Detection of culturable microorganisms in high-altitude atmospheric aerosol samples in the presence of a point forest fire in the sampling area

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Convection caused by biomass burning results in intense atmospheric pollution with gases and aerosol, including those containing microorganisms. There are cases when burning of infested fields of crops results in the spread of plant diseases in remote areas. In some cases, transcontinental transmission of diseases occurs. The presence of high concentrations of microorganisms in the atmosphere poses a potential danger to human health as the release of large amounts of pathogenic and allergenic microorganisms during combustion of large amounts of biomass can't be excluded. Therefore, the study of the effect of fires on the qualitative and quantitative composition of atmospheric microflora in the natural environment is now an important task.

Atmospheric air sampling for microbiological examination was performed during a routine flight of an aircraft laboratory over one of the forests in Southwestern Siberia on April 25, 2014 at eight altitudes: 500m, 1000m, 1500m, 2000m, 3000m, 4000m, 5500m and 7000m using impingers filled with 50 ml of sterile Hanks' solution. Airflow rate of 50 ± 5 liters/min for the used impingers was limited by a critical nozzle. Sampling time ranged from five to ten minutes.

To detect culturable microorganisms, the obtained suspension samples from impingers were seeded on agar nutrient media: RPA; depleted RPA medium (diluted 1:10), starch-ammoniac medium, soil agar. The seedings were incubated in a thermostat at the temperature of 28 – 30 °C and refrigerated at 6 – 10 °C for 3-14 days. Individual bacterial colonies grown on agar media were counted and seeded to obtain pure cultures and for the subsequent analysis. Individual microorganism cells were examined by phase-contrast microscopy.

The analysis of the obtained samples showed that the presence of a point forest fire in the sampling area radically changed the quantitative and qualitative characteristics of the microbial component of atmospheric aerosol.

High concentrations of culturable microorganisms are observed practically at all altitudes up to 7000 m. The difference between the annual indices averaged over the previous 14 years, and the data obtained in April 2014, is 2 - 3 orders of magnitude depending on the altitude. The altitude profile of distribution of culturable microorganism concentration also changes: the concentration has two main peaks at the altitudes of 500 m and 3000 m. The altitude distribution can be characterized as follows: the number of microorganisms decreases with the altitude in the interval between 500 m and 2000 m, then there is a sharp increase in the concentration at 3000 m and a smooth decrease as the altitude increases up to 7000 m. Such profiles have not been observed previously.

In addition to the total concentration of microorganisms, the study determined the contributions of individual morphological groups of microorganisms. All culturable microorganisms detected in the atmosphere were classified under 6 morphological groups: bacilli, cocci, nonsporogenous bacteria, fungi, actinomycetes and yeast. It was found that biomass combustion not only increases microorganism concentration in the air, but also affects the qualitative composition of atmospheric microflora. The conducted studies show that the presence of a local fire in the sampling area is characterized by and extremely high concentration of nonsporogenous bacteria reaching hundreds of thousands of units per cubic meter of air.

According to the literature data, most nonsporogenous bacteria are typical representatives of the upper layers of soil actively participating in the processes that are important for the maintenance and formation of the fertile layer, for example, representatives of the genera *Azotobacter, Bejerinckia* can fix atmospheric nitrogen. It should be noted that many plant pathogens also belong to nonsporogenous microorganisms such as maize rot pathogen (*Bacterium dissolvens*), tail beetroot rot pathogen (*Bacterium bussei*), silver beet pathogen (*Bacterium betae*), etc. There is no information on cases of human and animal infectious diseases associated with biomass combustion in available literature.

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