

USING EXAMINATIONS OF YOUNG BLACK-HEADED GULLS (*LARUS RIDIBUNDUS*) FOR THE DETECTION OF SALMONELLAE IN THE ENVIRONMENT

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Abstract

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During June 1991, cloacal smears from nestlings and chicks of black-headed gull (*Larus ridibundus*) of the nesting colonies in the middle reservoir of the water system Nové Mlýny (Břeclav district) were examined for the presence of salmonellae. On 13 June 1991, 96 young gulls were examined and salmonellae were found in 20 gulls (i. e. 20.83 %), the serotypes being *Salmonella typhimurium* and *S. derby*. On 25 June 1991, 171 juvenile gulls were examined and salmonellae were found in 63, i. e. 36.84 % (*S. typhimurium*, *S. enteritidis*, *S. agona*, *S. montevideo*, *S. derby*, *S. hadar*, *S. infantis* and *S. abony*). On 16 May 1991, 79 eggs of black-headed gulls from the same colony were examined and no salmonellae were found.

It was proved that the water flowing into the reservoir from the river Jihlava and river Svratka in June 1991 was contaminated with salmonellae (i. e. *S. typhimurium*, *S. montevideo*).

Examinations of the juvenile black-headed gulls can be used for the detection of the occurrence of salmonellae in the water.

Salmonellae, black-headed gull (Larus ridibundus), eggs, nestlings, chicks, water

Analyses of the occurrence of epidemiological and epizootological alimentary infections and intoxication have shown that the situation has considerably changed over the recent 10 years. In the Czech Republic, the incidence of salmonellosis in the human and farm animal populations has increased rapidly, *Salmonella enteritidis* being the main source of epidemics (Dědičová et al. 1990; Šrámková et al. 1991). The main source of salmonellae is the intestinal tract of sick people and animals. The salmonellae there find favourable conditions for reproduction and through the faeces they get out into the environment. Due to their tenacity and rapid adaptability they find convenient living conditions, particularly in biological refuse. Consequently, they can be found in sewage water from municipal agglomerations, from slaughter-houses, from farm buildings, and also in surface waters (Reilly et al. 1981; Johnston et al. 1986; Komínková and Blatný 1987).

We tried to find out how the contamination of surface water would affect the incidence of salmonellae in populations of wild birds. The black-headed gulls (*Larus ridibundus*) were chosen as a model species because they are very numerous, partly synantrophic, and they are in immediate contact with the water.

In Czechoslovakia, Šerý and Strauss (1957) drew attention to the incidence of salmonellosis in a colony of black-headed gulls. They isolated *S. typhimurium* in 77 % of clinically ill and dead gulls. Literák and Kraml (1985) examined cloacal smears from 23 flying black-headed gulls of the Heřmanický pond near Ostrava. In one case they isolated *S. typhimurium*. Čížek (1990) dealt with the incidence of salmonellae in black-headed gulls, he examined 502 birds from various localities and he isolated 8 serotypes of salmonellae in 12.5 %.

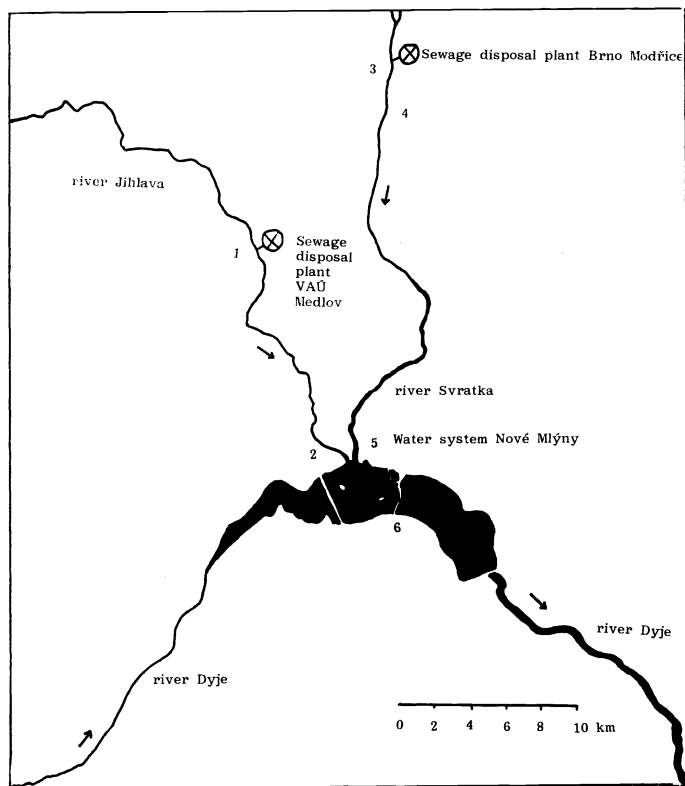


Fig. 1. Illustration of rivers in investigated regions 1–6 where salmonellae were found in the water in June 1991.

Abroad, it was namely Coulson et al. (1983) and Fricker (1984) who studied the incidence of salmonellae in black-headed gulls. Coulson et al. (1983) examined 416 birds and in 2.9 % their findings were positive. Fricker (1984) examined 1 080 birds and in 17.7 % he found 10 serotypes of salmonellae.

Further literary data refer to salmonellae in other species of gulls where the percentage of positive findings differed in dependence on the age of the gulls and type of feed (e. g. Williams et al. 1976; Edel et al. 1976; Fenlon 1981; Coulson et al. 1983; Butterfield et al. 1983; Monaghan et al. 1985; Glunder et al. 1991).

Brand et al. (1988) studied the causes of mortality of gulls. In groups of 99 and 96 specimens consisting of 4 species of gulls, he indicated salmonellosis as being the cause of mortality or disease in 10 and 5 cases, respectively.

Materials and Methods

The black-headed gulls were investigated and sampled for the occurrence of salmonellae in the middle water reservoir of the Nové Mlýny waterworks in the Břeclav district (Fig. 1). The reservoirs are built on the Dyje river below the Pálava Hills. The rivers Jihlava and Svatka which, with the river Dyje, collect most of the water of South Moravia, flow into the middle reservoir. The area of the middle reservoir is 1 031 ha, and the average depth is 3.4 m.

In 1991, it was found that about 20,000 pairs of black-headed gulls nested on the islets of the middle reservoir. The birds nested in two similar colonies. One colony was on the islets in the place of what once was the village Mušov and the other on the islets near Dolní Věstonice. Adult

birds which were not nesting were found in the reservoir along with the nesting birds and the young ones.

During the nesting period in 1991, the range of movements of the gulls was studied in 4 stable lines oriented to the four cardinal points. The length of one line was approximately 20 km. Nearly all the adult gulls moved to their feeding sites within a radius of 15 km of the breeding colony. Longer distances were rare and, in essence, eliminated the possibility of nesting. It is a well-known fact that birds flying longer distances from the colony, use the colony only overnight during nesting.

From the breeding colony near Dolní Věstonice, samples were taken and examined of 79 eggs on 16 May 1991, 96 cloacal smears from young birds not yet flying on 13 June 1991, and 171 cloacal smears from other not flying birds on 25 June 1991.

Using cotton swabs exposed for several days, waste water from the expected sources of contamination of the river was sampled in June 1991. Samples of water were taken of water discharged into the Svatka river after being cleaned in the sewage treatment plant in Brno-Modřice, and into the Jihlava river from the sewage treatment plant of the veterinary decontamination institute.

Using the same cotton swabs, samples were taken from the Svatka river near Rajhrad, from the Svatka and Jihlava rivers near the inflow into the Nové Mlýny reservoir, and from the Dyje river after passage through the dike between the middle and lower reservoirs of the Nové Mlýny waterworks near Dolní Věstonice.

Isolation and identification of salmonellae

Immediately after sampling, the cloacal smears were placed into test tubes with 5 ml of buffered peptone water (BPW), transferred to the laboratory and incubated at 37 °C for 16–20 hours. The inoculum from the BPW of a volume of 20 µl was transferred to Rappaport's medium (Rappaport et al. 1956) for selective incubation. After 24 and 48 hours of incubation at 37 °C, the samples were inoculated on XLD agar (Imuna, Šarišské Michařany) and incubated here for 24 hours at 37 °C. The suspect colonies of salmonellae were sub-cultivated on Hain's agar (Imuna, Šarišské Michařany) and identified by the biochemical microtests Enterotest I and II (Lachema, Brno). Salmonella antisera (Imuna, Šarišské Michařany) were used for serological identification. Samples of sewage and surface water were elaborated in the same way, the only difference being that the samples were incubated in 225 ml of BPW.

Results

On 16 May 1991, 79 eggs of black-headed gulls were examined and no salmonellae were found.

Tab. 1 shows the results of examinations of young black-headed gulls performed on 13 June 1991 and 25 June 1991. Among the investigated groups a statistically highly significant difference was found ($\chi^2 = 73.05$, $P < 0.001$).

The occurrence of salmonellae in sewage water after discharging into the reservoirs, and in the water of the rivers Jihlava, Svatka and Dyje in June 1991 was as follows:

- | | | |
|---|------------------------|-----------------------|
| 1) sewage water, Medlov | (sampling 1 June 1991) | <i>S. montevideo</i> |
| 2) Jihlava river entering the Nové Mlýny waterworks | (25. June 1991) | <i>S. typhimurium</i> |
| 3) sewage water, Brno-Modřice | (6. June 1991) | <i>S. montevideo</i> |
| 4) Svatka river, Rajhrad | (25. June 1991) | <i>S. montevideo</i> |
| 5) Svatka river entering the Nové Mlýny waterworks | (13. June 1991) | <i>S. typhimurium</i> |
| 6) Dyje river, Dolní Věstonice — dike | (24. June 1991) | <i>S. typhimurium</i> |

Discussion

The percentage of occurrence of salmonellae in the young black-headed gulls from the nesting colony in the middle reservoir of Nové Mlýny is consi-

Table 1

Isolation of salmonellae from young black-headed gulls (*Larus ridibundus*) from a nesting colony on the Nové Mlýny waterworks (Břeclav district)

Date of examination	13. 6. 1991	25. 6. 1991
Number of birds examined	96	171
Salmonellae not found	76	108
<i>Salmonella typhimurium</i>	10	38
<i>S. derby</i>	10	3
<i>S. enteritidis</i>	—	7
<i>S. agona</i>	—	5
<i>S. montevideo</i>	—	4
<i>S. berta</i>	—	2
<i>S. hadar</i>	—	1
<i>S. infantis</i>	—	1
<i>S. abony</i>	—	1
<i>S. typhimurium</i> and <i>S. enteritidis</i>	—	1
Proportion of birds with salmonellae	20.83 %	36.84 %

dered to be very high. The contamination of surface water from the assumed sources, which are probably supplemented by others, less important, down to the large area of Nové Mlýny is extremely important in terms of epidemiology and epizootiology. The water of these relatively shallow reservoirs contains a great amount of organic impurities and in the summer provides an ideal environment for the survival of salmonellae and obviously also for their reproduction.

In previous studies the opinion prevailed that gulls are infected with salmonellae from various refuse, they become vectors of salmonellae and contribute to their circulation in the environment (Fenlon et al. 1974; Edel et al. 1978; Benton et al. 1983).

If we analyze the obtained facts, we come to the conclusion that it could also be the other way round, i. e. that the salmonellae-contaminated water could be the cause of frequent findings of salmonellae particularly in the young gulls. Nesting gulls fly to feed within a range of 15 km where waste of animal origin does not occur in larger quantities. During nesting, 85 % of the food of the gulls consist of animal components (fish, worms, insects, mammals) and 11 % of plant components, the remaining part being various mineral and unidentified components (Kondělka 1969). Despite the fact that the volume of the food is relatively large, the daily consumption of food per one bird is 54.78 g (Stadie 1929), the source of salmonellae in young gulls is probably not the food. Neither does ovarian transfer play a more important role, as the negative results of examinations of eggs from the studied colony showed. It is true that some of the gulls from the colony who are not nesting fly to feed on rubbish tips or larger sewage disposal plants etc., situated farther away, however, their contact with the young gulls is not immediate.

Therefore, the most probable source of infection of the chicks is the polluted water in the colony. In spite of Fenlon (1981) stating that the concentration of salmonellae in waste water is low and cannot allegedly provide the sufficient dose of infection, it is necessary to take into account the well-known fact that the young are much more sensitive to salmonellae infection than the adult birds.

The fact that salmonellae of 7 serotypes were found in 57 out of 377 young black-headed gulls (i. e. 15.1 %) examined in 1984—1986 in the colony on the pond near Chropyně (Čížek 1990) proves that the high incidence of salmonellae

in these young gulls is not incidental or rare in the colony of the middle reservoir of the Nové Mlýny waterwork.

On the basis of the present investigations it is not possible to determine what is the relationship between the incidence of salmonellae in gulls and the occurrence of salmonellosis in them, expressed, for instance, in the proportion of losses in the population. Findings of salmonellosis in gulls, however, have been described (Šerý and Strauss 1957; Brand et al. 1988).

The effect of various interactions of pathogens on the incidence of salmonellae and salmonellosis in gulls has not been explained either. Botulism in water birds in the middle reservoir of the Nové Mlýny waterwork has recently been found quite regularly during the summer season. Chytil (1990) described an extensive epizootic there in 1990. In the present study, in samplings from 25 June 1990, we also found a sporadic occurrence of clinical symptoms of botulotoxin poisoning in black-headed gulls.

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Využití vyšetření mláďat racka chechtavého (*Larus ridibundus*) k detekci salmonel v prostředí

Během června 1991 byly vyšetřeny na přítomnost salmonel kloakální výtěry mláďat racka chechtavého (*Larus ridibundus*) z hnízdní kolonie na prostřední nádrži vodního díla Nové Mlýny (okr. Břeclav). Dne 13. 6. 1991 bylo vyšetřeno 96 mláďat a salmonely zjištěny u 20 (20,83 %) jedinců (sérotypy *Salmonella typhimurium*, *S. derby*); 25. 6. 1991 bylo vyšetřeno 171 mláďat a salmonely zjištěny u 63 (36,84 %) jedinců (*S. typhimurium*, *S. enteritidis*, *S. agona*, *S. montevideo*, *S. derby*, *S. berta*, *S. hadar*, *S. infantis*, *S. abony*). Při vyšetření 79 vajec racků chechtavých z 16. 5. 1991 ze stejné kolonie nebyly salmonely zjištěny.

Bylo prokázáno, že voda, která přitékala v červnu 1991 do nádrže řekou Jihlavou i řekou Svratkou byla kontaminována salmonelami (*S. typhimurium*, *S. montevideo*).

Vyšetření mláďat racků chechtavých může být použito k detekci výskytu salmonel ve vodním prostředí.

Использование исследований птенцов чайки (*Larus ridibundus*) для определения салмонелл в окружающей среде

В течение июня 1991 г. проводили исследования клоачных мазков чайки (*Larus ridibundus*) с целью выявления салмонелл в окружающей среде гнездования гидросооружения Нове-Млины (район Бржецлав). Исследования 96 птенцов проводили 13-го июня 1991 г. и салмонеллы были выявлены у 20 (20,83 %) особей (серотипы *Salmonella typhimurium*, *S. derby*); 25-го июня 1991 г. исследовали 171 птенца и у 63 особей (36,84 %) установили салмонеллы (*S. typhimurium*, *S. enteritidis*, *S. agona*, *S. montevideo*, *S. derby*, *S. berta*, *S. hadar*, *S. infantis*, *S. abo-*

ny). В ходе исследования 79 яиц чаек, проводимого 16-го мая 1991 г. на одинаковом гнездовании салмонеллы не были выявлены.

Было установлено, что поступающая в гидросооружения в июне 1991 г. вода рекой Йиглавой и пекой Свраткой была заражена салмонеллами (*S. typhimurium*, *S. montevideo*).

Исследования птенцов чаек можно использовать для определения салмонелл в воде.

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