Culturable microorganisms in high-altitude samples of atmospheric aerosol in the presence of local forest fires in the sampling area

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Key words: forest fire, bioaerosol, aircraft sampling, culturable microorganisms.
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Convection caused by biomass burning results in intensive pollution of atmosphere with different chemical substances in gas and aerosol phases. As it is noted by Mims et al. (2004), culturable microorganisms can also be found in atmospheric aerosol resulting from fires. In 2014, the authors observed a sharp increase in the concentration of viable microorganisms in air samples taken at the altitudes of 500 – 7000 m in an area of a local forest fire (Vechkanov, *et al* 2014). The soil origin of aerosol was also confirmed by a chemical analysis of the elemental composition of the samples: there are high concentrations of aluminum and silicon in the atmosphere. The presence of high concentrations of microorganisms in the atmosphere is a potential hazard to human health because of the possible release of large quantities of pathogenic and/or allergenic microorganisms during the biomass burning. Therefore, the study of the influence of forest fires on the quantitative and qualitative composition of atmospheric microflora is an urgent task.

In 2015, an increase in the concentration of microorganisms associated with fires was reported in the atmosphere near Novosibirsk at the altitudes of 500 – 7000 m. According to the data of Terra and Aqua satellites (http://pro-vega.ru/press/fireobzor.shtml), 05.05.2015(the date of aircraft sampling) in the territory of the Russian Federation (on all kinds of areas including agricultural land), 312 wildfires with active combustion were observed. The maximum number of fires (111) was observed in Novosibirsk region.

Like in 2014, the average concentration of microorganisms was 10^5 CFU/m^3. The contribution of non-sporiferous bacteria that aren't found in such significant quantities in the absence of fires was about 90%. The altitude profiles of concentrations of the biological components of atmospheric aerosol and the numerical distributions of microorganisms were compared by the main morphological groups. Figure 1 presents the altitudinal distribution of concentrations of viable microorganisms. The diagram also shows the percentage contribution of non-sporiferous bacteria to the total number.

Based on these findings, one can make a cautious assumption that non-sporiferous bacteria can serve as a marker for aerosol of soil origin. Since, according to literature data, most non-sporiferous bacteria are typical representatives of the upper soil layers. Among them there are well known representatives of the families *Pseudomonadaceae*, *Nocardiaceae*, *Streptomyceteceae*, the genus *Arthrobacter* as well as the genera *Rhizobiaceae*, *Azotobacter*, *Bejerinckia*, which fix atmospheric nitrogen. It should be noted that many plant pathogen also belong to non-sporiferous microorganisms such as *Bacterium dissolvens*, *Bacterium bussei*, *Bacterium betae*, etc. (Mishustin and Pertsovskaya, 1954).

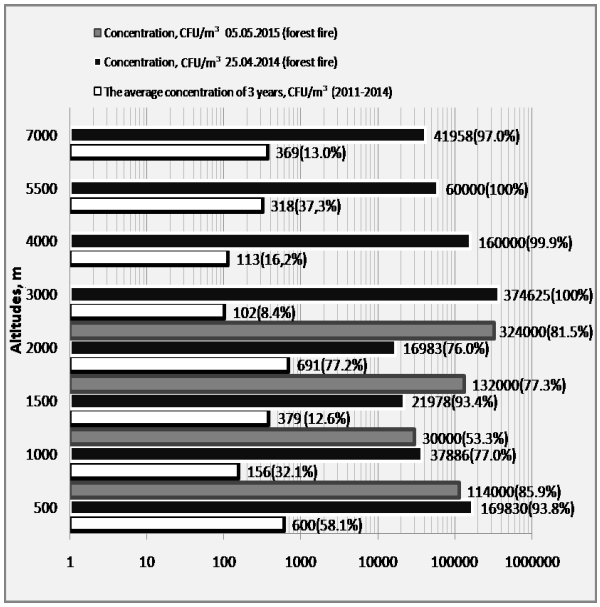

Figure 1. The concentration of microorganisms (CFU/m^3) in absolute values, the share of non-sporiferous bacteria is indicated as percentages (in parentheses) for each column

Thus, the paper presents new data confirming the local impact of forest fires on biogenic components of atmospheric aerosol at the altitudes up to 7000 m. A comparison with earlier data (Vechkanov, *et al* 2014) was performed.

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