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Salmonella enterica Serotype Typhimurium Infection Causing Mortality in Eurasian Tree Sparrows (*Passer montanus*) in Hokkaido

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From December, 2005, dead sparrows were observed frequently in Hokkaido, Japan. By July 28, 2006, 1,517 cases had been reported (Table 1). They were observed in a wide area of Hokkaido, primarily in Asahikawa City (Hokkaido Government publication). Several organizations investigated these sparrow deaths, but the cause has not yet been determined. We conducted a study in which 15 dead sparrows found in the area of extensive mortality were examined pathologically and microbiologically. Based on the results, we inferred that mortality was due to an epidemic caused by *Salmonella enterica* serotype Typhimurium DT40. It was the first time this serotype has been identified in Japan. This report outlines our study and findings.

We examined 15 dead sparrows found in various locations in Hokkaido: Noboribetsu City (two sparrows), Asahikawa City (six), Otaru City (three) and Sapporo City (four). Of these, the eight sparrows from Noboribetsu and Asahikawa had been decomposing for some time, so they were immediately frozen for preservation. A standard pathological examination was conducted on all sparrows. The crop, liver, spleen and intestine were tested for general bacteria and *Salmonella*. The strains identified as *Salmonella* were isolated and their serotypes and phage types were determined. Drug suscep-

tibility testing and genetic testing by means of pulsed-field gel electrophoresis (PFGE) (Fig.1) and random amplified polymorphic DNA (RAPD) analysis were also conducted.

Ingluvitis, splenomegaly, hepatomegaly and the formation of white nodules were observed in the two Noboribetsu sparrows, one Asahikawa sparrow, the three Otaru sparrows and two Sapporo sparrows (Fig. 2). A characteristic finding in these birds was bacterial and necrotic ingluvitis. Colonies of Gram-negative bacilli and necrotic lesions were observed

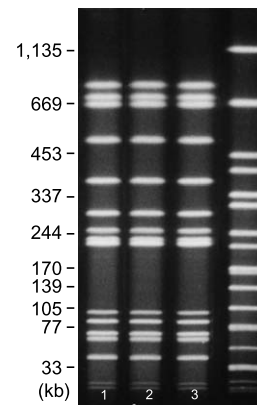


Fig. 1. *Xba*I-digested PFGE patterns of *Salmonella* Typhimurium isolated from sparrow crop samples. Lane 1, Noboribetsu 1; lane 2, Noboribetsu 2; lane 3, Asahikawa; lane 4, a molecular size marker (*S. Braenderup* H9812 digested with *Xba*I).

Table 1. Number of sparrow deaths by subprefecture in Hokkaido

| Branch office | No. of incidents reported | No. of carcasses |
|---------------|---------------------------|------------------|
| Ishikari | 153 | 404 |
| Osima | 12 | 7 |
| Hiyama | 3 | 3 |
| Siribesi | 43 | 70 |
| Sorati | 23 | 51 |
| Kamikawa | 203 | 717 |
| Rumoi | 13 | 35 |
| Souya | 5 | 5 |
| Abasiri | 7 | 10 |
| Iburi | 104 | 190 |
| Hidaka | 1 | 1 |
| Tokati | 10 | 13 |
| Kusiro | 14 | 9 |
| Nemuro | 2 | 2 |
| Total | 593 | 1,517 |

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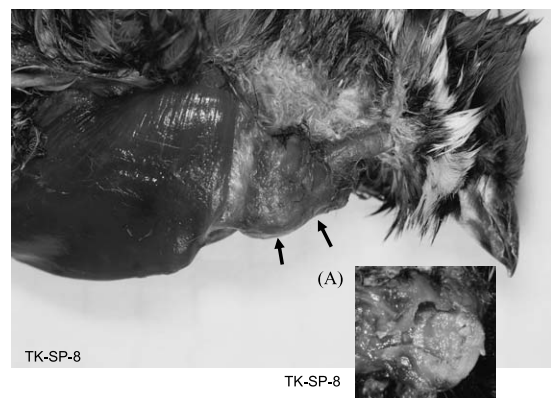


Fig. 2. Sparrow with necrosis of crop indicated by arrowheads. (A) A cutaway picture of the crop. The wall of the crop was extensively enlarged.

in visceral organs. These bacteria were found positive in an immunostaining assay using *Salmonella* O4 antiserum. *Salmonella* were isolated from organs in all sparrows except five from Asahikawa, and the strain was identified as Typhimurium. The isolated *S. Typhimurium* showed a very weak reaction in a catalase test and was negative for citrate utilization. The phage type was DT40, and the antibiotic resistance profiles and PFGE and RAPD patterns were almost the same in all isolates, suggesting a single origin.

Extensive mortality due to *S. Typhimurium* in wild birds such as finches and house sparrows (*Passer domesticus*) has been reported in Europe, North America and New Zealand, and *S. Typhimurium* is attracting attention as the cause of drastic reductions in the populations of these species (1-5).

Hepatomegaly, splenomegaly and the formation of white nodules have been observed frequently in finches infected with *S. Typhimurium*, with a pathognomonic finding of ingluvitis (4,6,11). These findings match our own. Even though the population we analyzed was small, we inferred that *S. Typhimurium* caused the extensive mortality in sparrows in Hokkaido, especially as many of the abovementioned epizootics also occurred in winter.

In New Zealand, there was a mass outbreak of *S. Typhimurium* infection in humans at the same time as mortality in house sparrows was observed, and house sparrows were thought to be the source of the infection in humans (4,6).

In addition, death due to *S. Typhimurium* originating from house sparrows was observed in ducks and quails; hence, there is concern that it could spread to livestock. *S. Typhimurium* infection requires extreme vigilance from the viewpoints of public health, animal health and the preservation of species. The phage type of *S. Typhimurium* isolated in this study was DT40, which has been significantly associated with mortality in Norway, North America and the United Kingdom (1,2,7-9). DT40 had not been detected previously in animals or humans in Japan (10, Izumiya, H., unpublished data), and it is not known when or how it entered this country.

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