INVESTIGATION OF THERMOPHILE AEROBIC BACTERIUM IN THE CONDITIONS OF THE AZERBAIJAN REPUBLIC

Farayat AHMEDOVA*, Şeker MUHTAROVA**
*Bakü Devlet Üniversitesi, **Botanik Enstitüsü, Azerbaycan Milli Bilimler Akademisi

ABSTRACT

In this work microbiotus in the thermal water-sources, located on the territory of the large and the small Caucasus of the Azerbaijan Republic are investigated.
.
From the investigated thermal springs, two species of non spore generating bacterium of *Thermus genus* (*T.ruber, T.flavus*) and 6 species of spore generating bacterium of Bacillus genus were extracted (*Bac.stearothermophilus, Bac.megaterium, Bac.mesentericus, Bac.subtilis, Bac.cereus, Bac.circulans*).

Keywords: Thermal water, Temperature, pH, bacterium

AZERBAYCAN CUMYURİYETİ KOŞULLARINDA TERMOFİL AEROBİK BAKTERİLERİN ARAŞTIRILMASI

ÖZET

Bu araştırmada Azerbaycan Cumhuriyeti'nin küçük ve büyük Kafkasya mıntıkalarında bulunan sıcak su kaynaklarının mikrobiyotosu araştırılmıştır.

Termal kaynaklarda iki tür spor doğurmayan *Thermus genus* (*T.ruber, T.flavus*) bakterileri ve altı tür spor doğuran *Bacillus genus* (*Bac.stearothermophilis, Bac.megaterium, Bac.mesentericus. Bac.subtilis, Bac.cereus, Bac.circulans*) bakterileri tespit edilmiştir.

Anahtar Kelimeler: Termal su, sıcaklık, pH, bakteri.

1. INTRODUCTION

Researches on the thermophile microorganisms are systematically and fruitfully conducted for a long time. These microorganisms possess high speed of exchange and greater variety of functions (1-3). There are data on intensive biosynthesis of some antibiotics, enzymes, vitamins, amino acids for various groups of thermophile microorganisms (4). Doing research of these microorganisms naturally and their interrelations between groups of microorganisms, is necessary for determining the characteristics of their role in transformation of inorganic and organic substances, and their possible practical applications for reception of methane, ethanol, enzymes, amino acids and other valuable substances (5-7).

Interest to ecological inspection of hot water sources, as there are new kinds and forms thermophile microorganisms have been found out lately, has noticeably increased (8).

Reception of new data concerning the structure of micro-biotic thermal sources and an establishment of communication between microbiological and chemical characteristics will allow revealing the role of microorganisms in formation of a chemical compound of thermal water (9).

It is shown that, balneological properties of thermal waters in many respects are defined by features of their chemical compound, and formation of the last is caused by the whole complex of non-biogenic and biogenic factors (10, 11). Therefore the detailed study of thermal water micro-biotics is necessary for the correct understanding of the formation mechanism of thermal water structure

Studying group of these microorganisms in conditions of Azerbaijan where thermal mineral sources are widely widespread, can promote, on the one hand, to the decision of these questions, with another, can be a basis for creation of conceptual and information base with the purpose of monitoring and the control over a condition of thermal sources of republic at possible anthropogenous intervention.

2. MATERIAL AND METHODS

The extraction of bacterium was conducted at the temperatures from 40^0 to 70^0 C. Commonly used mediums were used for their cultivation (Loginov with coath., 1966). The identification of bacterium was taken by determiners (Bergey, 1997; Krasilnikov, 1949), and by the monographs of Loginova with Coath (1973).

The activity of enzymes was evaluated by the zones of hydrolysis of specific substrate: starch – for the determination of amylolytic activity, casein – for the determination of protease's activity (Loginova with coath., 1966). For the determination of the activity of lytic enzymes dead and alive cells of gram-negative bacterium Escherichia coli were used. The determination of lytic activity of T.ruber Kb was conducted by turbodimetric method (Loginova with Coath., 1975, b).

A filtrate of cultural liquid T.ruber Kb was used as an enzyme.

3. RESULTS

In this research, spreading of the bacterium, referred as Thermus and Bacillus, onto the thermal-waters, their structure, various properties and specifications were determined.

The Explored thermal waters-sources possess certain specific features .Namely, the properties of the thermal-waters on the territory of the Large Caucasus are as follows; low-temperature (35,5-48,5^{0}C), pH-L 7,7-8,5, mineralization degree (0,9-1,5 q/l) include certain alloys of sulfur origin and reeks stinky, but at the same time the thermal-waters of the Small Caucasus are considered to be the ones with high-temperature (52-72^{0}C) pH-l 7,1-9,0, mineralization degree – 1,6-6,7 q/l and they have carbonates – without any scents – have no smell at all (tab.1, 2).

None of the 6-explored thermal water Source of the Large Caucasus (Hashi, Haltan, Jimih-1, Jimih-2, Oglanbulaq, Gizbulag), has got the representatives of the clan Thermus; Although following representatives of the clan Bacillus were disclosed–Bac.stearothermophilus, Bac.circulans, Bac.mesentericus, Bac.subtilis, Bac.megaterium and Bac.cereus (Table 1).

Table 1. General properties of thermal waters of the Large Caucasus and the composition of thermophile bacterium types spread there

Name's of water springs	Properties of water				Composition of bacterium types	
	t°	pH	The degree of mineralization	Composition of gas and salt	Spore generators	Non spore generators
Hashih	37,5	8,1	1,2	N_2-H_2S natrium hydrocarbonate	*Bac.mesentericus, Bac. subtilis, Bac. megaterium*	0
Haltan	48	8,5	1,5	-*-	*Bac.mesentericus, Bac. subtilis, Bac. megaterium Bac. circulans*	0
Jimih-1	43	7,7	0,9	N_2-H_2S natrium-sulphate-hydrocarbonate	*Bac.mesentericus, Bac. subtilis, Bac. circulans*	0
Jimih-2	35,5	7,8	1,1	-*-	*Bac.mesentericus, Bac. subtilis,*	
Oglanbulag	41	8,1	1,3	N_2-H_2S calsium, natrium-hydro carbonate	*Bac.mesentericus, Bac. subtilis, Bac. megaterium Bac. circulans*	0
Gizbulag	39	8,1	1,4	N_2-H_2S calsium, natrium-hydro carbonate	*Bac.mesentericus, Bac. subtilis, Bac. megaterium Bac. circulans*	0

As a result, representatives of the Thermus Lineage (clan) can be seen only into the thermal waters of the Small Caucasus which are volcanic origin.

However in these thermal-water sources disparity in the spreading of the mentioned clans, as well as in their amounts and in compositions was observed. In this connection it should be underlined that the representatives of the Thermus lineage were observed only in the sources Upper Isti Su (t-72^{0}C, pH-9,0) *T.ruber* (30%) and Bagirsag Su (t-64^{0}C, pH-7,1) *T.ruber* (59%), *T.flavus* (17%), but in the others sources – Lower Isti Su (hot water) (t-64^{0}C, pH-8,0) and also in Darridag the representatives of the clan Thermus weren't disclosed at all (tab.2).
Perhaps non–distribution of the bacterium of the clans of Thermus in the aforementioned last two thermal sources relates to the chemical structures and the characteristics (temperature, pH, gases, salt amounts, mineralization etc.) of the water.

In the thermal waters of the Small Caucasus, Bac.stearothermophilus, Bac.circulans, Bac.mesentericus, Bac.megaterium and Bac.subtilis were disclosed (Table 2).

Explorations implemented by means of the Electronic-Microscope (YEM-100B, of the firm YEUL) of the ultra-slim cuttings of thermophile bacterium have helped us to observe and disclose certain three-layered – walls of their cells.

An external layer penetrating onto the internal one divides the cells by invagination – into the separate blocks and in this case – makes up special configuration to the cells.

It's thought that such a composition has been driven from adaptation of the cells to the extreme conditions and brought-about the further exchanging of substances in their normal broom. By means of microscopic exploration, composition of the spore in the spore's bacterium, and their multiplication was observed.

Table 2. General properties of the thermal waters of the Small Caucasus and the composition of thermophile bacterium types spread there

Names of water springs	Properties of water				Composition of bacterium types	
	t^0	pH	The degree of mine-ralization	Composition of gas and salt	Spore generators	Non spore generators
Upper Isti Su	72	9,0	4,3	Carbonate, hydro-carbonate-chlorid-sulphate-natrium	*Bac. Stearother-mophilus, Bac.mesentericus, Bac.subtilis*	*T.ruber*
Lower Isti Su	64	8,0	6,7	-*-	*Bac.stearother-mophilus, Bac.mesentericus, Bac. subtilis, Bac. megate-rium*	0
Bagirsag	64	7,1	4,6	-*-	*Bac.stearother-mophilus, Bac. megate-rium, Bac. mesentericus*	*T.ruber T.flavus*
Darridag (NMR)	52	7,2	1,6	Carbonate, arsen-ic, hydro carbo-nate	*Bac.stearother-mophilus, Bac. circulans, Bac. subtilis*	0

Explorations of the physiological features of the obligate – thermophile *T.ruber* bacterium displays that the clan Thermus bacterium absorbs the substances easily, which contains in itself carbon, nitrogen and at the high-temperature. Their development demands some additional substances which ought to be able to provoke and instigate their growth.

As for as T.ruber Kb bacterium they are able to be responsible in the growing-up them in a condition of the peri-odic cultivations nearly 3-5 times more intensively in the hemostatus, and their demand for oxygen in that period of the time increases sufficiently.

Having investigated the lytical features of the culture, it was established their bacteriological influence on the dead and alive cells of the E.coli bacterium.

At last, in compliance with the results of the scientific explorations, namely each thermal water has its own spe-cific microbiotus and bacterium and they play essential role in setting-up of the water formation and also in the current microbiological processes.

LITERATURE

- Ahmedova F. R., Tereshina V. M., Loginova L.G. , Khovrychev M. P. 1989. The physiology of Thermus Ruber // Microbiology, v.58, is.2.
- Ahmedova F.R. , Gasimova G. S. , Babayeva T. A. 1988. The practical characteristics of obligat thermophyl Bakterium Thermus ruber staratin (CB) //. News of Baku University, № 4. pp. 84-87.
- Ahmedova F.R. 2003. Bakterium spreading into the certain thermal-waters of the Large and Small Caucasus / monograph, Baku State University, 80 p.
- Brock T. 1978. Thermophilik microorganisms and life at high temperatures. Springerverlag New York Hei-delberg Berlin; p.465
- Brock T. S and Freeze H. 1969. Thermus aquaticus gen.n, and sp.n ., a nonsporulating extreme thermophill // J. Bacteriol., , v 98, № 1, p.289-297
- Krasilnikov N. N. 1949. The determiner of bacterium and actinomycets. M .-L. pub. house, AS SSSR, 830 p.

- Loginova L. G. and Golovacheva R. S. 1973. Modern ideas of thermophile microorganisms // M ., Nauka, 275 p.
- Loginova L. G. and Yegerova L. A. 1977. New forms of thermophile bacterium // M ., Science, 157 p.
- Loginova L.G. Goloracheva R.S. and Yegerova L.A. 1966. Life of microorganisms at high temperatures // M. Nauka, 294.
- The determiner of Bergey bacteriums (edited by D. Holm, N. Krig, P. Spitt and others) M .: Mir, 1997, v. 1-2, 800 p.
- Yegorova L., Loginova L. and Chaloupka J. 1983.Turnover of Proteins in the extreme thermophile Thermus flavus / Flora micribiol, Czoslovak Academy of sciences, 28, 141-144.