

Antibiotic-resistant microorganisms in atmospheric aerosol of Southwestern Siberia

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It is known that microorganisms influenced by antibiotics can become antibiotic-resistance. Recently a large variety of antibiotics are used in the world, which ultimately can get into the environment causing the development of microorganisms' resistance to them.

The study of antibiotic resistance of bacteria found in atmospheric aerosol of Southwestern Siberia was performed in 2006 – 2008. More than 500 samples were collected in the vicinities of Novosibirsk in two on-ground points and one altitude point (from 500 to 7000 m using aircraft sampling). Sampling places and method using liquid impingers are described in more detail in Safatov *et al.* (2008).

Standard methods were employed to detect culturable microorganisms. Samples were seeded onto Petri dishes containing different agarized media. Successive sample dilutions were prepared if necessary. The seedings were incubated in a thermostat at the temperature of 28 - 30°C for 3-14 days. Morphological peculiarities of colonies of detected bacteria and the cell morphology were examined visually and with light microscopy, respectively. Fixed preparations of Gram-stained cells and vital preparations of cell suspensions observed with the phase contrast method were used for this purpose. Taxonomic groups the detected bacteria referred to were determined up to the genus according to the classifier (The Prokaryotes, 1981).

The sensitivity of microorganisms to antibiotics was determined on solid media using paper disks (Research Center of Pharmacology, Saint-Petersburg, Russia). The method is based on determining the diameter of zones of delayed growth of the studied microorganism round the disk with antibiotic (Methods ..., 1984). Fifteen antibiotics widely used in medical practice were tested in the work: ampicillin (10 µg/disk), neomycin (30 µg/disk), benzylpenicillin (100 U/disk), levomycetin (30 µg/disk), carbenicillin (100 µg/disk), canamycin (30 µg/disk), oleandomycin (15 µg/disk), rifampicin (5 µg/disk), streptomycin (30 µg/disk), polymyxin (300 U), erythromycin (15 µg/disk), lincomycin (15 µg/disk), oxacillin (10 µg/disk), gentamycin (10 µg/disk), tetracycline (30 µg/disk).

A total of more than 1500 strains of culturable bacteria were found in the samples (bacteria of the same genera detected in different samples were considered to belong to different strains); antibiotic resistance was determined for more than 800 of them. Research results show that only 12.8% of the studied bacteria found in

atmospheric aerosol of Southwestern Siberia are susceptible to all the used antibiotics. Correspondingly, more than 87% of the studied bacteria display resistance at least to one antibiotic. Approximately 26.8% of bacteria are resistant to the effect of only one antibiotic, and approximately 29.3% are resistant to the effect of two out of 15 different antibiotics. Less than 6% of bacteria display resistance to more than five antibiotics, and one bacterium is resistant to nine antibiotics. No bacteria resistant to a large number of antibiotics were detected.

Approximately 80% of the studied bacteria displayed resistance to polymyxin, and approximately 60% displayed resistance to oxacillin. Wide use of these antibiotics in medical practice in previous years could have made a large variety of bacteria in the environment resistant to them. On average, from 5 to 30% of the studied bacteria are resistant to the effect of other antibiotics. Bacteria resistance to neomycin, rifampicin and gentamycin are being minimal.

The carried out research demonstrated that atmospheric aerosol of Southwestern Siberia contains a surprisingly high percentage of bacteria displaying antibiotic resistance. Consequently, more strict administrative measures should be elaborated to preserve the existing ecosystems. The use of antibiotics in medical practice should be performed with great care to exclude their getting into the environment and replacing strains by antibiotic resistance ones.

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