разных горизонтах почвы. Корни и ризосфера обследовали на наличие грибов. Была обнаружена везикулярно-арбускулярная микориза в корневых клетках растений и ризосфере. В почве были определены сапротрофные и патогенные микромицеты. Данное исследование может способствовать улучшению качества мелиоративных работ на ОДАМ.

Over the past 40 years, the level of Aral Sea decreased by 29 meters, the water area reduced more than 5.8 times, the volume of water decreased from 1064 to 80 km^3, the salinity of the water reached 110-112 g/l in the western part, and 280 g/l in the eastern basin. The Aral Sea became almost a lifeless body of water.

The area of the drained bed of the Aral Sea (DBAS) is over 4.0 million ha. Naked sediments in the form of salt marshes and saline moving sands are a source of sand and salt storms that carry salt, dust and sand in a radius of more than 10 thousand km. As a result, the ecosystem of surrounding area was destroyed, more than 200 species of flora and fauna were disappeared, and there was desertification accompanied by decreasing in soil productivity (Baizakov et al., 2007).

In DBAS new natural complexes formed passing successive stages of salinization and desalinization, the formation of lithogenic bases and biotic development. Conducted works on forest melioration does not bring the desired results, and therefore there is a need for more deep study of interactions between plants and fungi in different zones of salinization.

The purpose of this research was the study interaction of plants and fungi in the zone of weak salinization in the DBAS.

The tasks of the research were following:

- study of vegetation and plant root systems;
- analysis for the presence of soil mycobiota in rhizosphere;
- establishing interaction of plants and fungi.

The object of research was the area of the initial drying the sea bottom with weak salinization of soil.

The study phytocenoses we carried out based on the routes and by discount areas sized 40 × 40 meters. We determined species composition by the degree of projective cover of each species, as the total area is 100%. We fixed location (coordinates) of the areas and altitude above sea level by GPS device. We laid one discount area for each position. The composition of vegetation and its status were determined. Collection of herbarium material we carried out according to the methods of A.K. Skvortsov (1977). The identification of host plants we did in accordance to the determinants of N.V. Pavlov (1969) and M.S. Baitenov (1999).

Selection of plant root systems, their conservation, soil sampling and microscopy we conducted according to the methods of I.A. Selivanov (1981). The roots of the vegetation and other elements (except herbarium) we preserved in 4% formalin (Selivanov, 1981). Soil (150-200 g) and roots of plants we sampled from horizons of 0-15, 16-25 and 26-40 cm, in the most root soil layer. Each sample of soil we dried to air-dry condition and placed in a sterile plastic bag, which we labeled and transported to the laboratory. Soil salinity by readily soluble salts we determined by conductometric method based on NaCl, using Anion 7051 device (portable ion meter / conductometer / dissolved-oxygen meter). Identification of mycoflora we carried out by the determinants (Kirilenko, 1977; Litvinov, 1967; Pidoplichko, 1971).

In the area of initial drying the sea bottom, we collected 350 samples of plant vegetative parts, root systems and soil. After that, we conducted laboratory studies of field data. On coastal soils with

inspired sand cover in the zone of already formed cenoses (area of initial drying the sea bottom) we described the most encountered plant species. They are *Haloxylon aphyllum* (Minkw.) Iljin, *Calligonum arborescens* Litv., *Tamarix gracilis* Willd., *Nitraria sibirica* Pall., *Halocnemum strobilaceum* (Pall.) M. Bieb., *Suaeda physophora* Pall., *Karelinia caspia* (Pall.) Less. and *Salsola* sp.

According to the results of preliminary identification in root cells of 12 species of host plants from 7 families (*Poaceae, Chenopodiaceae, Zygophyllaceae, Polygonaceae, Nitrariaceae, Amaranthaceae, Solanacea*) was defined vesicular-arbuscular mycorrhiza (As shown in Figure 1 and Figure 2).

The degree of mycorrhizal infection development among collected and examined samples was 73%, including 18% (*Nitraria sibirica* Pall., *Alhagi kirghisorum* Shrenk, *Stipa richteriana* Kar. & Kir. and *Ammodendron conollyi* Bunge ex Boiss.) with a high degree of mycorrhiza occurrence, 22% (*Halocnemum strobilaceum* (Pall.) M. Bieb., *Suaeda physophora* Pall., *Artemisia terrae-albae* Krasch., Karelinia caspia (Pall.) Less., *Halostachys belangeriana* (Moq.) Botsch., *Peganum harmala* L., *Artemisia leucodes* Schrenk, *Salsola paulsenii* Litv.) with an average degree of mycorrhiza occurrence and 33% (*Haloxylon aphyllum* (Minkw.) Iljin, *Ceratocarpus arenarius* L., *Kochia prostrata* (L). Schrad) with a single occurrence of mycorrhiza.

As a result of the analysis of the rhizosphere there were identified soil micromycete following genera: *Aspergillus* – 23,1%, *Penicillium* – 39,6%, *Alternaria* – 7,3%, *Fusarium* – 30%. We summarized the data in the Table.

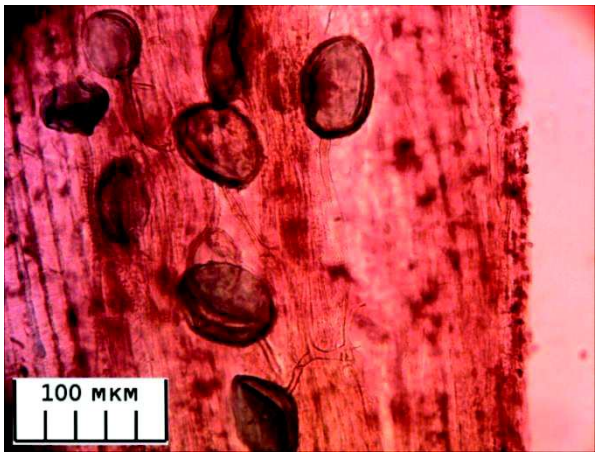

Figure 1. Vesicules in the roots of *Ammodendron conollyi* Bunge ex Boiss. Photo: V. Meshkov

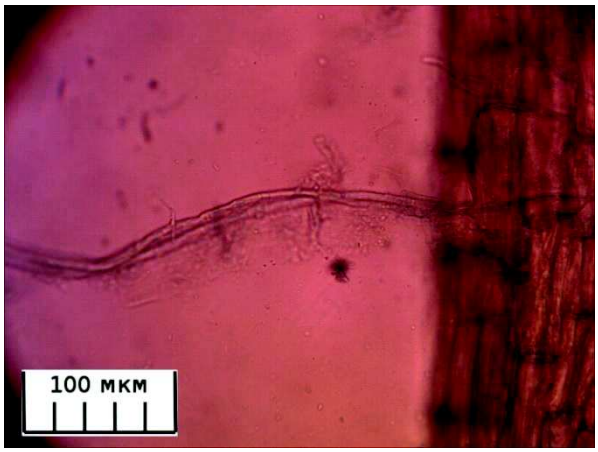

Figure 2. Arbuscules in the roots of *Salsola paulsenii* Litv. are outside of the root. Photo: V. Meshkov

Table – Micromycetes found in the rhizosphere

Class	Order	Family	Genus	Species and % of occurrence in the soil samples
Ascomycetes	*Eurotiales*	*Moniliaaceae*	*Aspergillus*	*Aspergillus fumigatus* 4,6% *Aspergillus sp* 13,8% *Aspergillus nidulans* 3,5% *Aspergillus niger* 1,2%
			Penicillium	*Penicillium* sp – 39,6%
	Pleosporales	*Pleosporales*	*Alternaria*	*Alternaria alternate* – 3,1% *Alternaria* sp – 4,2%
	Hypocreales	*Nectriaceae*	*Fusarium*	*Fusarium* sp – 13,8% *Fusarium incarnatum* 3,1% *Fusarium equiseti* – 8,8% *Fusarium solani* – 2,3% *Fusarium oxysporum* – 2%

Photos of some soil micromycetes incubated on nutrient media are shown in Figure 3 and Figure 4.

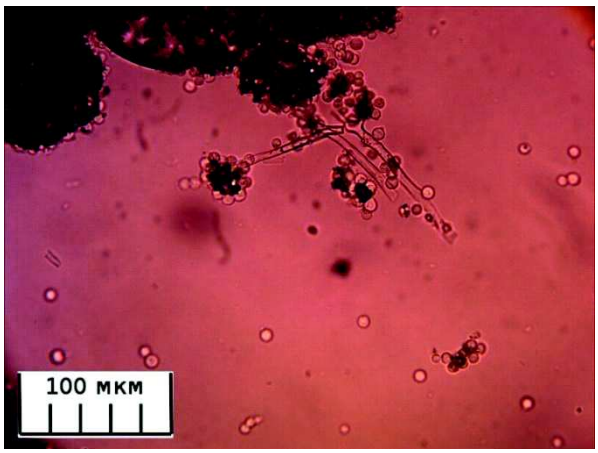

Figure 3. *Aspergilius niger* – soil micromycetes incubated on nutrient media. Photo: V. Meshkov

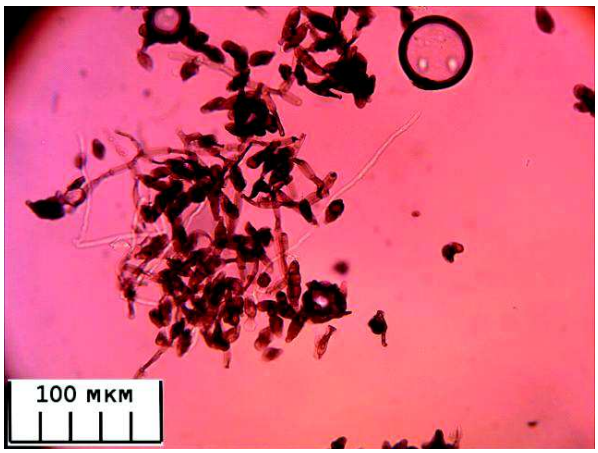

Figure 4. *Alternaria* sp, conidia-branch with broken conidia. Photo: V. Meshkov

The results of this research confirm the existence of mycosimbiotrophism in plant roots in the zone of weak salinization newly formed cenosis in the DBAS.

Further study of these processes continues. There will be received new factual material about the availability, status and dynamics of aboriginal mycobiota on the DBAS. Interaction of fungi and plants in the process of DBAS overgrowing will also be determined. This can contribute to enhancing of knowledge about the consort relationships in disturbed ecosystems. This knowledge will be necessary for afforestation and melioration of degraded lands.

We carried out this research within the framework of Basic Research of Committee of Science, Ministry of Education and Science of the Republic of Kazakhstan.

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ОЦЕНКА ИНТЕНСИВНОСТИ РАЗВИТИЯ БОЛЕЗНЕЙ ХВОИ И ПОБЕГОВ В НЕСОМКНУТЫХ СОСНОВЫХ КУЛЬТУРАХ

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EVALUATION OF SEVERITY OF FOLIAGE AND SHOOTS PATHOGENS IN UNCLOSED PINE PLANTATIONS

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Impact of pathogens in unclosed Scotch pine plantations is evaluated by occurrence and severity of disease, and vitality, height increment, stem quality of plants. The scales of severity of foliage and shoot diseases of Scotch pine are described. Symptoms and signs of *Gremmeniella abietina* and *Sphaeropsis sapinea* are revealed in all organs of tree, *Cenangium abietis* in all overground organs, *Dothistroma pini*, *D. septosporum, Melampsora pinitorqua, Sclerophoma pithya* in foliage, buds and shoots, *Cyclaneusma minus*, *Lophodermium seditiosum, Lophodermium pinastri* and *Coleosporium* sp. only in foliage.

Повреждение хвои и побегов сосны обыкновенной (*Pinus sylvestris* L.) болезнями в несомкнутых культурах может привести к их ослаблению, снижению прироста, деформации