

Salmonellosis in Animals and Birds in Papua and New Guinea.

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INTRODUCTION.

The domestic animal population of the Territory of Papua and New Guinea is relatively disease free. The so-called exotic virus diseases do not occur.

Bacterial diseases of livestock, brucellosis and tuberculosis, are subject to eradication campaigns. Salmonellosis of animals, which is of considerable significance in most livestock-producing countries in a wide range of animals, appears at present to occur sporadically in this Territory.

This paper describes clinical outbreaks of salmonellosis in cattle, pigs, poultry, a horse, a cat and guinea pigs, confirmed by the Veterinary Laboratory, Kila Kila, Port Moresby, in the period July, 1962 to August, 1964. It also presents results of a limited survey into the incidence of carriers of *Salmonella* serotypes in pigs and cattle in the Territory.

MATERIALS AND METHODS.

MATERIALS used in the diagnosis of clinical cases of salmonellosis have been faeces, intestinal content and organs of animals taken at post mortem examinations. Survey material consisted of faeces and paired faeces and mesenteric lymph node samples from abattoir pigs.

The laboratory practice has been to culture faecal lymph node samples overnight in an enrichment broth (tetrathionate and selenite) and to subculture at 24 hours on to desoxycholate citrate agar and MacConkey agar. Suspect colonies have been plated onto nutrient agar and submitted to standard biochemical tests. Those isolated which have had the biochemical reactions of the *Salmonella* group have been subjected to slide agglutination tests, using serum supplied for the purpose from Commonwealth Serum Laboratories, in Australia. Definitive typing has been carried out by either the above laboratory, the Institute of Medical and Veterinary Science, Adelaide or Department of Health, Brisbane.

DESCRIPTION OF CLINICAL SYNDROMES.

Horse.

Salmonella paratyphi C was isolated from one of four horses in the Rabaul area all of which had chronic diarrhoea. Treatment with antibiotics was of little if any value in four of the five cases. The horses belonged to two stables and there was contact between them by virtue of a mare being brought to service from one to the other.

The organism was isolated from a foal of about four weeks old. It had had diarrhoea from a few days of age and treatment with sulphaguanidine for two weeks apparently effected a cure.

The affected horses were shown to have significantly higher antibody levels to both O and H antigens of *Salmonella paratyphi* C than other unaffected horses, which were at risk. A native labourer whose duties included feeding of the affected horses was found to be an asymptomatic carrier of *S. paratyphi* C.

RESULTS.

Table 1.—Isolations from July, 1962 to August, 1964, from clinical cases of Salmonellosis.

Group.	Serotype.	Host.	No. of outbreaks.	Place in which outbreak occurred.
B	<i>S. saint-paul</i>	Cat and cattle	2	Port Moresby and Munum Plantation, via Lae.
C	<i>S. paratyphi</i> C	Horse	1	Rabaul.
	<i>S. bareilly</i>	Pig	1	Port Moresby.
	<i>S. cholerae-suis</i>	Pig	1	Port Moresby.
	<i>S. virchow</i>	Chicken	1	Port Moresby.
	<i>S. thompson</i>	Cattle	1	Rigo, via Port Moresby.
D	<i>S. pullorum</i>	Chicken	3	Kokoda, Lae and Port Moresby.
E	<i>S. anatum</i>	Pig and Cattle	2	Port Moresby and Munum, via Lae.
	<i>S. london</i>	Pig	1	Erap, via Lae.
	<i>S. weltevreden</i>	Guinea Pig	1	Port Moresby.

Poultry.

Two classical outbreaks of pullorum disease have been diagnosed in the Territory of Papua and New Guinea in the period under review. They were characterized by high mortality rates in the first week of life. Lesions at post mortem examinations were congested livers, pericarditis, caseous nodules in the lungs and unabsorbed yolk sacs. *Salmonella pullorum* was isolated from all these sites. In one outbreak in chickens imported by the Administration for distribution to native owners, all chickens in the batch were destroyed.

The third outbreak of pullorum disease occurred at an Administration owned brooding establishment. The disease history was unusual in that deaths did not occur until six weeks of age and initial mortality was not high. The whole brooding establishment was subjected to agglutination tests and over a 4-6 week period after the initial diagnosis, 15 per cent. positive reactors were found in the 1,200 birds on the property.

Some difficulty was experienced in isolating *S. pullorum* from these positive reactors. It was eventually isolated however from the liver and gall bladder of birds submitted to the laboratory.

Salmonella virchow. Deaths from toxæmia occurred in another batch of 100 (week-old) chickens imported as day-olds to the Animal Quarantine Station, Kila Kila, Port Moresby. Eight deaths occurred within two days and it was decided to destroy the whole batch. Lesions were typical of acute toxæmia and *S. virchow* was isolated from visceral organs and heart blood.

Guinea Pigs.

The outbreak of salmonellosis in guinea pigs due to *S. weltevreden* has been described previously by Egerton and Rampling (1963). It was characterized by intermittent losses in the laboratory's colony. The features of the disease were abscess formation in the liver, spleen and mesenteric lymph nodes and peritonitis.

Pigs.

Salmonella london. This organism was isolated at Erap via Lae, from a sow which died of toxæmia shortly after farrowing.

S. cholerae-suis. Diphasic strain. This outbreak occurred at the Animal Quarantine Station, Kila Kila. The piggery at the time housed four adult locally bred pigs, one boar and three sows—one sow with a litter of six (four-week-old) piglets, and 55 imported pigs which had been introduced from New Zealand about one month previously and were in contact with the local stock by virtue of having common attendants.

All stock was fed a ration made up of coconut meal, wheatmeal, cracked corn and meat meal with a vitamin supplement. Hygiene and management was considered to be sound.

The first loss occurred in a locally-bred boar which died with acute toxæmia after twenty-four hours' sickness. Post-mortem examination revealed hæmorrhages in the heart and lungs and small areas of congestion in the small intestine and mesenteric lymph nodes. A pure culture of a diphasic strain of *S. cholerae-suis* was obtained from the bile, lung and pericardial fluid.

On the following day a locally bred sow died. The principal lesions were massive areas of congestion and necrosis in the stomach and small intestine. *S. cholerae-suis* was isolated from the organs and the heart blood. These deaths were followed by the deaths of two or four piglets with similar lesions. No clinical illness was observed in any of the imported pigs.

The first tests, which were carried out on the day after the first death, revealed no carriers amongst the pigs but four different *Salmonella* serotypes were isolated from the food mix and the remainder of the meat meal which had been added to that mix. A repeat test five days later revealed that 21 pigs were excreting group E serotypes and one pig a group C serotype.

Subsequent typing confirmed that *S. Anatum* was present in the meat meal and was being excreted by the pigs. The presence of *S. cholerae-suis* in the meat meal was confirmed

and also three other serotypes (see Table 2). It is likely that many more serotypes were present in the meat meal but not confirmed.

Cattle.

S. thompson. This organism was isolated from faecal samples of a group of sixteen cattle, which had been transported 42 miles by truck from one property to another in the Rigo (near Port Moresby) area. About a week after arrival four deaths occurred following scouring and several beasts had a milder enteritis. Unfortunately, post mortem examinations were not carried out.

Table 2.—Bacteriological Findings.

Group.	Serotype.	Source.
C	<i>S. cholerae-suis</i>	 Dead pigs and meat meal.
E	<i>S. anatum</i>	 Pigs (no symptoms) and meat meal.
C	<i>S. bareilly</i>	 Pigs (no symptoms).
C	<i>S. infantis</i>	 Meat meal.
E	<i>S. vejle</i>	 Meat meal.

S. anatum and *S. saint-paul*. An outbreak of salmonellosis occurred in a herd of 242 young heifers at Munum Plantation, via Lae. These cattle had been imported recently from North Queensland and the final batch of 103, along with one stallion, had arrived four weeks before the start of the outbreak. Five cattle had bloody diarrhoea and four deaths occurred. Three dead heifers were examined, the post mortem picture being that of acute septicaemia. *Salmonella saint-paul* was isolated from the peritoneal fluid.

Salmonella anatum was also isolated from the faecal specimen of an eighteen months old heifer which was scouring and in poor condition. This animal was treated unsuccessfully with sulphadimidine and died after a few days.

Thirty-nine faecal specimens were tested from other beasts in the herd and eleven of these were found to be positive for *S. anatum*. This organism was also found in the faeces of the stallion which was in contact with the herd.

The stallion was being fed on a locally compounded ration containing some imported meat meal. This same ration was being fed to ducks which were dying in large numbers on another property. Samples of the ration and faecal specimens from the ducks were tested but it was not possible to prove any cross infection.

Cat.

S. saint-paul. This organism was isolated from a cat which was treated at the Veterinary Clinic, Port Moresby. The cat was submitted

with an elevated temperature and suffering from severe diarrhoea. The organism was found to be sensitive in vitro to streptomycin and the animal was treated with Streptomagma. The cat was not brought back for re-examination.

SURVEY.

Results of our survey investigations into the incidence of carriers amongst cattle and pigs are given in Table 3.

Table 3.

Salmonella Survey.	Samples.	Isolations.
Swine (New Britain abattoir)	Faeces 309	1
	Mesenteric lymph nodes 109	1
Swine (New Guinea Highlands)	Faeces 320	1
Cattle (all main centres of Papua and New Guinea)	Faeces 150	1
	888	4

Two of the organisms isolated from the 738 pig specimens were of group D (not further identified) of the Kaufmann-White classification and the other was *Salmonella anatum*. The cattle sampled came from the main centres of Papua and New Guinea and were all aged twelve months or less. One group E serotype was isolated from the bovine faeces but not identified.

DISCUSSION.

Poultry.

S. pullorum. Day-old chicks were imported only from Australian hatcheries which have a satisfactorily low incidence of positive pullorum reactors in their flocks. For two of the pullorum outbreaks described, the authorities in Australia were able to show that the incidence of pullorum reactors had risen above the acceptable level. In the outbreak at Lae which occurred in older birds it could not be shown that the hatchery was at fault. The disease syndrome suggested that the infection may have been acquired locally.

S. virchow. It is probable that this infection was picked up on the property, as there had been an outbreak of porcine salmonellosis some time before and on testing it was found that

some pigs were still excreting a variety of *Salmonella* spp. serotypes. Cross infection would have been easy because at the time the same attendants fed both the pigs and the chickens.

Pigs.

S. cholerae-suis. *S. cholerae-suis* does not as a rule, produce an acute fatal illness in adult pigs and it is interesting to note that, although all the herd was exposed to infection, only the locally-bred stock succumbed. These animals were in good condition and on a balanced ration. The only apparent reason for their susceptibility is that their isolated environment had not enabled them to acquire any active immunity by previous exposure to infections.

Our results seem to incriminate the meat meal as a source of infection and as a variety of serotypes were isolated from it, it is most likely that contamination occurred during manufacture. Tests on the imported pigs revealed no carriers at the time of the first death but, after a few days of exposure to contaminated feed, several pigs were excreting *Salmonella*.

The production of sterile meat and bone meal presents difficulties as the environment of the plant invariably contains a variety of contamin-

ants originating from the raw bones and offal (Gray *et al*, 1960). Even under strict conditions of production it is easy for a bag or batch of meat meal to become contaminated. *Salmonella* spp. have been shown to multiply and survive for several years in meat meal and consequently this feed is a source of danger in a pig breeding enterprise such as this. This is especially so in the Territory of Papua and New Guinea where, if our preliminary results are confirmed, little, if any, immunity to *Salmonella* exists in pigs.

Cattle.

S. thompson. This appears to be a classic example of mature cattle, which are not under normal conditions susceptible to acute salmonellosis, becoming clinically affected after being subjected to the rigours of transportation.

S. anatum and *S. saint-paul*. The outbreak at Munum occurred in young cattle within the age group which is generally considered to be susceptible to salmonellosis, i.e., under two years old. It is unfortunate that it was not possible to trace the source of infection.

GENERAL DISCUSSION.

The results of our limited survey on cattle and pigs agree with indications obtained in clinical outbreaks that the incidence of *Salmonella* infections in animals and domestic fowl in the Territory of Papua and New Guinea is very low. In addition Public Health Department's records of clinical outbreaks in the human population over the past two years confirm our opinion that the incidence of salmonellosis (excluding typhoid and paratyphoid) in man and animals is lower here than in Australia.

At the Kila Kila Veterinary Laboratory only ten different strains of *Salmonella* spp. were isolated from clinical outbreaks. Of these it was evident that in some cases the infection had been introduced, as in the outbreak of porcine

salmonellosis at Kila when meat meal was incriminated and in two of the outbreaks of pullorum disease.

It is interesting to note that *S. cholerae-suis*, which was found by Simmons *et al*, 1963, to be the cause of 162 out of 239 outbreaks of porcine salmonellosis in Queensland, was isolated only once by us, in spite of the large pig population of the Territory. This organism has been recorded only once in a human patient during the past years. *Salmonella typhimurium* has been recorded by the authors (Simmons *et al*, 1963) as the strain most frequently found in Queensland animals and birds but it does not appear to have reached the Territory as yet.

SUMMARY.

A record of the *Salmonella* diagnosed in animals and domestic fowl from July, 1962, to August, 1964, has been made. Only ten different strains have been isolated and it appears that salmonellosis is not as yet of economic significance in livestock enterprises in the Territory.

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