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Salmonella serotypes isolated from tortoises and frogs in Istanbul

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SUMMARY

The incidence of *Salmonella* in tortoises and frogs captured in Istanbul was studied. From 31 out of 40 tortoises (77·5%) and from 16 out of 311 frogs (5·1%) salmonella strains belonging to 18 and 14 serotypes respectively were isolated.

INTRODUCTION

There are several reports on the isolation of *Salmonella* serotypes from cold-blooded animals. Although many articles concern the salmonella strains in tortoises, snakes and lizards (LeMinor, Fife & Edwards, 1958; Özek, Çetin, Anğ & Töreci, 1965; de Hammel & McInnes, 1971), there are only a few reports on the presence of salmonellas in frogs (Pantaléon & Rosset, 1964; Desmet-Paix, Lambion, Van Oye & Veslemans, 1968; Özek *et al.* 1969). The present paper records the serotypes and incidence of salmonellas in tortoises and frogs captured in the suburbs of Istanbul.

MATERIALS AND METHODS

The stools obtained every day from each of the 40 tortoises, which were kept separately in isolated boxes, were cultured.

Liver, spleen, heart, kidney, leg muscles and intestinal contents of each of 311 frogs were examined separately for the presence of salmonella strains. The frogs, under ether narcosis, were fixed on sterile wooden plates. After cleaning the skin with alcohol, the frogs were dissected with sterile tools. The above mentioned parts of the body were removed, cut into small pieces and inoculated into tubes containing Mueller–Kaufmann and selenite F broths. After 48 hr. incubation subcultures were made on Endo and deoxycholate citrate media. The identification of suspected colonies on these media was carried out with the usual bacteriological and serological techniques.

RESULTS

From 31 out of 40 tortoises (77·5%) 17 *Salmonella* serotypes and two *Arizona* strains were grown. Table 1 shows the distribution of these among the tortoises. Four different serotypes were grown from each of two tortoises, three serotypes (one an *Arizona* type) from one, and two serotypes (one *Arizona*) from 17 tortoises.

Eighteen of the 31 tortoises from which different salmonella serotypes were

Table 1. Salmonella *serotypes isolated from tortoises*

Tortoise no.	*S. abony*	*S. abortus bovis*	*S. arizona*	*S. boecker*	*S. canastel*	*S. charity*	*S. clifton*	*S. halle*	*S. hermannsverder*	*S. hofit*	*S. kvittingfoss*	*S. irumu*	*S. java*	*S. kottbus*	*S. mikawasima*	*S. nashua*	*S. potsdam*	*S. sofia*
1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
4	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
5	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.
6	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	+	+	.
7	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
8	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
9	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.
10	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
11	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.
12	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+
13	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
14	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
15	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
16	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
17	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
18	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
19	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
22	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
23	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
26	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
27	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
28	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
29	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.
30	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
31	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
32	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
33	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.
35	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
37	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.

isolated in our investigation were dissected under ether anaesthesia and their bloods were taken. Autopsies were performed and cultures were made from their blood and organs. The media into which their blood and interior organs were added remained sterile.

From 16 out of 311 frogs (5·1 %) 15 *Salmonella* strains belonging to eleven serotypes, and three *Arizona* serotypes, one of each, were grown. The distribution of these in the organs of individual frogs is shown in Table 2.

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Table 2. Salmonella *serotypes isolated from frogs and their sites of isolation*

Frog no.	Site of isolation	Salmonella serotype
17	Liver	*S. bovis-morbificans*
48	Liver	*S. arizona* (47:c:e, n, x, z_{15})
112	Liver	*S. newport*
113	Liver and leg muscles	*S. newport*
118	Liver	*S. arizona* (61:r:z_{53})
120	Leg muscles and intestinal contents	*S. hvittingfoss*
153	Intestinal contents	*S. abony* var. *haifa*
154	Liver	*S. abony*, *S. kottbus*, *S. istanbul*
159	Liver	*S. abony* var. *haifa*
164	Liver	*S. arizona* (61:i:z_{53})
196	Liver	*S. mikawasima*
204	Liver	*S. hofit*
232	Liver	*S. richmond*
235	Liver	*S. boecker*
241	Liver	*S. hofit*
267	Liver	*S. kottbus*

DISCUSSION

Salmonella serotypes were first encountered in tortoises in 1946 (Boycott, Taylor & Douglas, 1953). A number of authors stress the potential importance of tortoises namely pet turtles as carriers of salmonellas. All kinds of tortoises are not salmonella carriers in the same proportion. For example, Vincent, Neel & LeMinor (1960) found the incidence to be 78 % among the *Testuda graeca* captured in Maroc, Dimow, Wesselinof & Rohde (1961) 56 % among tortoises in Bulgaria, and Bövre & Sandbu (1959) 81·8 % in Norway among the tortoises brought from the Mediterranian countries.

The presence of salmonellas in frogs was established by some reports (Pantaléon & Rosset, 1964; Desmet-Paix *et al.* 1968). This finding may be especially important for human health in countries where frog meat is consumed. In Canada, several Salmonella serotypes were isolated from imported and native frogs legs. In France Pantaléon & Rosset (1964) found 31 out of 164 specimens of imported frog muscles to contain one or two of 13 different serotypes. Of these, *S. newport* and *S. hvittingfoss* were also encountered in our study. In the present work, the specimens were taken from each living animal to gain an accurate opinion about the percentage of salmonella organisms in frogs. This also prevented contamination from other sources which might occur in the course of the preparation of frogs' leg muscles as canned food, which were investigated by other authors. Sixteen of 311 frogs (5·1 %) were found to contain salmonella strains. One of the frogs had three serotypes in the liver. In two frogs, two different specimens gave positive cultures for the same serotypes. The presence of salmonella strains only in the liver in thirteen instances suggests that the first organ to be examined is the liver, but the reason for this finding is obscure.

Nearly all of the *Salmonella* serotypes isolated from tortoises and frogs in this study were encountered in Turkey for the first time.

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