

DISTRIBUTION OF MICROORGANISMS IN NATURE AND SUBSTANCES

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Abstract: *This article explores the diverse distribution of microorganisms across various natural environments and substances. It examines the ecological roles of microorganisms in soil, water, air, and living organisms, as well as their presence in man-made materials and extreme environments. The study highlights the adaptive capabilities of microbes, their interactions with other organisms, and their significant impact on biogeochemical cycles. Emphasis is also placed on the methods used to identify and study microbial populations in different ecological niches.*

Keywords: *microorganisms, ecology, microbial distribution, natural environments, biogeochemical cycles, microbial diversity, soil microbiology, waterborne microbes, extremophiles, microbial interactions*

INTRODUCTION

Among all objects in the external environment, microbes are abundant in the soil. Microbes spread to water and air mainly from the soil. The soil has the most favorable conditions for the life and activity of microbes, such as organic and mineral substances, sufficient moisture, and protection from sunlight. Microbes are not evenly distributed in different soil layers. The uppermost layer has fewer microbes because microbes dry up there and die quickly under the influence of sunlight. Microbes are most abundant in the Earth's layer at a depth of 10-20 cm. As the soil deepens, the character of microbes changes and their total number decreases, and at a depth of 4-5 m, the soil can be almost sterile. However, microbes can also be found in deeper layers. Depending on the soil composition, lighting conditions, humidity level, seasons, climatic conditions, and other factors, soil microflora also differs in quantity and quality. For example, stony and sandy soils have fewer microbes. It is abundant in plowed and fertilized soils. There can be several million or even a billion bacteria in the soil. It has been determined that 1g of cemetery soil contains 19 billion bacteria. Spore aerobes, spore anaerobes, thermophilic

bacteria, pigment producers, and cocci are common in the soil. As a result of evolutionary development, a metabiotic relationship has formed between certain groups of microorganisms. One bacterium prevents or destroys the development of another. They are antagonistic bacteria, which are important in the processes occurring in nature, in the soil, especially in the fight against disease-causing microbes.

There are activator microbes in the soil, which accelerate the growth and development of plants with the products they produce during their life. These include spore-bearing and spore-free bacteria, yeast, etc.

Pathogenic microbes are also found in the soil. They enter the soil with dead animals, their various excretions, contaminated running water, and various wastes. Some pathogenic microbes (causing anthrax, tetanus) develop in the soil. Bacteria live in the soil at different distances depending on the conditions. For example, tuberculosis bacillus lasts from 5 months to 2 years, brucellosis - up to 100 days, swine fever virus - up to 5 days, etc. However, spores of pathogenic microbes (spores of anthrax, tetanus, malignant tumors, and blackleg) live in the soil for several decades, and soil contaminated with them is a source of disease transmission and is considered very dangerous.

Water microflora. Since there are conditions for the survival and reproduction of microorganisms in water, there are always microbes in it. The microflora of rivers, lakes, seas, oceans and other water sources varies depending on the conditions. They are more common near the coast, on the surface, and less common in the depths and in the depths. The presence of microbes in water depends on many factors: the amount of organic matter in it, the location and degree of pollution of the water body, the speed of water flow, ambient temperature and season, etc.

There are microbes that live in water, adapted to its conditions, and microbes that have come from outside. Depending on the microbiocenosis in water, it is divided into three zones.

1. Polysaprobic zone - water is very polluted, low in oxygen, rich in organic compounds. In 1 ml of such water there are up to several million microbes. More E. coli and anaerobic bacteria cause rotting and fermentation processes.

2. Mesosaprobic zone - microbiocenosis develops in an environment with less organic matter. There are strong mineralization, as well as oxidation and nitrification processes. The amount of E. coli is reduced, the total number of microbes in 1 ml of water is up to 100 thousand. This is a moderately polluted zone.

3. Oligosaprobic zone - is characteristic of clean water. Its microbiocenosis is not very large: in 1 ml of water there are tens or hundreds of microbial cells, there are no E. coli.

The microflora of well water is very variable and its quantity depends on where the well is dug, the structure of the well and the method of its use. Well water contains fewer microbes than surface water, because the water is filtered through the subsoil. If there is a barn or toilet near the well, its water will contain many different microbes. If pathogenic microbes - pathogens - get into the well water, such a well becomes a source of disease.

Waterborne diseases become widespread. It is important to know the number of microbes to determine the sanitary condition of water. The number of microbes is the number of colonies that are formed when 1 ml of water is inoculated onto meat peptone agar in Petri dishes (GPA) and grown at 37°C for 24 hours. The total number of microbes in 1 ml of tap water should not exceed 100. If it is 100-150, the water is considered suspicious, if it is 500 or more, it is considered contaminated. Open water bodies, well water should not contain more than 1000 in 1 ml.

The results of the determination of *E. coli* in water are expressed in coli-titer, coli-index. Coli-titer is the presence of even one *E. coli* in the smallest amount of water (ml), and Coli-index is the amount of *E. coli* in 1 l of water. To convert coli-titer to coli-index, 1000 must be divided by the coli-titer indicator. $1000:500=2$; to convert coli-index to coli-titer, 1000 must be divided by the coli-index indicator.

As a result of the transformation of organic and inorganic substances in nature, their forms also change. A state that is not completed in terms of quantity and does not appear anew is called the exchange of substances and energy.

In nature, the transformation of matter occurs continuously. All plants take in carbon dioxide from the air, decompose it, and release oxygen into the external environment, and they form organic substances from mineral substances. Animals, on the other hand, obtain the organic substances they need from plants and release them into the external environment with their urine and feces. Also, a large amount of organic substances fall into the soil with plant residues and animal corpses. However, these organic substances are unsuitable for plant nutrition. Only as a result of the vital activity of microorganisms do organic substances gradually decompose and turn into simple compounds that plants can absorb. From them, new organic substances are synthesized in plants. Thus, microorganisms actively participate in the metabolism of substances, they break down various complex organic substances with the help of their enzymes, synthesize new compounds that are essential for the formation of plant and animal proteins.

Nitrogen cycle. The atmosphere contains 75.5% nitrogen, the remaining 24.5% is in water and soil in the form of organic and mineral compounds. Protein contains 16-18%, and the soil contains about 6-18 tons of bound nitrogen, but animals and plants cannot use nitrogen in the air. Nitrogen cycle. The atmosphere contains 75.5% nitrogen, the remaining 24.5% is in the form of organic and mineral compounds in water and soil. Protein contains 16-18%, and soil contains 6-18 tons of combined nitrogen, but animals and plants cannot use nitrogen in the air. Free and combined nitrogen in the air must first be converted by microorganisms into a form usable by plants and animals. The conversion of organic nitrogen into mineral nitrogen, and mineral nitrogen into organic nitrogen, takes place in several stages.

Protein decomposition is carried out by putrefactive microbes. As a result of their decomposition of protein, a combination of intermediate substances (albumose, peptone, amide, amino acids), odorous substances (indole, scatopic, hydrogen sulfide, volatile fatty

acids) and ammonia are formed. This is called ammonification, and its initiators are called ammonifiers. This process is important in the purification of nature. Putrefactive microbes include *Cl.sporogenes*, *cl.septicum*, *cl.purtificus*, *p.vulgaris*, *b.subtilis*, fungi, etc. They produce proteolytic enzymes. Urea accumulates in the animal body as a result of protein metabolism and is excreted in the urine. Urobacteria decompose urea under the action of the urease enzyme into water, carbon dioxide and ammonia. Ammonia is absorbed by plants. The second stage in the nitrogen cycle of microorganisms after ammonification is nitrification. During the nitrification process, nitrifying microbes oxidize ammonia and ammonium salts to nitrite ($2\text{NH}_3 + 3\text{O}_2 = 2\text{HNO}_2 + 158 \text{ cal}$) and nitric acid ($2\text{HNO}_2 + \text{O}_2 = 2\text{HNO}_3 + 48$) salts. The resulting nitric acid combines with alkalis in the soil to form nitrate. Nitrate is well soluble in water and is absorbed by plants. As a result of this process, the soil is enriched with nitrogen and its fertility increases. *Nitrosomonas*, *Nitrosocystis*, *Nitrosospira* include nitrifying microbes. Denitrification is the opposite process to nitrification. In this case, under the influence of denitrifying microorganisms, nitric acid salts are reduced to molecular nitrogen and released into the air, as a result of which soil fertility decreases. To prevent this, it is necessary to plow the land and soil frequently. In nature, denitrifying bacteria - *Thiobacillus denitrificans*, *Ps. Aeruginosa*, *Ps. Fluorescens*, *Ps.stutzeri*, etc. are common.

Nitrogen-fixing bacteria fix molecular nitrogen in the atmosphere and form compounds useful for plants. Nitrogen-fixing bacteria include *azotobacter*, *clostridium*, and nodular bacteria.

Carbon cycle. Carbon in the atmospheric air in the form of carbon dioxide makes up 0.03%. Carbon dioxide is taken up by plants and undergoes complex changes, as a result of which oxygen is released into the air. In nature, carbon cycle occurs as a result of the decomposition (fermentation) of nitrogen-free organic compounds. As a result of fermentation, carbon dioxide, water and intermediate compounds are formed - alcohols, acids (lactic, acetic, fatty acids). The carbon dioxide formed rises into the atmosphere and is absorbed by plants and produces oxygen. In this way, carbon is exchanged in nature.

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