Microbiology, Vol. 73, No. 6, 2004, pp. 737–739. Translated from Mikrobiologiya, Vol. 73, No. 6, 2004, pp. 854–856.

CHRONICLE

The All-Russia Conference "The Biodiversity and Functioning of Microbial Communities of Aqueous and Terrestrial Systems in Central Asia"

The All-Russia conference "The Biodiversity and Functioning of Microbial Communities of Aqueous and Terrestrial Systems in Central Asia," which was held in Ulan-Ude (Buryatia), July 21–29, 2003, was organized by the Institute of General and Experimental Biology, Siberian Division, Russian Academy of Sciences, and sponsored by the Siberian Division of the Russian Academy of Sciences and the Ministry of Education and Science of the Republic of Buryatia.

The participants of the conference came from research institutions of the Russian Academy of Sciences (Moscow, Moscow region, the Siberian Division, and the Far East Division), the Ufa Scientific Center, the Buryat Agricultural Academy, the Buryat University, Moscow State University, and the East Siberian Technological Institute, as well as from Mongolia, Kazakhstan, Finland, and the United States. All in all, 80 reports and communications were presented, which were then included in the proceedings of the conference, published in Ulan-Ude by the Buryat State Agricultural Academy in 2003. It should be noted that more than 30% of these reports were made by researchers from the Institute of General and Experimental Biology. The scientific program of the conference included a plenary meeting, two sections ("Microbial communities of aqueous ecosystems" and "Microbial communities of terrestrial ecosystems"), a roundtable discussion, and some very interesting and well-organized scientific excursions.

The conference was timed to the 70th birthday of the prominent Russian microbiologist Georgii Aleksandrovich Zavarzin, whose contribution to our understanding of the life of microbial communities, including those in Central Asia, is very great. The fundamental and impressive report of Zavarzin, who opened the conference, dealt with the current knowledge of cyanobacterial communities and their role in the formation of the Earth's atmosphere. The speaker emphasized that modern soda lakes are relicts of the primary planet biocenosis. The study of the alkaliphilic microbial communities of soda lakes in the Baikal region, which are known for the great diversity of their chemical composition, is of particular theoretical and practical interest.

A comprehensive report by Prof. B.B. Namsaraev was devoted to the functional role of microbial communities living in the extreme aqueous ecosystems of the Baikal rift zone. He noted that the geological and physicochemical conditions of numerous soda, salt, and freshwater lakes in the Baikal region favor the growth of thermophilic, alkaliphilic, halophilic, and psychrophilic microorganisms. The study of these microorganisms greatly contributes to our understanding of the biological recycling of the most important elements in the aqueous and terrestrial systems of the region.

Dr. T.N. Zhilina reported on the role of anaerobic alkaliphilic bacteria living in soda lakes and provided experimental evidence for the hypothesis of a "soda continent," postulating that the microflora of modern soda lakes is analogous to that of the ancient Precambrian time, which was first formed on the continent and only then propagated to marine environments. The validity of this hypothesis is confirmed by the high morphological diversity of modern alkaliphilic communities, which covers all presently known prokaryotic morphotypes. Recent investigations showed that the alkaliphilic community of highly mineralized lakes represents a trophic system that is necessary and sufficient to close the main biochemical cycles.

One should note the good proportion between the reports dealing with fundamental problems of general microbiology and the reports concerned with the study of the microflora of particular natural objects (lakes, rivers, springs, soils, etc.), the isolation of microbial cultures, their study, and practical applications.

Many reports were devoted to the study of lakes in the Baikal region. The sources of salts in these drainage-lacking lakes are waters that continually come from fault zones and artesian basins communicating with underground bodies of sulfate and soda waters. Microbiological processes are most active in the upper horizons of lake muds dominated by phototrophic bacteria, which are components of layered cyanobacterial mats 2.5–3.5 cm in thickness. Soda lakes are dominated by *Phormidium, Oscillatoria*, and *Microcoleus chthonoplastes* cyanobacteria. The morphological characteristics of these cyanobacteria (many of which are not typical) vary, depending on the species composition, water mineralization, and pH (L.M. Gerasimenko, A.V. Bryanskaya, and others). In the shallow littoral zone, cyanobacterial mats and decomposing plant residues contain anoxygenic phototrophic bacteria, such as sulfur and nonsulfur purple bacteria and green filamentous bacteria (V.M. Gorlenko and A.I. Bryantseva). Anoxygenic photosynthesis is observed at a

0026-2617/04/7306-0737 © 2004 MAIK "Nauka/Interperiodica"

depth of 4.6–5 m (Lake Shunet), persisting in the ice-covered lake during the winter season (I.I. Rusanov, O.N. Lunina, and others).

The utilization of most of the organic matter in slightly and moderately mineralized soda lakes is associated with methanogenesis and bacterial sulfate reduction. The enrichment cultures of sulfate-reducing bacteria from soda lakes can grow and reduce sulfate not only in alkaline but also in neutral media. However, elevating the pH of the medium from 7 to 11 increases the production of hydrogen sulfide by a factor of four (L.P. Kozyreva, D.Yu. Sorokin, E.G. Altaeva, A.V. Vatsurina, and others).

Some reports were devoted to the problems of methanogenesis and methanotrophy. Methanotrophs and methylobacteria were found in saline (with salinities up to 12% NaCl) and alkaline (with pH up to 11) bodies of water. It was shown that methanotrophs are involved in nitrification and the retention of nitrogen in soda lakes. The results of a 16S rRNA gene sequence analysis of microbial biodiversity in bottom sediments containing gas hydrates were presented by Yu.A. Trotsenko, T.I. Zemskaya, O.P. Dagurova, E.A. Gainutdinova, and others.

Attention was also given to aerobic and anaerobic proteolytic, amylolytic, and cellulolytic bacteria (E.Yu. Abidueva, P.S. Syrenzhapova, T.G. Banzaraktsaeva, D.D. Barkhutova, and others). These researchers reported that the prokaryotic benthic complex of salt lakes is capable of nitrogen fixation and denitrification. Actinomycetes can stimulate the growth and photosynthetic activity of cyanobacteria (D.K. Setchenko, N.A. Manucharova, E.O. Omarova, and others).

A number of reports were devoted to the study of the microbiota of mineral springs and to attempts to reveal a correlation between the hydrochemical characteristics of springs and the rate of microbiological processes. The main producers of organic matter in springs are cyanobacteria of the genera *Phormidium* and *Oscillatoria*, which grow in the upper layer. Two deeper layers are occupied by anoxygenic purple bacteria and sulfate-reducing bacteria, respectively (E.V. Danilova, S.V. Zaitseva, L.P. Kozyreva, and others). In alkaline and neutral thermal springs, microbial mats develop at temperatures no higher than 64 and 73°C, respectively (Z.B. Namsaraev and others). These authors believe that high pH values diminish the toxicity of sulfides, which allows cyanobacteria to dominate even at sulfide concentrations exceeding 1 g/l. Sulfate reduction is typical of mineral springs, being more intense the higher the sulfate concentration. High temperatures and pH values, however, suppress this process. The maximum rate of sulfate reduction is observed at temperatures below 50°C. The degradation of organic matter in springs is mainly due to sulfate reduction, although in some springs, such as Sukhaya Zagza on the Lake Baikal shore, it is mainly due to methanogenesis (I.S. Tsyrenzhapova, O.P. Dagurova, B.B. Namsaraev, and others).

Riverine microbial communities were the subject of reports made by S.P. Buryukhaeva, T.P. Vinogradova, E.B. Matyugina, and others. V.V. Dryukker and N.V. Dutova presented the results of a study of phages in the water of the Angara River within Irkutsk. Many reports concerned the isolation of microbial cultures from natural sources, the investigation of their physiology and enzyme activity, and practical applications.

E.A. Bonch-Osmolovskaya and collaborators reported on the study of the diversity of thermophilic prokaryotes by physiological–biochemical, radioisotopic, and molecular biological methods. They described isolates belonging to new genera and higher taxa. Radioisotopic methods made it possible to reveal processes that had not yet been observed under laboratory conditions (e.g., high-temperature acetogenesis and acetoclastic methanogenesis). The 16S rRNA gene sequencing analysis proved to be more efficient than the physiological–biochemical method in detecting new thermophilic microorganisms. The authors believe that all three methods used in combination will allow new ecologically important groups of microorganisms to be isolated.

N.G. Usanov and collaborators proposed a modified method for the isolation of microorganisms from natural sources by introducing bactericidal substances (such as azide, fluoride, and perchlorate) into enrichment cultures. The microorganisms isolated by this method are tolerant to anions and can be considered a new group of extremophiles. A.I. Slobodkin and others were the first to observe the formation of magnetite by sulfate-reducing microorganisms. Of great interest was the report presented by V.V. Klimov and colleagues. They suggested that the alkaliphilic microbial community may be responsible for the induction of oxygenic photosynthesis since bicarbonate can initiate the assembly of the tetramanganese cluster of the water-oxidizing complex of photosystem II in plants and cyanobacteria.

V.V. Kevbrin reported that thermoalkaliphiles can produce nearly all the industrially important enzymes. These organisms attract biotechnologists' interest by exhibiting a high resistance to infection by foreign microflora. He described a protease from a thermoalkaliphile that exhibited maximum activity at pH 12 and a temperature of 70°C. Many reports were concerned with the therapeutic effects of mud from salt lakes and hot springs.

The reports by N.G. Kuimova, L.M. Pavlova, E.B. Matyugina, and L.P. Zimina were devoted to the potential application of microorganisms in mining industry, biohydrometallurgy in particular.

There was an extended discussion on the isolation of novel microorganisms. Dr. M.B. Vainshtein, who took an active part in this discussion, emphasized that success in revealing the entire biodiversity of a natural sample depends on the composition of the selective nutrient media used for analysis and on the specific cultivation conditions used for the growth of aerobes,

anaerobes, acidophiles, alkaliphiles, and other microbial groups. The isolation of novel microorganisms may require specific treatment procedures (magnetic, ultrasonic, thermal, and others) and the addition of various, sometimes very exotic, substances to the media.

The second section, which included about one-third of the reports at the conference, concerned the microbial communities of terrestrial ecosystems, which are of particular interest to soil scientists. Ch. Battsetseg and G. Namsuren spoke about the necessity of coining a new ecological parameter, soil genotoxicity, since DNA-damaging (genotoxic) substances sorbed by soils then come to riverine water and may enter plant and animal organisms via the trophic chains.

The microorganisms of saline soils were the subject of reports made by G.A. Lisichkina, V.B. Dambaev, G.G. Gonchikov, Tynynbaeva, and others. Of particular interest was the report presented by Gonchikov and V.M. Korsunov, who, in collaboration with researchers from Moscow State University (D.G. Zvyagintsev, L.M. Polyanskaya, and T.G. Dobrovol'skaya), showed that methodology is very important in isolating particular taxa. The use of *culture-dependent* approaches made it possible to show that cryoarid (cold) soils are dominated by prokaryotes, actinomycetes in particular. At the same time, *culture-independent* (direct) methods show that these soils are dominated by mycelial fungi (90–95% of the total biomass). Thus, organic matter in these soils is mainly decomposed by fungi. Such decomposition differs from that implemented by bacteria not only in the mechanism but also in the ecological function.

The roundtable discussion was devoted to the ecological problems of Lake Baikal and the Baikal region. Now that a trans-Siberian oil pipeline is being projected, the financial and political interests seem to prevail over the ecological interests in this region. The participants supported the idea that the biodiversity of microorganisms can be protected and preserved only through the protection of their natural habitats, which can be achieved by creating natural wildlife preserves and sanctuaries. Zavarzin emphasized that society does not yet fully realize the important role of microorganisms in life on the planet and the necessity to preserve microbial diversity. The role the mass media play in the propagation of ecological ideas must be increased.

The participants were very grateful to the conveners of the conference (researchers from the Laboratory of Microbiology, headed by B.B. Namsaraev) for its good organization and emphasized that the Institute of General and Experimental Biology in Ulan-Ude is one of the leading schools of Russian microbiologists.

V.K. Orleanskii,
Winogradsky Institute of Microbiology,
Russian Academy of Sciences, Moscow

B.B. Namsaraev,
Institute of General and Experimental Biology,
Siberian Division, Russian Academy of Sciences,
Ulan-Ude