THE BACTERIOLOGICAL INVESTIGATION OF THE TISZA IN THE STRETCH BETWEEN CIGÁND AND KISKÖRE IN 1975

B. Estók—P. Andrik

Public Health Station of County Heves, H—3300 Eger, Hungary,
Public Health Station of County Borsod, H—3501 Miskolc, Hungary
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Abstract

The Tisza, on the basis of the bacteriological investigation of its longitudinal section between Cigánd and Kisköre, proved to be a "polluted — a little polluted" water. It is the most polluted in the region of Tokaj, from there advancing towards Kisköre, the pollution decreases, between Tisza-füred and Kisköre, even the percentile occurrence of the enteral pathogens is showing a considerably more favourable picture. In these river-stretches self-purification is increased because there are no newer polluting sources. The preservation of this state is justified, if only for utilizing the water of the Kisköre Reservoir in a complex way.

At the section investigations, the section of Tokaj was shown to be the most polluted because of the influence of the refused waters and the inflow of the Bodrog.

At present, in the river stretches investigated, the manifold utilization of the Tisza water can be solved for the time being with an appropriate technique. At the same time, however, in addition to the preventive measures, the regular bacteriological investigation of the river is also necessary, following with attention the various changes in its state and giving information on the development of the quality of the water.

Introduction

In the years past, the bacteriological investigation of the Tisza was performed by more researchers. According to Papp's investigations (1961), the bacteriological conditions of the rivers, on the basis of the coliform number, still developed favourably. The Tisza, in its upper region, is clear; in its lower region, the situation has hardly changed. According to Deák's results (1972), at Tokaj, Leninváros a "somewhat polluted", at Szolnok, Szeged a "very much polluted" water quality has developed. According to Takács and Andrik (1975), the Tisza is, on the basis of the investigations carried out in 1971—1974, at Cigánd "clear", at Tokaj "polluted".

The demand on a bacteriological supervision is more and more justified, as the number of the various water utilizations is increasing. The planned scooping out drinking and industrial waters in the Borsod stretch of the Tisza (Tokaj, Leninváros) necessitates the investigations. At Kisköre, by building the barrage; the largest artificial lake of our country will be formed, suitable for storing 400 million cubic m³ water, with a surface four times as large as that of the lake Velencei-tó. The Kisköre Reservoir, in the framework of a complex water utilization, will undertake the tasks

of recreation (bathing, water sports, relaxation), irrigation, procuring for drinking-water (MÁTRAI 1969, 1973). The regular hygienic investigation of the river seems therefore to be justified, for taking a right view of the possible utilization and for determining the degree, place and origin of pollution.

Materials and Methods

In 1975, we took 154 water samples from the stretch in question of the Tisza, for bacteriological investigations. The samples originate from the line of current, resp. in Tokaj, Leninváros, Tiszafüred, and Kisköre we investigated the transverse profile, as well. On the occasion of the field-survey, we put on record the water-level, the meteorological data, the polluting sources along the riverside. At moulding the longitudinal section, the speed of flowing was also taken into consideration. Our sampling sites are shown in Fig.1.
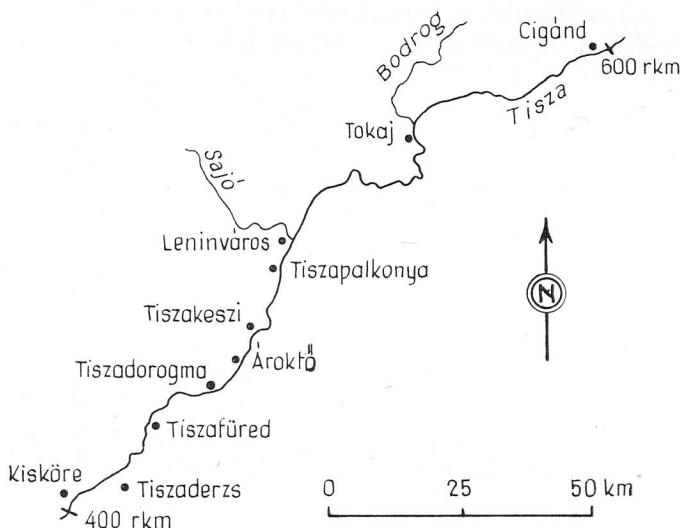

Fig. 1. Sampling places in the 200 km longitudinal section of the Tisza.

In the course of the laboratory investigations we have determined the coliform number indicating water pollution, the number of bacteria growing at 37 °C, the number of *Streptococcus faecalis*, the *Clostridium* number, and have performed the investigation of pathogenic bacteria *(Salmonella, Shigella)*, referring to an infection. For the bacteriological analysis we have followed the guidance of the special literature (MSZ.22.901-71), and other texts (DEÁK 1970, DAUBNER 1972, WHO 1968, APHA 1965). In this paper, apart of our results will be outlined.

Results

The change in the coliform number indicating the pollution of surface waters has been plotted in the longitudinal section of the Tisza, with the average results of the year 1975 (Fig. 2). For qualifying the water, we took into consideration, the suggestions of the Plan of Sectoral Normalization (Eü.M.—OVSZ, 1972) (Tabl. 1). On the basis of this, at Cigánd the quality of water is "a little polluted" — "polluted", while in the district of Tokaj the surface water is considerably worse, "polluted". Below Leninváros — perhaps owing to the decrease in the pollution of the Sajó

(VÁNCSA 1975) — the quality is better. Lower, in the reaches between Tiszafüred and Kisköre, a similar improvement may be observed.

In Fig. 3, we are showing the absolute values of the coliform number — in three sampling sites — also taken as a function of the water output. The water output seems to be in inverse ratio to the value of the coliform number. The large water output is joined to low or not changing pollution, and the other way round: in drier periods the quality of the water deteriorates. In this way, within the bacterial pollution, we have to reckon with an increase in the number of coliforms primarily at low water. We don't specify here the bacteriological parameters investigated, mentioning only
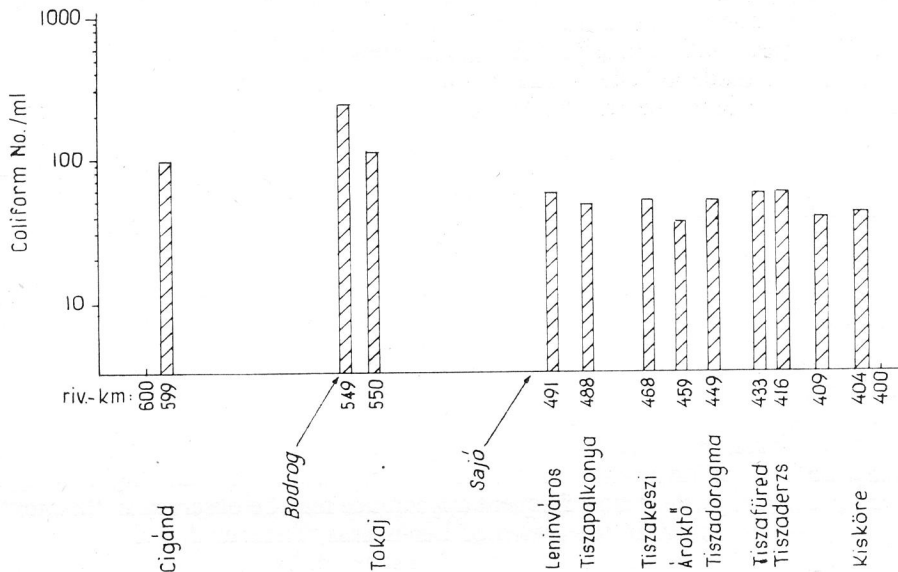

Fig. 2. Change in the coliform number in 1975, in the longitudinal section of the Tisza between Cigánd and Kisköre.
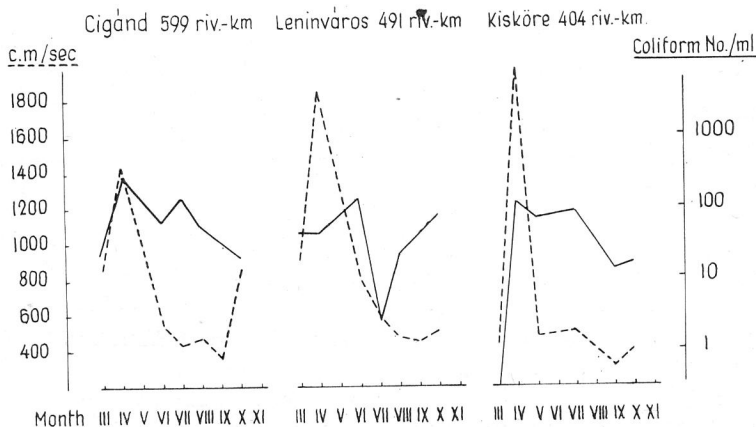

Fig. 3. Absolute values of the caliform number, as a function of the water-output.

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that the number of bacteria which grow at 37 °C, was showing favourable values in the whole Borsod stretch of the Tisza.

In the reaches between Tiszafüred and Kisköre, we got higher values first of all at high water, and later in the initial period of the recession following that (order of magnitude: 100,000). This may be evaluated as a result of the surface runoff.

The *Streptococcus* faecal number changed between 0 and 32/ml, giving proof of an averagely polluted water. Its change in time and space followed the coliform number. The older *Clostridium* number showing massive pollution remained generally low (0—54/40 ml). Some pathogenic bacteria were isolated from any sampling points of the Tisza. The rate of occurrence, in the Borsod stretch, reached 50 per cent of samples, in the Heves stretch, this rate diminished to 22 per cent. It is a good thing that, advancing from Leninváros to Kisköre, the percentage of the pathogenic agents decreases, making possible the more favourable utilization of water. The water of the Tisza is made infectious by the isolated *Salmonella* and *Shigella bacteria*, its utilization as drinking-water, bathing-water, irrigation-water demands, therefore,

Tabl. 1. *Suggestion of the Plan of Sectoral Normalization (Eü.M.-OVSz, 1972) for the bacteriological qualification*

	coliform number/1 ml	bacterial number 37 °C/1 ml
Class I "clear"	0—10	0—2000
Class II "a little polluted"	10—100	2 000—10 000
Class III "polluted"	100—1000	. 10 000—
Class IV "strongly polluted"	1000—	

some more increased attention and supervision. Between the appearance of the pathogenic bacteria and water output no connection was found. They live in the water almost always, their most frequent appearance may be observed in the months of October—November. In the region of Leninváros, Tiszafüred, and Kisköre, the whole transverse profile of the Tisza was investigated. We have established that at Tokaj there is no essential difference between the single profiles as regards the quality of water. At Leninváros, the profile of the Tisza on the right is unequivocally more polluted than the line of current and the left riverside — what can be explained with the inflow of the Sajó and of refuse waters. In the section investigated at the highway bridge at Tiszafüred, the point in the right proved to be more polluted bacterially, although there is no polluting source at the riverside. On the basis of the average results, the bacteriological picture is favourable at all the three points of the Kisköre section, proving the self-purification of the river. It is interesting that, in the 200 km river-stretch investigated, we have succeeded just here in isolating, on one occasion, a *Shigella flexner* strain. To find the origin of this, we shall perform a large number of further investigations.

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