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MICROBIOLOGICAL MONITORING OF THE RIVERS ACHARISKALI AND THE BARTSKHANA IN WESTERN GEORGIA

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Abstract:

Among the problems arising in the field of environmental protection in Georgia, the issue of river pollution stands out. They are mostly polluted by agricultural, industrial and household waste and direct human activities. The growing anthropogenic load on the rivers can lead to the breakdown of the balance of substances in the water ecosystem, the deterioration of the sanitary-hygienic and recreational conditions of the water body, and finally the degradation of water body resources. Preservation and protection of the desired ecological condition of rivers require a special approach and solution. It is necessary to constantly monitor them in order to determine the source of pollution and the ways of its spread.

In order to evaluate the degree of pollution caused by anthropogenic factors, we conducted sanitary-microbiological studies in 2019, 2020 and 2021 on two rivers of Western Georgia (the Bartskhana and the Ajgaritstskali). In the analysis samples, we determined sanitary-microbiological indicators - total coliforms, Escherichia coli, fecal coliforms, Salmonella.

Based on the results of the research, we can conclude that microbial pollution was observed in the Adjaristskali in the summer and autumn of 2019. The increase of anthropogenic load in the river Bartskhana is observed in all three years, which, in our opinion, is caused by agricultural and household pollution. The mentioned problem requires a serious approach and decisive measures.

Keywords: anthropogenic pollution, total coliforms, Escherichia coli, faecal streptococci, Salmonella

INTRODUCTION: Western Georgia is a region rich in rivers. They flow into the sea and have a significant impact on its water quality. Human economic activities have a negative effect on water ecosystems: they use river water for various purposes (mainly for irrigation and agricultural purposes), thereby reducing the resources of these ecosystems. In addition, people release polluted waters into the river as a result of various activities. The aquatic ecosystem has the ability to neutralize a certain amount of pollution, however, this ability is not infinite. If excessive pollution is discharged or large amounts of water are withdrawn from a body of water, the ecosystem can be seriously damaged or completely destroyed. To prevent this, it is necessary to protect surface waters (M. Ghoghoberidze, 1992)".

The specific pollutants of the hydrosphere, whose influence deteriorates water quality, include chemical compounds, pathogenic organisms, and various physical factors. Various waterborne infectious diseases may be caused by pathogenic microorganisms. Among them are bacterial pathogens, some of which are directly related to the water environment, such as Shigella, Salmonella, E.coli, Campilobacter jejuni, V.cholerae and others, which cause acute diarrheal diseases. Due to the waterborne way of spread of these diseases, the threat of epidemics may arise (Mchedluri, T. 2020).

The most recognized and widespread sanitary-indicator microorganisms in the whole world are bacteria of the group of intestinal rods (IRGB). Their advantage as an indicator of fecal contamination is fully consistent with the basic requirements imposed on sanitary-indicative microorganisms, (IRGB) life span and persistence are close, but somewhat higher than, the corresponding indicator of intestinal pathogenic microorganisms in a contaminated object (Labinskaya A. S, 1983)

Some researchers indicate a direct relationship between salmonellae and bacteria of the intestinal rod group (correlation coefficient ч=0.54), salmonellae and E.coli (ч=0.54) salmonellae and intestinal rod phages (ч=0.54). Given the fact that the persistence of Escherichia coli in the environment is much higher than that of all known causes of bacterial enteric infections. The conclusion of the researchers that in the water of open water bodies in the environment, Escherichia coli retains its ability to live for a long time after the situations where the coli titer of the water is quite low, but pathogenic bacteria are no longer found in it, is not without logical content (Labinskaya A. S. 1983)

In recent years, the problem of anthropogenic pollution of rivers is growing, and the need to monitor them is becoming more urgent. Industrial economic growth has a negative impact on aquatic ecosystems. In case the pollution rate exceeds MPC, it is possible to start the process of eutrophication against the background of the reduction of self-cleaning processes, and the possibility of the spread of infectious agents may increase. All of the above will lead to a disruption of the balance in the river ecosystem and a sharp deterioration of the ecological and recreational conditions (Mchedluri T. Liparteliani M. 2021). Anthropogenic pollution has a serious impact on the ecological condition of rivers, ecosystems, hydrobionts and fish.

RESEARCH OBJECT AND METHODS: The object of the research was the rivers Bartskhana and the Adjaristskali in Western Georgia. Researches were conducted seasonally in 2019, 2020 and 2021. While investigating the sanitary-microbiological indicators, we examined total coliforms, Escherichia coli, fecal coliforms and pathogenic microorganism - Salmonella in the water.

We conducted research on rivers according to the scheme of field research prepared in advance. We specified the coordinates, visited the place, took photos and registered in the field journals. We conducted sanitary-microbiological studies using the membrane filtration method. We determined and counted the total number of heterotrophic (mesophilic aerobes and facultative anaerobes) bacteria using the ISO 17994:2004 method; We used the ISO 7899-2:2000 method to determine and count intestinal enterococci (Enterococcus faecalis) - fecal coliforms; Total coloforms and Escherichia coli (E.coli) were determined and recorded using the E-coli ISO 0157:H7 method.

RESEARCH RESULTS AND ANALYSIS: The length of the river Adjaristskali is 90 km. The area of the basin is 1540 km2, it flows in the territory of Adjara and is the right tributary of the Chorokhi. Its source is on the western slope of the Arsian ridge at an altitude of about 2375 m above sea level. It is an amateur fishing and recreational area. Therefore, from a sanitary point of view, it is of great importance. The river is polluted by household waste, runoff from livestock farms and toxic chemicals used in agriculture.

The river Bartskhana of Western Georgia is located in the territory of Khelvachauri. It is the right tributary of Adjaristskali. The river, the length of which is 8.2 km and the area of the basin is 19 km2, comes from the northwestern slope of the Meskheti ridge (Encyclopedia "Georgia", vol. 1, vol., 1997). There is a large amount of sewage water and household waste pollution in the mentioned area.

Since the mentioned rivers are under certain anthropogenic pollution, it is important to study their ecological condition in order to determine the sources of its pollution. They should be monitored, ecologically controlled and protected. In the analysis samples, we determined sanitary-microbiological indicators - total coliforms, Escherichia coli, fecal coliforms, Salmonella.

It should be noted that the ecological situation in the lower reaches of the Bartskhana has been unsatisfactory for quite a long time. In this case, we have both domestic and industrial pollution. The mentioned problem requires a serious approach and decisive measures.

The results of the microbiological analysis of the Bartskhana in 2019-2021 are presented in tables No. 1, 2, 3

The results of microbiological analysis of the Bartskhana water

Table №1

Determined microorganisms	Place and time of sampling		
	The river Bartskhana 2019		
	Spring	summer	Autumn
Total coliforms	6885	7550	8250
E-coli	6855	5850	6100
Fecal streptococci	530	650	580
Salmonella	were not found		

The results of microbiological analysis of the Bartskhana water

Table №2

Determined microorganisms	Place and time of sampling		
	The river Bartskhana 2020		
	Spring	summer	Autumn
Total coliforms	6522	7542	7644
E-coli	5850	7850	8856
Fecal streptococci	608	578	588
Salmonella	were not found		

The results of microbiological analysis of the Bartskhana water

Table №3

Determined microorganisms	Place and time of sampling		
	The river Bartskhana 2021		
	Spring	summer	Autumn
Total coliforms	8664	9056	8114
E-coli	6542	7126	5927
Fecal streptococci	498.9	628.5	660.5
Salmonella	were not found		

The results of our 2019-2021 microbiological research of the river Adjaristskali are given in tables No. 4, 5, 6.

The results of microbiological analysis of the Adjaristskali water

Table №4

Determined microorganisms	Place and time of sampling		
	The river Adjaristskali 2019		
	Spring	summer	Autumn
Total coliforms	7120	8020	8840
E-coli	5050	6840	6245
Fecal streptococci	548	640	730
Salmonella	were not found		

The results of microbiological analysis of the Adjaristskali water

Table №5

Determined microorganisms	Place and time of sampling		
	The river Adjaristskali 2020		
	Spring	summer	Autumn
Total coliforms	4986	5300	5100
E-coli	5000	6055	5850
Fecal streptococci	440	490	499
Salmonella	were not found		

The results of microbiological analysis of the Adjaristskali water

Table №6

Determined microorganisms	Place and time of sampling		
	The river Adjaristskali 2021		
	Spring	summer	Autumn
Total coliforms	5280	5890	6910
E-coli	4885	4880	5220
Fecal streptococci	395.8	408.0	468.1
Salmonella	were not found		

As can be seen from the research results, in the water of the Bartkhana, the concentrations of E-coli in the water are increased in all three years, depending on the seasons. In 2019, it varies within 5850-8856 units/l, in 2020 - within 5850-8856 units/l, and in 2021 - within 5927-9056 units/l. In the summer of 2021, compared to 2019 and 2020, the highest rate was recorded. Total coliforms (9056) and faecal streptococci (628.5) Salmonella were not found in any of the three-year data.

The year 2019 turned out to be the most polluted in all three years. The rate of E-coli (6245) was recorded in the summer, total coliforms (8840) and faecal streptococci (730) - in the autumn. Salmonella was not found in any of the samples.

Based on the results of the research, we can conclude that in the rivers of West Georgia, the Bartskhana and the Adgaristskali, fecal pollution is observed in the background of increasing anthropogenic load. Taking into account their 2019-2021 sanitary-hygienic status, rivers require constant monitoring and protection of their ecological status.

CONCLUSION:

Researches on the Adjaristskali and the Bartskhana of Western Georgia were carried out in 2019, 2020 and 2021. The degree of pollution caused by anthropogenic factors on them was evaluated. The influence of polluting substances on the ecological condition of rivers was established. Based on the results of the research, we can conclude that there is fecal pollution in the rivers. From the monitoring results of three years, it is clear that the microbial pollution of the Adjaristskali was the highest in the autumn of 2019. Anthropogenic load is observed in the Bartskhana in all three years, which can be clearly seen by the indicators of total coliforms, E-coli and faecal streptococci.

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