

Porcine Anthrax in Papua and New Guinea.

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INTRODUCTION.

In 1946, an Army Veterinary Survey Unit described a disease of pigs in the Highlands of New Guinea which closely resembled anthrax (unpublished report). Carne (1958), who examined cultures of the organism derived from cases investigated by the Survey Unit, considered it to be a strain of *Bacillus anthracis* of lower than normal virulence.

Anthrax is a disease of a wide range of mammals. It is generally accepted that herbivorous animals are more usually affected (Sterne 1959). Anthrax in pigs is not, however, an uncommon disease and has been recorded in most parts of the world. In advanced communities anthrax in pigs usually results from the feeding of infected food-stuffs to confined animals (Brennan 1953). Experience has shown that anthrax in the Territory of Papua and New Guinea assumes epizootic proportions in large areas of the country. In a country where the pig is still the most common domestic animal the resulting loss is considerable.

In this introductory paper it is proposed to present available evidence on field aspects of porcine anthrax. Laboratory experiences with the causative organism will be described in a later publication.

DISTRIBUTION.

THE Territory of Papua and New Guinea is divided into 15 Administrative districts (see frontispiece map): Of these the Southern Highlands District of Papua and the Eastern and Western Highlands Districts of New Guinea are considered to be anthrax enzootic areas.

In addition to these areas, the presence of anthrax has been confirmed in the Lumi Sub-district of the Sepik District. Unconfirmed reports suggest the disease may exist in a small area of coastal country in the Madang District, about the mouth of the Ramu River.

The climate in Highlands Districts is more temperate than tropical. Climate data for the administrative centre of the three Highlands districts are given in Table 1. The valleys in

which these centres are situated range in altitude from 5,000-5,500 feet above sea level. Subsidiary valleys may range in altitude up to 8,000 feet above sea level. Rainfall varies from 80-120 inches per annum and there is a concentration of rainfall in the months November to April, during the north-west monsoon season. Scattered rain falls throughout the drier south-east trades season.

The enzootic area in the Sepik District—the Lumi Subdistrict—is situated on the inland slopes of a coastal range, the Torrecelli Mountains, and ranges in altitude from 700 to 2,800 feet. Temperatures are accordingly higher, as is the rainfall at about 160 inches per annum. The country is less mountainous and generally more heavily timbered than the Highlands region.

Table 1.

	Mean Max. °F	Mean Min. °F	Relative Humidity %		Annual Rainfall ins.
			9 a.m.	3 p.m.	
Goroka	77.9	57.6	83	56	76.59
Mendi	74.2	54.6	75	74	111.58
Mount Hagen	76.8	54.5	82	64	102.57

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OCCURRENCE AND SEASONAL INCIDENCE.

In enzootic areas two types of outbreaks occur, the most striking being an epizootic form which causes the death of a large number of pigs. Epizootics occur in restricted areas such as a river valley system and recur at 3-5 year intervals. The second type of outbreak involves individual cases of anthrax which occur throughout the enzootic area at sporadic intervals.

It is probable that, within a given geographical area, a herd immunity develops following an epizootic which lasts for approximately the

life of a pig, that is 3-5 years. Individual cases occur in those animals which were not involved in the previous epizootic or in which immunity has waned. The development of a new population with neither active nor passive protection against anthrax provides the basis for a further epizootic.

There is some evidence to suggest that the majority of outbreaks of anthrax occur during the wet season. *Table 2* records the seasonal occurrence of outbreaks which have been investigated by officers of this Department.

Table 2.

Outbreak.		District.		Year.	Months.
Asaro River Valley	....	Eastern Highlands	....	1954	November-December.
Kama Valley	....	Eastern Highlands	....	1959	March.
Nebilyer Valley	....	Western Highlands	....	1961-1962	December-February.
Ningil	....	Sepik District	....	1962	January-April.
Henganofi	....	Eastern Highlands	....	{ 1962	September.
				{ 1963	June-August.
Kerowagi	....	Eastern Highlands	....	{ 1960	April, May, June.
				{ 1963	November-December.

MORBIDITY AND MORTALITY RATES.

The percentage of pigs affected in an outbreak is difficult to assess. Native owners only recognize the disease by the characteristic swelling of the neck region which occurs in the advanced cases. Since the development of this sign is usually followed by death, natives claim that all pigs affected die. It is likely, however, that infection producing no characteristic sign may occur in other animals and that the majority of these recover.

Mortality rates in pigs exposed to risk vary from 10-25 per cent. Two outbreaks which were investigated and confirmed bacteriologically as anthrax are summarized in *Table 3*.

Table 3.

Outbreak.	Pig Population.	Deaths.
Nebilyer, Western Highlands District	Estimated 4,000	400
Ningil Village, Sepik District	255	51

Pig populations in villages are difficult to count accurately as individuals may share ownership of several pigs and many of the village pigs

spend most of the time foraging in surrounding bushland. The figures quoted in *Table 3* are derived from questioning people in outbreak areas but do not necessarily account for the local feral pig population.

CLINICAL SIGNS AND POST MORTEM LESIONS.

Field cases of anthrax in Papua and New Guinea have all shown unilateral or bilateral swelling of the throat region which is accompanied by dyspnoea and sometimes dysphonia. Vomiting may occur. The temperature ranges from normal to 108 degrees F., respiratory and heart rates are elevated whilst depression and anorexia mark the terminal stages.

The swelling at the throat develops rapidly and death usually occurs 2-4 days after it first becomes obvious. In a small percentage of cases regression of the swelling occurs over about fourteen days and the animal recovers. No cases of intestinal infection have been diagnosed. At necropsy, lesions are confined to the affected throat area. Incision into this area shows the presence of a blood tinged gelatinous oedema

and free fluid escapes from the incision. The organism can usually be cultured only from this area of oedema and sometimes from the regional lymph glands. Splenomegaly does not occur and a terminal bacteraemia is not usually present.

TRANSMISSION.

The nature of the lesion seen in field cases suggests that infection occurs by ingestion and possibly that infection is aided by the presence of lacerations in the mouth and throat regions.

DISCUSSION.

Bacillus anthracis strains isolated from pigs by officers of the Army Veterinary Survey Unit (unpublished) report were considered by Carne (1958) to be of lowered virulence. This view has been supported by Anderson (1960) who described porcine anthrax in the Territory of Papua and New Guinea as atypical. In fact anthrax in swine in the Territory is quite typical of that described in other countries. Losses resulting from the disease number many hundreds each year and anthrax is probably the most important bacterial disease of animals in the Territory. The organism when freshly isolated in the laboratory has all the characteristics described in standard texts.

The failure to diagnose field cases in other susceptible species in the enzootic area has lent support to the view that anthrax in the Territory of Papua and New Guinea is atypical. The native people live in very close association with their pigs and in the past the Highlands native usually ate pigs which died of anthrax. Throughout the area, however, the infective nature of the disease is recognized and the affected head region is discarded. Since a bacteraemia is not common in porcine anthrax the risk of acquiring anthrax from eating a pig is considerably less than from a herbivore.

Skin infection has been diagnosed bacteriologically in man once only in the Territory. The case occurred in a laboratory worker (Egerton unpublished). In 1962-1963, four cases of cutaneous anthrax were reported in native people in New Guinea (Commonwealth of Australia, 1964). None of these cases was confirmed bacteriologically (Abbott, 1964). Considering the high human population in the enzootic areas (ca. 700,000 people) and the degree of close

association, the recorded cases of human anthrax are extremely low. Man is said to be quite resistant to anthrax however and symptoms, even when severe, tend to subside rapidly (Sterne, 1959).

The number of cattle grazing throughout the enzootic area of the Highlands is relatively small—5,000 to 6,000 head—and no deaths are known to have occurred from anthrax. The density of the pig population in the same region is much greater, and is estimated to be between quarter and half a million pigs. It is likely that as the bovine population grows and the grazing pressure increases, cases of anthrax will occur in these animals.

It has been demonstrated that sporulation is of importance in the persistence of anthrax in an enzootic area. Competition with organisms of decay or even soil saprophytes results in the destruction of the vegetative form of *Bacillus anthracis*. Minett (1950) showed experimentally that sporulation occurred slowly at 21 degrees C. and increased in tempo as the environmental temperature approached 37 degrees. The relative humidity of the environment also had some influence on sporulation. In conditions of relative humidity lower than 60 per cent, it was observed that desiccation might supervene before spores formed. Minett concluded from his investigations, however, that under practical conditions temperature is the most important factor controlling sporulation.

Minett (1951) on the basis of monthly climatological data divided India into areas according to their favourability for the development and persistence of anthrax. When the Territory of Papua and New Guinea is considered according to Minett's climatological data it is found that the Highlands region is only slightly favourable for sporulation and thus the maintenance of infection in the area. The mean daily temperature throughout the Highland valleys is in the vicinity of 70 degrees F. and relative humidity 65-70 per cent. Throughout the coastal plains the higher temperatures (80-90 degrees F.) and relative humidity between 50 and 60 per cent. would be more favourable for persistence if the disease was established as in the Sepik District. There is a possibility that if spread occurred the disease could become established in river valleys such as the Ramu and

Markham where cattle grazing is assuming some significance. While vaccination outside the present known enzootic areas would probably not be justified it would be desirable to vaccinate all cattle in the Highlands region and Lumi Sub-district annually. Vaccination in both cattle and pigs should be carried out annually and timed to precede the wetter periods of the year, as evidence indicates that outbreaks are more prevalent at this time. The absence of proven cases of bovine anthrax until now does not necessarily prove that they have not occurred or will not occur in the future. The introduction of susceptible bovines as a potential source of infective material will do nothing to alleviate the present problem.

SUMMARY.

Porcine anthrax has been recognized in Papua and New Guinea since 1946. It is enzootic throughout the Eastern, Western and Southern Highlands Districts and in the Lumi area of the Sepik District. Throughout the enzootic areas sporadic losses occur throughout the year. From time to time epizootics occur in restricted areas resulting in an annual loss of many pigs. All cases of the disease seen have been characterized by unilateral or bilateral swelling of the pharyngeal region.

Field cases of anthrax have not been reported in other domestic animals. Cases in man are also apparently rare. The possibility of the establishment and persistence of anthrax in other parts of the Territory has been discussed.

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