SALMONELLA AND ARIZONA INFECTIONS IN REPTILES IN THE NETHERLANDS

by

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Salmonella and Arizona are closely related groups of Enterobacteriaceae. It is, therefore, understandable that CALDWELL and REYERSON (1939) when for the first time they isolated from a Gila monster (Heloderma suspectum) and a Chuckawalla (Sauromalus ater) a micro-organism that later appeared to be an Arizona, proposed the name Salmonella dar-es-salaam, var. arizona, on account of the liquefaction of gelatin, which also occurs in S. dar-es-salaam. Later, KAUFFMANN (1941) called this organism S. arizona. CALDWELL and REYERSON observed fermentation of lactose and liquefaction of gelatin, which still form the biochemical basis of the differentiation between the Arizona and the Salmonella groups.

The identification of the various serotypes in the Arizona group is mainly the work of EDWARDS and his co-workers (EDWARDS et al., 1943, 1947, 1956a, 1959; PELOFFO et al., 1942; LE MINOR et al., 1958).

In America, Arizona bacteria have so far most frequently been isolated from turkeys, hens and eggs. However, they have repeatedly been found in patients with intestinal disorders, without other pathogenic bacteria being demonstrable (EDWARDS, 1945; MURPHY and MORRIS, 1950). In a study carried out by EDWARDS, McWORTER and FIFE (1956b) on 87 cultures isolated from man, the high percentage of isolations from the blood of patients leads to the conclusion that Arizona infections in man are at least as serious as, if not more so than Salmonella infections. The findings of HINSHAW and MCNEIL (1944, 1946) show that Arizona bacteria may be pathogenic for reptiles.
The *Arizona* group is characterized by the following qualities: Gram-negative, motile rods, which produce acid and gas from glucose. They produce H₂S, ferment lactose in a longer or shorter time, while gelatin is liquefied – though often slowly. Due to their definite serological relationship with *Salmonella* O and H antigens, most cultures show a positive agglutination with polyvalent *Salmonella* serum. A study on snakes, by Le Minor, Fife and Edwards (1958) revealed that a high percentage of the *Arizona* bacteria show fermentation of lactose in 24 hours, combined with gas formation; 20.8% of the strains isolated by them produce indole; 3.6% ferment saccharose, and 1% grow in the KCN medium. They used in their investigation the lysine-decarboxylase test to distinguish *Escherichia freundii* from the urea-negative, H₂S-positive, motile cultures.

**Personal investigations.**

In connection with a study on the cause of death of captive animals in the Netherlands, approximately 200 reptiles have been autopsied in the past two years. Material from the liver, heart and intestine of the vast majority of these animals was smeared on brilliant-green-phenol-red agar plates. The lactose-negative colonies and those which slowly ferment lactose were further examined. When pure cultures had been obtained these were inoculated into glucose, sucrose, lactose, dulcitol and often into sorbitol, and the motility, indole formation, H₂S production and urea fermentation were also studied. Afterwards Leifson's malonate medium was added. This compound is not fermented by *Salmonella*, in contrast to the positive action by *Arizona* and *Hafnia*. The two latter species can be differentiated on the ground of the lactose fermentation and the gelatin liquefaction of the *Arizona* group.

The isolated strains were sent to the Laboratory for Zoonoses and Pathological Anatomy of the National Institute of Public Health, Utrecht for determination.

Using the above-mentioned method, a number of *Arizona* types were isolated. Their characteristics are presented in Table 1.

The strain from the last-mentioned rattlesnake (*Crotalus terrificus*) was found to be a new serotype.

Besides *Arizona* bacteria, *Salmonella* were isolated from several of the reptiles examined.

A striking feature was that, apart from *S. typhimurium*, various types were found that are very rarely observed in the Netherlands.