

Investigation of native microbial cenoses of *Arabidopsis thaliana* rhizosphere in artificial substrates

Microcenosis is one of the most variegated and common type of the space-structure live consortium on Earth. These cenoses exist in both natural environment and artificial substrates. Investigation of such consortiums has been conducting for more than a hundred years. This studying generally results from the destroying of natural space architecture of cenosis. Unfortunately there is no universal approach to analysis of native microcenoses space structure. In the present article a completely new method of an investigation of the microcenosis in their natural architecture is proposed.

A qualitatively different spatial organization of microflora takes place in artificial substrates — zeolite, vermiculite, etc. There is no loose-continuous medium in them. The second limitation is due to the nature, biology of the inhabitants of microcenoses, the overwhelming majority of which cannot grow on artificial nutrient media in laboratories.

Currently, despite all the efforts and perfection of research methods, no more than 0.1% (which is the limiting value, since a figure of 0.01% is usually given) of all microorganisms determined in substrates by direct methods of calculating the total number can grow by the totality of all those culture media that are used in laboratories [1]. To some extent, this is made up for by molecular diagnostic methods — real-time PCR, fluorescent probes, etc. [2, 3], but only to “a certain extent”. The third limitation is determined by what is attributed to the concept of “ecology”. For microcenoses, their ecology is almost never defined in terms of reality [4].

Based on modern capabilities, to create the necessary technology that combines the ability to work with microbial cenosis in its natural architecture using all modern techniques with different levels of resolution. The main goal was to develop a non-destructive technology that allows working with cenosis in its native architecture.

Preparations for research in scanning electron microscopes Jeol JSM 35C and Jeol JSM 6060LA were attached with epoxy glue with aluminum chips to a stage, kept for three days in a sealed vessel with silica gel cubes and sprayed with gold 15–20 Å.

The technology of cultivating *Arabidopsis* plants on an artificial substrate has been worked out. On the new substrate, the full life cycle of *Arabidopsis* plants was obtained, and viable seeds were obtained. The life cycle averaged 60 days.

This list boiled down to the following:

- the basis of the technology should be a special substrate for growing plants and establishing in it an appropriate rhizosphere microcenosis;
- the substrate should not have cracks, cavities, and its entire surface should be accessible for study;
- the substrate, being the material basis for both plant growth and the formation of microcenoses, should provide in all ranges of space the possibility of carrying out all informative research methods that exist for the study of microorganisms.

Arabidopsis, grown under the conditions of a laboratory analogue of a greenhouse, was chosen as a model plant. Microflora overgrows the substrate, and then in the already formed system, plants are grown. In this case, the succession will still take place, since the base is substrate, which allows the study and control with exhaustive completeness to the entire depth of the substrate (from the surface in contact with the atmosphere to the bottom) and to the entire theoretically possible scale magnifications, namely using electronic optics.

Due to the fact that such an artificial substrate — “quasi-substrate” can be located, fit, penetrate into the natural substrate, it becomes its integral part. The fragment of the microcenosis formed on it is full-sized, and after the removal of the “quasi-substrate-object” of studying what has formed on it, the entire microcenosis in its intact architecture becomes fully accessible to the entire desired depth (thickness) of the substrate with a gradient of conditions. The very organization of the placement of the “quasi-substrate-object” provides full accessibility for any study in any size in terms of the area and volume of the substrate.

The coenosis in artificial substrates must be controlled. Only in substrates of full resolution this is fundamentally possible due to exhaustive control over the state of cenoses and their dynamics. This becomes possible by changing the conditions, if necessary, then generally introducing some additional, pre-prepared biological components in accordance with the information obtained by monitoring the state of the cenosis, and if they deviate from the desired, making changes to the cultivation mode and tracking the changes in cenosis occurring under their influence.

1. *Kordyum V.A., Shpylova S.P., Moshynets E.V., Adamchuk-Chala N.I., Irodov D.M., Andriyenko V.I.* Biopolymers and cells in dimension of microbial community architecture. 1. Fenomenology // *Biopolymers and Cell.* — 2009. — 25. — P.150–165.
2. *Buckley D.H., Schmidt T.M.* Diversity and dynamics of microbial communities in soils from agro-ecosystems // *Environmental Microbiology.* — 2003. — 5(6). — P.441–452.
3. *Buckley D.H., Schmidt T.M.* The structure of microbial communities in soil

and the lasting impact of cultivation // *Microbial Ecology*. — 2001. — Vol. 42, No. 1. — P.11–21.

4. Volkogon V.V., Nadkernichna O.V., Tokmakova L.M., Melnichuk T.M., Tchikovskaya L.O., Nadkernichny S.P., Sherstoboev M.K., Kozar S.F., Kopylov Y.P., Krutylo D.V., Parkhomenko T.Yu., Kameneva I.O., Adamchuk-Chala N.I., Kovalevskaya T.M., Didovich S.V., Volkogon K.I., Pyshchur I.M., Volkogon M.V., Dimova S.B., Komok M.S. For Science. *Experimental soil microbiology: monograph* / ed. by V.V.Volkogon. — K.: Agrarian. Science, 2010. — 464 p.