Eradication and Control of Rinderpest in Ceylon

BY

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RINDERPEST, the major plague of cattle, needs no introduction. This disease is one of the most destructive epizootics known in the annals of infectious diseases. Wherever it has appeared there have been tremendous losses of cattle, sheep, goats and pigs. In some territories these animals have become almost extinct. The disease is believed to have originated in Asia Minor, and to have spread throughout Central Europe as a result of wars. It later appeared in Russia where it was called Steppe Murraine. From there it spread to Siberia and subsequently infected practically the whole of Asia. The complete eradication of rinderpest was urgent and consequently European governments adopted measures by which it was pressed back to the Far East. The plague spread considerably in Middle Europe for the last time during the Franco-Prussian War (1870–1871) but in the following decade it was completely suppressed, so that since 1881 it has been confined to Russia and Turkey and, more recently, has apparently disappeared even from European Russia.

While rinderpest is prevalent on the mainland of Asia, it has been eradicated from Ceylon, where it involved a tremendous expenditure of money and livestock. This paper records the methods used in the eradication.

INTRODUCTION OF RINDERPEST INTO CEYLON

Ceylon being so close to India, there has always been the risk of becoming infected from cattle imported for slaughter, work and dairy purposes. During the last century cattle have been imported into the Island in several thousands without proper quarantine, and rinderpest broke out now and again. Although the disease was not endemic, yet cases occurred, being lingering remnants of an outbreak originally traceable to imported cattle. After the appointment of the first Government Veterinary Surgeon, steps were taken to reduce the incidence of this disease but it took thirty-nine years (until 1934) for the disease to be finally eradicated. After 10 years of freedom from the disease, the Island again became infected in 1943, when slaughter cattle and goats were imported from India *via* Colombo for the Forces when proper quarantine measures could not be adopted to house the animals and distribute them. A characteristic feature of the 1943 outbreak, which continued up to September, 1946, was that it started in places adjoining

military livestock depots, unlike the previous outbreaks which spread from one province to another. Since there were several foci of infection, control measures were swiftly adopted even when cattle were surreptitiously removed to various parts of the country, and the disease was completely eradicated from the Island in September, 1946.

METHODS OF CONTROL

Prior to 1895, there is no record of any preventive steps taken by the authorities except those which the village headmen were supposed to have taken. There were no qualified veterinarians. It is believed that the animals must have been treated by village cattle doctors known as "Vedaralas". In 1901, a committee nominated by government with the Government Veterinary Surgeon, who was at that time attached to the Department of Public Instruction, as a member, drew up control measures which included the following (1) Northern ports of the Island to be closed for importation of cattle from India, (2) Control of the importation of cattle *via* Colombo, (3) A better system of reporting rinderpest—the headmen were to report first to the Provincial Government Agent, who in turn directed the Stock Inspector attached to his office to proceed to the spot where the disease had broken out. He also informed the Government Veterinary Surgeon, who gave further assistance to the Stock Inspector if required, (4) Existing laws to be strictly enforced—concealment of cases or neglect to isolate diseased animals to be followed by prosecution, (5) As a preventive, glycerinated bile to be inoculated, (6) Increase the resistance of the animals by improving the quality of the cattle and (7) Increase the number of veterinary personnel.

These measures did not in any way reduce the incidence of the disease in the Island. Importation of cattle from India continued and every outbreak was traced to some imported animal. Importation of cattle also could not be entirely stopped. However, in 1929, importation of cattle from Asian ports *via* Colombo was prohibited and spleen pulp vaccine, as prepared by Daubney in East Africa, was introduced into the field and the disease was eradicated in 1934. Ceylon remained free from rinderpest from 1934 to 1942, when a fresh introduction of the disease took place. This happened in a batch of goats which was imported from India and kept at the Quarantine Stations in Colombo and Kayts. This outbreak was suppressed in the Quarantine Stations itself. The first intimation that rinderpest had broken out among Ceylon cattle was from the Municipal Veterinary Surgeon in Colombo in January, 1943, a year later. The disease then was present among cart bulls in at least four widely-separated cattle sheds. From Colombo the disease spread to various other places. The circumstances which made it possible for the disease to infect our cattle may be summarized briefly as follows :—

(1) War conditions made it necessary to increase very greatly the number of sheep and goats imported from India. (2) It was necessary to amend the previous regulation that all sheep and goats from India would be imported *via* Colombo and would be slaughtered in the Colombo Slaughter House. Instead of all imported goats being slaughtered in Colombo, it was necessary to distribute living sheep and goats to many centres in remote parts of the country. (3) The greater part of the Municipal Quarantine Station in Colombo

had been requisitioned for emergency use and so was not available to quarantine the much-increased imports. (4) As a result of (3), makeshift and very unsatisfactory arrangements had to be made in Colombo for quarantine of the imported animals. (5) Normal administrative control proved to be unsuitable under emergency conditions and did not provide the necessary co-operation between the various interests involved, namely, the Government Veterinary Department, Municipal Veterinary Department, and the Military Supply Services.

Under the above limitations, the disease broke out in various parts of the Island, usually adjoining Military Supply Depots. At first the disease was combated with serum for contacts and spleen pulp vaccine for protective inoculation. In August, 1944, spleen pulp vaccine was replaced by goat virus which gave better results in protecting the local cattle, buffaloes and European cross-bred cattle. With the introduction of goat virus for mass vaccination and the Government Veterinary Surgeon assuming full power in the control of rinderpest, the whole campaign took a turn for the better as the goat virus vaccine proved very successful and created confidence among the veterinarians and cattle owners, which factor helped in the early eradication of the disease.

MEASURES USED TO COMBAT RINDERPEST

(1) *The Glycerinated Bile Method of Immunization.*—The glycerinated bile method of immunization tried by Robert Koch in South Africa was the first preventive vaccine used in Ceylon. It was used from 1901 to 1911, and only a few thousand head of cattle were injected. This method had to be abandoned for several reasons. The disadvantage of the bile method of immunization is that, if the bile is stained with a small quantity of blood, the inoculation of such material is liable to produce the disease and cause a high percentage of mortality. Immunity was not established immediately after inoculation but only about ten days later, and hence this method was of little use in immunizing cattle during an actual outbreak. This method had the further drawback that sufficient quantity of bile was not always available for immunizing large herds of cattle. In addition, the opening of the carcases was likely to cause resentment among the people on religious grounds.

(2) *Virulent Blood.*—Blood was drawn from the jugular vein of sick animals at the height of disease and run into a measuring glass containing citrated saline and then 1/500 formalin added, the proportion being one part virulent blood, one part citrated solution, and two parts of 1/500 formalin saline, making an ultimate dilution of 1/1000 formalin. The vaccine was kept in a dark place, unexposed to sunlight, for at least three days before use. This vaccine was given a trial in a small scale but found to be of little value and was discontinued.

(3) *Serum alone Method and Quarantine.*—The glycerinated bile method of immunizing was discontined from 1912, and the serum alone method and quarantine were started. Under suitable conditions this method is of great value but it suffers from the disadvantage that the protection which it confers in an animal is of short duration, lasting only from ten to fourteen days. Because of this and the cost of the product it was not used extensively. Instead, existing quarantine laws were strictly enforced.

(4) *Simultaneous inoculation of Virus and Serum in the field.*—This method was also given a fair trial in Ceylon during the nineteen-twenties. By this method, the cattle are inoculated with serum just as in the case of the "serum alone" method but at the same time they receive an injection of virulent blood taken from an animal suffering from rinderpest. Following this simultaneous injection of serum and virulent blood, the injected cattle pass through a modified attack of rinderpest, recover, and are then immune against rinderpest. This method had to be carried out with safety as the disease was not enzootic in Ceylon. The inoculated animals had to be kept under rigid isolation for a period of two or three weeks while passing through the modified attack. The disadvantage of this method was the risk of spreading infection and the desired results were not obtained. The virus obtained in such a haphazard manner did not ensure uniformity of virulence, and exposed animals in an infected area were not proper subjects for this type of immunization. Moreover, the transmission of other blood diseases such as piroplasmosis and surra was facilitated and may have contributed to the high mortality.

(5) *Spleen Pulp Vaccine.*—About this time when trials were undertaken with Serum-Virus inoculations, Daubney claimed to have succeeded in immunizing cattle by using a vaccine prepared from the spleen of cattle suffering from rinderpest. Crawford in Ceylon prepared two batches of vaccine—one the way Daubney had prepared it, using formalin in the preparation, and the other chloroform-treated as done by the Philippine workers. The results of these experiments were encouraging. The formalized vaccine proved easier to work with, did not cause such painful swellings at the site of inoculation, and conferred a strong immunity. It therefore had some advantages over the chloroform vaccine. It suffered, however, from the disadvantages that it had to be used within a week of preparation, while it was claimed for the chloroform vaccine that it would keep for periods up to one year. By 1930, the spleen pulp vaccine was pushed ahead in the villages of the North-Central Province and encouraging results were obtained. However, this vaccine suffered from a few shortcomings in the second outbreak which occurred in 1943. In most cases a satisfactory degree of immunity was obtained but in some cases the results were disappointing. This failure was mainly due to the vaccine being of low potency and occurrence of low grade and fleeting immunity where a heterologous vaccine was used. If the vaccine was prepared from the spleen of a buffalo, it failed to induce immunity in cattle and *vice versa.* This was a serious drawback which made the author resort to goat virus vaccine.

The method employed in the preparation of the spleen pulp vaccine was as follows :—The spleen was first reduced to a fine pulp by passing through a fruit pulper, which proved to be very suitable for the work. The pulp was then weighed and one percent. hypertonic salt added. This was allowed to stand for 24 hours on ice in the ice chest. Sterilized water was then added to bring the concentration of salt to 9 per cent. Formalin at the rate of 1 : 1000 of the mixture was added and the whole allowed to stand for three days in the ice chest. It was then examined for evidence of contamination and if found satisfactory was bottled and issued. No vaccine older than 2 weeks was used.

TABLE I

Showing statistical Data on the effect of Rinderpest Vaccines and Sera on the incidence of Rinderpest in Ceylon

Year	*Cases*	*Deaths*	*Doses of Rinderpest vaccine or sera*	*Remarks*
1928	1,757	813	817	Serum used
1929	10,330	5,137	3,809	do.
1930	11,826	10,857	1,240	do.
1931	20,634	18,086	17,729	Spleen pulp vaccine single injection
1932	8,373	6,817	27,667	do.
1933	3,035	2,419	9,899	do.
1934	207	Figure not available	Figure not available	do.

When disease was again introduced in 1943—after 10 years freedom from this disease

Year	*Cases*	*Deaths*	*Doses of Rinderpest vaccine or sera*	*Remarks*
1943	3,789	3,025	246,088 cc	Spleen pulp
			35,900 cc	Serum
1944	4,682	3,856	554,503 cc	Spleen pulp
			431,500 cc	Serum
			240 cc	Goat virus
1945	4,818	3,188	70,500 cc	Serum
			36,742 cc	Goat virus
1946	1,289	888	107,900 cc	do.
1947			2,400 cc	do.

(6) *Goat Virus.*—It was in August, 1944, that Goat Virus was tried in the field. Edwards (1928), who was the first to introduce the use of goat virus in India, had two objects in view in recommending the use of this product as a method of immunization against rinderpest. Firstly, goat virus is free from protozoan parasites, and secondly, the virus is sufficiently attenuated for safe injection into susceptible cattle. One of the limitations of the goat vaccine method, however, is that its application is liable to produce untoward results in highly susceptible breeds of cattle. Preliminary experiments were carried out by the author in Ceylon on local cattle (Sinhala type), buffaloes, and cross-bred cattle, and the results were very encouraging. When a small dose of goat virus was given to local cattle there was a thermal reaction in addition to slight signs of digestive disturbances. A small dose of serum was all that was necessary to modify any severe reaction. In local buffaloes, a small dose of goat virus produced neither a thermal reaction nor any bodily disturbances. In cross-bred cattle, the reaction was slightly more marked, but with a little serum the method was entirely free from danger. Susceptible animals, even when kept in close contact with vaccinated animals, failed to contact rinderpest. When this vaccine was introduced into the field the results were so convincing that it was used till the whole island became free of rinderpest. At the beginning it was feared that this vaccine, if used in the field, might produce carriers of the disease, but this fear was quelled when the field reports were encouraging. There was not a single instance in which the use of this vaccine produced any "flare up" of the disease. The reasons for the popularity of the goat virus are: (1) Method of preparation—simple and

can be undertaken by any veterinary officer. (2) Fresh viable vaccines available on the spot and inoculated animals show no ill effects. (3) Capable of producing quick immunity and thus its use in infective herds was responsible for clearing infection in a comparatively short time. (4) Cheaper than spleen pulp vaccine.

(7) *K. A. G. Virus* (*Goat tissue Vaccine*).—A dried virus obtained from Kabete Laboratory in East Africa was given a trial in the field. Results could not be recorded as it was replaced by Goat Virus in our work in this Island. No bad effects were noted but its efficacy could not be studied.

(8) *Slaughtering of Sick and Exposed Animals.*—Shooting of the affected animals was carried out when there was an outbreak of rinderpest in areas where large numbers of cattle had no owners, but this usually caused resentment among cattle owners. Very often when this was done cattle were moved to remote villages and jungles and thus new places became infected.

This practice was not encouraged by the veterinary authorities as a routine measure of combating rinderpest. The people too resented this method as Ceylon is predominantly a Buddhist country.

(9) *Strict Quarantine and Sanitation.*—In the rinderpest campaign in the country strict enforcement of proper quarantine and sanitary measures covering the entire infected areas were undertaken. In the 1943 outbreak military aid was obtained to round up animals which could not be caught in a district in East Ceylon. In another district, on account of the large number of ownerless cattle which roamed about in the open pastures, the unusual method of seizing the semi-wild cattle with the help of nets had to be adopted to vaccinate them. The method became very popular with the villagers as some of them were able to redeem their cattle.

When an outbreak occurred in a new area, the sick animals were rounded up and tied under sheds and in some villages healthy animals and contacts were also tied, about 10 yards apart, with strong ropes. No work passes were issued and all movements of animals were temporarily stopped during the fifteen-day tie up. The owners were obliged to bring food, water and individual drinking vessels in order to prevent the possibility of directly or indirectly spreading the disease. Watchers and guards were also appointed by Government to enforce strict sanitary measures and quarantine. Further, if one village was infected, besides the animals being tied up, the villages contiguous to this infected village were considered infected and proclaimed as such. An area about 5–10 miles in diameter was also proclaimed as the "protective zone". No movement of cattle from the infected zone to the protective zone was allowed and *vice versa*, and no animal was permitted to leave either of these zones. Guards employed by Government were placed at points of exit from these zones to prevent surreptitious removal of cattle. Working animals were allowed to move freely in the infected or protective zone after vaccination and with a permit from the Government Veterinarian in charge of the outbreak. Where sick animals were housed, a guard was placed on duty to see that no one entered other than the caretaker or authorized agent of the veterinary officer on duty. An area was declared free of rinderpest only if there were no fresh cases and if four weeks had passed from the date of the last death of a diseased animal.

As soon as an area was declared infected by the Government Agent of the Province or the Government Veterinary Surgeon, a census of all the animals in the infected and protective areas was taken, the source of infection traced, and a planned vaccination campaign undertaken. It is not possible, in a country with open fields, devoid of fences, and where animals roam freely for their food, to eradicate animal diseases by strict quarantine measures alone. That was why the Government attacked the problem of disease control by building up a permanent immunity which was to go hand in hand with other measures. At first the people strenuously objected to bringing their animals for vaccination, because of the inconvenience and also of the failure of the vaccine in some places due to improper handling. By diplomacy, tact, and the permanent immunity acquired by the treated animals, the people became convinced of the efficacy of the vaccine and a good response for vaccination was seen in the majority of places.

DISCUSSION

Ceylon is free from rinderpest for the second time. In 1934, this disease was eradicated from the Island after a campaign lasting about 39 years. Again, after a lapse of ten years, in 1943, the disease was introduced into the Island from India during war time. This 1943 outbreak was stamped out of the country by September, 1946. Enormous losses of livestock and tremendous expense of money were incurred, but they were well worth the sacrifice as the greatest deterrent in Ceylon to the development of animal industry and agriculture was rinderpest. The peculiar conditions under which the campaign had to be carried out were responsible for the repeated failure in the past; the open fields devoid of fenced enclosures wherein all species of animals roamed freely for their food; the ignorance of the people about the spread of infectious disease; and the lack of sufficient veterinary personnel.

The spleen pulp vaccine prepared according to Daubney's method was helpful in building a solid immunity among vaccinated cattle resulting in the final eradication of the disease in 1934. Since this vaccine had its own disadvantages it was replaced by Goat Virus vaccine in the 1943 outbreak. The goat virus was sufficiently attenuated for safe injection into susceptible cattle, it was free from protozoan parasites and capable of producing quick immunity, and thus its use in infective herds was responsible for clearing infection in a comparatively short time. Another advantage was that this vaccine could be prepared by any veterinary officer and fresh viable vaccine was always available.

SUMMARY

1. Rinderpest has always been introduced into Ceylon from India. Before 1934, the disease broke out in Ceylon as a result of the importation of cattle for slaughter, draught, and dairy purposes. The disease was stamped out in 1934, but again introduced in 1943 through importation of cattle and goats for the military in large numbers and when no proper quarantine facilities were available.

2. The first attempt to combat this disease was by the Glycerinated Bile method of Koch. This was tried from 1901 to 1911, but was found to be impractical and was soon discontinued.

3. The simultaneous inoculation of serum and bull virus in the field was instituted in the nineteen-twenties. It proved to be ineffective because the virus obtained in the field was not uniform in virulence and exposed animals were not proper subjects for this type of immunization.

4. The serum alone method with quarantine was enforced since 1908. This failed because the protection offered lasted only 10 to 14 days.

5. The strict enforcement of quarantine and sanitary measures alone with the object of stopping the spread of the disease for fifteen-day periods in the hope that the infection would die out, did not succeed. Parallel mass vaccination of cattle and buffaloes had to be undertaken.

6. The introduction of Spleen pulp vaccine and building up an inmunity in the cattle was responsible for the eradication of disease in 1934.

7. The use of Goat Virus vaccine prepared on spot and used freshly and on a large scale finally eliminated the last vestiges of the infection which started in the year 1943, and in September 1946, the Island was officially declared free of rinderpest.

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