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NOTES ON SALMONELLAE ISOLATED FROM WILDLIFE IN KANO ZOOLOGICAL GARDENS

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Abstract: Fourteen strains of *Salmonellae* were cultured from sick and dead zoo animals and birds in the Zoological Gardens in Kano Nigeria.

INTRODUCTION

Reports on Salmonella in African Wildgame are very rare.[6] In Nigeria, few reports are available for Salmonellosis in wildlife. Collard and Montefiore[2] found the Agama lizards *(Agama agama)* but not gekkoes *(Coleonyx variegatus)* to be good reservoirs of some Salmonellae species. Some strains of Salmonellae were isolated also from rats *(Rattus rattus)*.[3]

Between January, 1974 and December, 1975 a variety of morbid specimens including carcasses and faecal samples of captive wild animals and birds in the Kano State Zoological Gardens were examined for Salmonellae in our laboratory. This paper reports the Salmonellae serotypes isolated from the specimens during the two year period.

MATERIALS AND METHODS

Kano State Zoological Gardens cover a total area of about 40.47 ha and lies just outside this ancient city. A large variety of animals and birds, some imported from East Africa, have lived here since November, 1972 when the zoo was first opened. About 300 animals and birds of 43 different species live in large wire enclosures set among trees. The animal population also includes orphans brought in from all over Nigeria and donated to the Gardens. The animal and bird specimens examined are given in Table 1.

Faecal samples collected from various animal species (Table 1) with clinical signs of diarrhea and lethargy were submitted to our laboratory for examination.

Systemic organs and intestinal contents of carcasses showing lesions suggestive of septicaemia and enteritis at necropsy were collected for examination.

Whole carcasses of various captive wild birds submitted by the Zoo were examined at necropsy and organs were sampled for examination.

Primary isolations were obtained by inoculating about a 2 g faecal sample contents from a small intestinal segment into 10 ml selenite broth (SF). Heart blood, bile and small samples of systemic organs, (notably liver, and ovaries in case of birds), were directly cultured on brilliant green agar (BGA), MacConkey Agar (MCA) and desoxycholate citrate agar (DCA). Cultures were incubated for 24-48 h at 37 C followed by subculture from SF onto DCA and BGA plates. After incubation of the plates at 37 C for 18 h, colonies resembling salmonellae were subcultured into MacConkey agar medium. Non-lactose fermenting colonies on MCA were then inoculated in peptone water, incubated for about 5 h and then tested for motility by the hanging drop technique.[4]

Biochemical tests,[5] were carried out for fermentation of glucose, sucrose, lactose, dulcitol, salicin and mannitol, and also for the formation of indole. Slide agglutination tests were carried out us-

ing polyvalent somatic antiserum, polyvalent specific and non-specific flagellar antisera.[7] The isolates which appeared to be salmonellae were freeze dried and sent to Dr. B. Rowe of the Salmonella and Shigella Reference Laboratory, Colindale, U.K. for confirmation and serotyping.

TABLE 1. Carcasses and faeces examined in the Zoological Gardens.

Animal/Birds	No. of Specimens examined**
Miscellaneous	
*Kangaroo *(Marcropus rufus)*	6C, 135F
*Zebra *(Equus burchelli)*	2C, 6F
*Eland *(Taurotragus oryx)*	1C, 30F
*Giraffee *(Giraffa c. trippelskirchi)*	1C, 9F
Hippopotamus *(Choeropsis liberiensis)*	19F
Galago *(Galago d. demidovii)*	2C, 12F
Porcupine *(Hystrix cristata)*	50F
Rhinocerus *(Diceros bicornis)*	12F
Warthog *(Phacochoerus aethiopicus)*	10F
Antelopes	
Bush Buck *(Tragelaphus scriptus scriptus)*	70F
Grants Gazelle *(Gazelle granti)*	20F
Thomson's Gazelle *(Gazelle thomsonii)*	16F
Impala *(Aepyceros melampus)*	40F
Oribi *(Ourebia ourebi)*	24F
Cats	
Carcal *(Felis caracal)*	22F
Cheetah *(Acinonyx jubatus)*	12F
Civet *(Viverra civetta)*	15F
Genet *(Genetta tigrina)*	10F
Lion *(Leo panthera)*	20F
Hyaena *(Hyaena hyaena)*	40F
Leopard *(Panthera pardus)*	3F
Serval *(Felis serval)*	10F
Jackal *(Canis adustus)*	15F
Primates	
Baboon *(Papio anubis)*	30F
Chimpanzee *(Pan troglodytes)*	1C, 35F
Colonies *(Colobus abyssinicus)*	18F
Drill *(Papio leucophaeus)*	24F
Patas *(Erythrocebus P. patas)*	10F
Birds	
Ostrich *(Struthio camelus camelus)*	1C
Pelican *(Pelecanus rufescens)*	12C
Parrot *(Psittacus arithacus)*	2C
Flamingo *(Phoenicopterus rubus roseus)*	20C
Pigeon *(Columba guinea guinea)*	40C
Vulture *(Gyps ruppellii ruppellii)*	12C
Weaver bird *(Plesiositagra cuculatus)*	13C
Peacock *(Pavo cristatus)*	5C

*Exotic to Nigeria.
**F = Faeces; C = Carcass

RESULTS

Gross Pathology

Birds: The significant findings in the adult birds were congested lungs; enlarged, congested bronze livers and enteritis.

Mammals: Among the animals examined, a carcass of a young chimpanzee *(Pan troglodytes)* on post-mortem showed hemorrhagic ulcerative colitis. Most of the herbivores, especially zebras *(Equus burchelli)* and elands, *(Taurotragus oryx),* showed gastroenteritis, while kangaroos *(Marcropus rufus)* showed haemorrhagic enteritis and muscular dystrophy.

Bacteriology

The results of the isolation of *Salmonellae* from carcasses and other sources are given in Table 2. Fourteen isolates were identified. One of three *S. typhimurium* isolates was phage-typed as type (PT)U258 (DT)193 from a pigeon *(Columba guinea guinea)* liver, while two other *S. typhimurium* isolates also from pigeon livers consisted of a mixture of two phage types (i) type (PT)1a (DT)2 and (ii) type (PT)U40 (DT)99.

DISCUSSION

S. dublin, the most severe species for cattle was isolated from a giraffee *(Giraffa camelopardalis)* liver. *S. dublin* is rarely demonstrated in wild species, the only records available being from the fox *(Vulpes vulpes)* and rat.[8] Of 40 pigeons examined, three were carrying *S. typhimurium* and the phage types involved were (PT)U258 (DT)193 in one and a mixture of two phage types viz (PT)1a (DT)2 and type (PT)U40 (DT)99. While the significance, if any, of these particular phage types of *S. typhimurium* found is not known, it is reasonable to assume that septicaemic salmonellosis could be a potent cause of mortality in such flock. The isolation of *S. gallinarum, S. dublin, S. epicrates, S. durban, S. vejle, S. oranienburg, S. liverpool, S. elizabethville, S. rissen* and *S. chandans,* are now reported for the first time in captive zoo animals in this country.

Apparently it is rare for free-living wild primates to be infected at the time of capture but quickly become infected in captivity.[1] Of 117 primate feces examined only a sample from chimpanzee *(Pan troglodytes)* was positive for *S.*

TABLE 2. Salmonella serotypes isolated from zoo animals and birds.

	Animal Species/Specimens	Salmonella Serotype
Birds	Pigeon Liver	S. typhimurium
	"	"
	"	"
	Parrot small Intestine	S. give
	Peacock Liver	S. gallinarum
	Flamingo Faeces	S. apeyeme
	Pelican small Intestine	S. tilene
	Vulture Liver	S. gallinarum
Mammals	Gazelle small Intestine	S. epicrates
	Giraffee Liver	S. dublin
	Galago (Bush Baby) small Intestine	S. durban
	Kangaroo Liver	S. vejle
	Hyaena Feces	S. oranienburg
	Cheetah Feces	S. chandans
	"	S. rissen
	Lion Feces	S. vejle
	Chimpanzee	S. liverpool
	"	S. elizabethville

elizabethville. The other chimpanzee from whose small intestine *S. liverpool* was isolated had severe dysentery. The peacocks *(Pavo cristatus)* from which *S. gallinarum* was isolated showed progressive weakness and emaciation with whitish diarrhea. The flamingoes *(Phoenicopterus rubus roseus)* from which *S. epeyeme* was isolated were imported from Kenya. Several flamingoes developed diarrhea, became emaciated, lethargic and died.

Probably the sources of *Salmonellae* for the zoo animals are fruits and food indiscriminately provided by zoo visitors and also native rodents and wild small birds which could have access to cages. However, these species as well as feeds fed by zoo attendants or visitors were not examined as possible sources of Salmonellae.

Although the number of specimens in this survey is too small for valid conclusions, a number of new serotypes, hitherto never reported in captive wildlife or domestic pets or livestock in this country were encountered. Further work in this direction may be desirable as knowledge of the distribution of these organisms is of great importance not only from the viewpoint of animal health, but also because of their risks to man.

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