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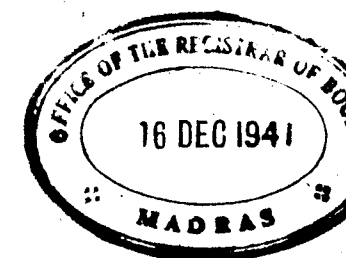
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(The Journal of the All-India Veterinary Association)



Editor :

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The Indian Veterinary Journal

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Devoted to the cause of the Veterinary Profession

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THE Indian Veterinary Journal

(The Journal of the All-India Veterinary Association.)

Vol. XVII

JANUARY 1941

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CONTENTS

	PAGE
Editorial.	
Rinderpest in India	201
Symposiums on Rinderpest Control in India.	
A Note on Rinderpest in Assam.—By V. R. Gopalakrishnan, G.M.V.C.	205
Rinderpest Control in Baluchistan.—By Jahan Shah.	208
The Present Position in regard to the incidence of Rinderpest in Livestock of Baroda State.—By Y. N. Marathe, G.B.V.C.	209
Problem of Rinderpest in Bihar.—By M. I. Malik, B.Sc., M.R.C.V.S.	213
A Short History of Rinderpest in Gwalior State.—Major M. S. Apte, G.B.V.C.	215
A Brief Note on Rinderpest in H.E.H. The Nizam's Dominions, Hyderabad (Deccan).—By B. K. Badami, G.B.V.C.	216
Control of Rinderpest in Jodhpur State (Marwar).—By Dr. C. J. Fernandez, G.B.V.C., P.G. (Bom.), P.G. (Port.), F.R.H.S. (Lond.), F.Z.S. (Scot.)	218
Rinderpest, its incidence and prevention in the Province of Madras.—By T. J. Hurley, M.R.C.V.S., D.V.S.M., I.V.S.	220
Rinderpest Eradication in India.—By N. C. Sen, G.B.V.C.	225
Rinderpest Control in Mysore.—By S. D. Achar, G.B.V.C., P.G. (Punjab)	234
Rinderpest in N.W.F. Province.—By S. M. Sarwar, M.R.C.V.S.	239
The Control of Rinderpest in the Punjab.—By Ch. Jainti Ram, P.V.S.	240
Control of Rinderpest in Sind.—By J. H. G. Jerrom, M.R.C.V.S., I.V.S.	250
Rinderpest in the Central Provinces and Berar.—By P. S. Nair, G.B.V.C., and S. L. Zargar, G.B.V.C.	251

SULFARSENOL

FOR

Piroplasmosis

See The Indian Veterinary Journal
Vol. VIII. No. 4, April 1932.

FOR

Nervous Localisations of Distemper in Dogs

See The Indian Veterinary Journal
Vol. IX No. 4, April 1933.

FOR

Pneumonia and Angina after Distemper in Dogs

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THE

Indian Veterinary Journal

Vol. XVII

JANUARY, 1941

No. 4

Editorial

RINDERPEST IN INDIA

To our readers in India and abroad we offer our New Year Greetings with this special issue of our *Journal* which is wholly devoted to the topic of Rinderpest, comprising of articles contributed through the courtesy and co-operation of Veterinary Officers in the Provinces and Indian States. From very early times, as far back as legendary or recorded evidence goes, this fell disease has been known to be the bane of stock owners and agriculturists throughout this vast sub-continent; and its periodical visitations continued to cause untold mortality among cattle until a decade or two ago when protective inoculation came to be successfully applied to check the outbreaks and minimise mortality.

Some idea of the extent and magnitude of the loss in those days to the cattle population of India, can be had from the report of the Indian Cattle Plague Commission which was appointed by the Governor General in Council in 1869. The results of the enquiries and investigations not only provide interesting reading but also constitute the earliest record of a comprehensive survey of the infectious diseases of cattle in India, Burma, Ceylon and the Andamans. This is what the Commission wrote in commenting upon the mortality from Rinderpest—"As regards the losses of stock incurred through

this plague, while exact information is very much wanted, it is evident that the yearly loss, both absolute and relative to number of living stock all over the country, is very serious and to be counted by hundreds of thousands."

During the period of seventy years that has elapsed since the Commission submitted its report, considerable progress has been made in the matter of prompt reporting of outbreaks of Rinderpest and other infectious diseases, largely as a result of the formation of the Civil Veterinary Department in each of the Provinces and Indian states; but the policy in combating outbreaks has been neither vigorous nor sustained enough to produce the best possible results.

It seems to us that in some of the Provinces and States at least the question of policy still remains a matter of speculation and expediency, no better than what it was 70 years ago when the Commission made its recommendation in favour of *Repression* as against *Protection*. That policy was in accordance with the then existing state of knowledge of prevention and control of the disease. It was already known "that one attack of the disease confers immunity from a second" but no scheme of protective inoculation could be recommended in the absence of the means by which the severity of the infection artificially induced, could be controlled. We are no longer in that unhappy position for, in the present-day-anti-rinderpest serum, we possess a potent means of controlling the severity of infection in a campaign of active immunisation leading to lasting and solid immunity against the disease but yet in many provinces in India to-day, on the score of economy or expediency, recourse is being had to doubtful and inefficient methods of protection. The serum simultaneous method of inoculation is acknowledged on all hands to be the best from the point of view of immunity—solid and lasting—; and there can be no justification for resorting to doubtful methods especially in the face of the fact that, that method wherever and whenever practiced has demonstrated its superiority beyond question in reducing the incidence of Rinderpest to an amazing extent.

We know that in the Madras Presidency a departure from that policy of S. S. inoculation in the campaign against Rinderpest has resulted in a set-back, but we understand that the authorities are taking steps to retrieve the position and continue to advance on the remarkable progress already made. This Province has all along led the way in the matter of measures for the prevention and control of cattle diseases as will be seen from the summary of historical sketch appended to the Indian Cattle Plague Commission's report of 1871. "The history of cattle murrain in the Madras Presidency is peculiarly interesting, because of the early notices which exist regarding cattle plagues; because in recent times the Madras Government took the initiative in investigating the subject and stimulated an interest in the matter which has borne abundant fruits in other parts of India; because here a skilled agency was first employed to enquire into the subject and devise measures for the prevention and treatment of disease causing mortality among cattle; because a legislative enactment was devised for these purposes; and because after three years' experience and continued attention to the subject by professional men and district officers, the application of the enactment so devised was authoritatively declared to be neither expedient nor necessary and the stamping out, limitation, and treatment of murrains were entrusted to the knowledge, the personal efforts, and influence of individuals". We hope that, as in the past, Madras with its Serum Institute and other equipments will continue the initiative and lay down the policy for the rest of India in the Campaign against Rinderpest.

There is a vast territory covered by the numerous Indian States in between the Provinces from the Himalayas to Cape Comorin with a very large cattle population and freedom of movement for purposes of trade, traffic and grazing, to and from the adjoining provinces but with no mutual understandings or obligations in the matter of the prevention and control of the spread of infectious diseases of animals. This state of affairs is hardly satisfactory; and the development of the Indian Cattle Industry as a whole would depend upon the remedial

measures adopted. Legislation would appear to be urgently indicated and we have no doubt that the States would welcome such measures and extend their co-operation to their utmost capacity.

We regret, however, to have to mention that, barring some of the major States like Mysore, Hyderabad, Baroda, Jodhpur and Gwalior, very little is known as to what, if any, organisation or agency exists for combating outbreaks of diseases of cattle in the other states, (too numerous to specify by name). It can't be that no attention is being paid in those States to the prevention of diseases of stocks and development of cattle industry but as we have stated, information is lacking.

We would earnestly appeal to the concerned State authorities to come into line with the rest of India by organising an adequate staff of professional men to deal with the diseases of stock.

In conclusion we wish to call attention to the rapid strides made and results achieved during the last few years in combating Rinderpest in this country and to sound a note of warning as well. There is sufficient evidence in the papers published herein to show that immunisation against Rinderpest by the biologic products obtained through a series of unbroken passages of the virus through the goat, do not ensure a safe or satisfactory method of conferring active immunity in all cases without the use of the anti-serum to moderate the reactions in the inoculated animals. It is necessary, therefore, to exercise great caution in using these products alone in mixed herds of varying susceptibility for, when severe reactions and mortality occur in particular localities or herds even though the percentage in the aggregate for the Province be small, it is bound to have serious repercussions. Another point which we wish to emphasise is with reference to the so called "blocked out" reactions in Rinderpest immunisation. It is well known that in this disease there is no immunity without infection and the severity of infection does not depend upon the infecting dose but on the susceptibility of the animal. There is no such thing as a "blocked out" reaction resulting in immunity. If there is no reaction at all as a result of the introduction of Rinderpest virus, then it means one of two things, namely, that the virus was dead or the animal had pre-existing immunity.

Symposiums on Rinderpest Control in India.

A NOTE ON RINDERPEST IN ASSAM.

BY

V. R. GOPALAKRISHNAN, G.M.V.C.,
Veterinary Investigation Officer, Assam.

Before proceeding to the subject of Rinderpest in Assam, it would appear necessary to give a brief description of the natural features and geographical conditions of the Province to appreciate fully the epidemiology of disease. Assam is a landlocked province forming the north-eastern frontier of India. The climate is humid and the rainfall is high. The topography presents numerous undulations consisting of hills and dales abounding in forest and marshy tracts respectively. There are two main valleys—the Brahmaputra and the Surma that constitute mainly, though not entirely, the whole province. Sloping downwards from the Bhutan Hills on the north, numerous tributaries join the Brahmaputra. South of the river again there are many hill ranges below which a valley is formed where the Surma river flows. There are large lowlying areas and inundated tracts full of weedy and rough vegetation. Quick communication and good roads are of recent development. These advantages could not be obtained in certain hill tracts even now, due to the inherent natural obstacles. But there are many road communications, mostly country road tracts, between this province and the adjoining states and provinces.

It is generally held by many observers that Rinderpest infection was brought into India by movement of cattle from the neighbouring countries through the North Eastern Frontier tract which forms part of Assam. The province has been sustaining more or less severe periodic losses from Rinderpest. The disease is responsible for about 50% of the total mortality, as indicated by the available figures. Hence the control of Rinderpest has been the main problem of the Veterinary Department, Assam, since its inception early in this century.

The disease presents its common symptoms and course within the limit of the usual variations observable under the field conditions, but the mortality has been found to show wide range, depending upon the breeds. The plains Assam cattle appear to be more resistant than the hill breeds and buffaloes. Very heavy mortality among buffaloes has often come to the notice. There has been an indiscriminate mixing of blood or breed—such as Bhutan hill breed and local or Tharpakar; Seindi and local; Manipur and local etc., not to speak of the intermixing of English breed too, so much so that the resistance to natural infection of Rinderpest is of a variable nature.

The 'Serum alone' method of inoculation, the only method in vogue during the beginning of the Veterinary organisation, was adopted to control the outbreaks. The idea of popularising this method was a real uphill task and a missionary work. At first there was great opposition to the inoculation of cattle but this opposition has been gradually broken down. "It is curious to note that one factor which helped to break down this objection was the injection of large number of people themselves in the treatment of Kala azar". Also facility for communication was not developed as at present with the result that prompt attendance of outbreaks was not feasible in all cases in consideration of the large areas under jurisdiction.

The necessity for reinoculation should the disease persist in the locality, was realised and to obviate this, attempts have been made to confer more lasting immunity by infecting all inoculated animals with a mixture of saliva and urine from the sick cattle. This modification was attended with more or less successful results.

The Department has been availing the facilities of the progress of research at the Imperial Veterinary Research Institute, Mukteswar, on this subject and as far as possible put into practical application of the methods evolved. The 'Serum Simultaneous' method was adopted to protect the cattle of Government Farms although much headway could not be made to extensively adopt this method in the field. Similarly vaccination with 'Goat Virus alone' method was also tried on an experimental basis. In fact, the policy of the Department was to control the disease by suitable methods with such products, safe and reliable, compatible with the funds available.

Extensive researches conducted in the Imperial Veterinary Research Institute, Mukteswar, resulted in the production of Goat Tissue vaccine as a safe and reliable biological agent for combating Rinderpest. This method is now extensively adopted in the province both for prophylaxis as well as in actual outbreaks. It will be of interest to quote a relevant portion from the Annual Report of Civil Veterinary Department, Assam 1936-37. "The department is now in a position to confirm its report of last year that the Goat Tissue vaccine inoculation in actual seat of epidemic of Rinderpest has now passed its experimental stage in respect of plains cattle in Assam. It is indeed a great relief to all concerned. The success of the method solves a triangular problem—problem to the stock-owners, to the department and to the Government." It need not be mentioned that the method gained rapid popularity and at times the department was embarrassed due to the inadequacy of the staff to cope with the demand. Substantial reduction in the expenditure was also effected as the cost of vaccination for 1,000 plains Assam cattle worked out at Rs. 6 while the protection of the

same number by serum method would cost Rs. 400. The ultimate savings by replacing 'Serum alone' method with Goat Tissue vaccine roughly come to over four lakhs of rupees and this is largely due to the impetus given by Rai Sahib S. C. Ghose, Director, Veterinary Department, Assam, to popularise this method.

Necessity for the increase in the field staff was pressing and the paucity of qualified Veterinary graduates was disquieting and therefore the department had to undertake the training of the new field staff known as 'Veterinary Field Assistants' for helping the Veterinary Assistant Surgeons in carrying out vaccination in addition to other minor works. They undergo practical training for six months in the Gauhati Veterinary Hospital and are trained mainly for vaccination against Rinderpest besides an elementary practical training in Veterinary aid. It is considered that with this additional staff the demand for vaccination could be adequately met with.

Although every year a few lakhs of animals are being protected by this method, certain other problems presented themselves entailing further investigation. They are the grades of reaction at the time of immunisation, the susceptibility of various breeds of cattle and particularly buffaloes, the minimum requirement of anti-serum to control severe reaction in buffaloes, the part played by sheep and goats in natural outbreaks of Rinderpest, etc. Investigation into these problems are still in progress.

The immunisation of buffaloes in Assam involved a preliminary study of the susceptibility of various breeds and also those in various localities. Some breeds of buffaloes manifest very severe reaction attended with deaths while in some, the severity of reaction could be controlled with a dose of anti-serum from 20 to 50 c.c. Experiments were conducted with a modified dose of Goat Tissue vaccine (half the usual dose i.e. 0.5 c.c.) and with normal dose of Goat Tissue vaccine (1 c.c. of goat spleen emulsions) and a controlling dose of ordinary Rinderpest serum (Sero-virus method) in a hill breed of cattle in Assam at an altitude of 2500 feet and over, above the sea level. Similar experiments were also carried out in more susceptible buffaloes. Reaction was found to vary and further work on this line is contemplated. Rare instances came to our notice in which delayed reaction was also observed. Therefore, when the work is actually in progress some vital issues, not to say of complications, develop requiring thorough investigation with a view to modify, if necessary, and make the method as far as possible fool-proof.

It would be of interest to conclude this report by briefly indicating the future plan and policy of work. We have now at hand a method of controlling the worst scourge among cattle. But the crux of the problem in

the control lies in the viability of the virus at the time of vaccination. Under field conditions, depending upon the season, the vaccine more or less rapidly deteriorates, emphasising the *time factor* between production and use. This raises the question of local Vaccine Depot to ensure an adequate and timely supply and quick transport of potent vaccine, as systematic and extensive vaccination would considerably reduce the incidence of Rinderpest.

Another factor that is constantly engaging the attention of the Department is how to control and regulate the unrestricted importation and movement of cattle from neighbouring parts of the country. This is a problem that has been tackled in other provinces similarly situated. Vaccination of all the imported cattle in Quarantine Stations, is likely to reduce the incidence of the disease and the spread of infection by movement of affected cattle. Legislation is the only possible way by which this problem can be solved.

Last, but the most important of all, is the education of the illiterate cultivators who form the great bulk of the livestock owners, by propaganda in the matter of epidemic diseases and in all matters concerning the general welfare of the livestock. Serious contagious diseases of cattle, especially Rinderpest, act as deterrent towards the progress of animal industry in the province and have a great direct bearing on agriculture, dairy produce and ultimately on the economic condition of the province. Much work in this respect is yet to be done for the amelioration of the mass but the only encouragement for the future is the appreciation by the public, of the work done so far.

RINDERPEST CONTROL IN BALUCHISTAN

BY

JAHAN SHAH,

Deputy Superintendent,

Civil Veterinary Department, Baluchistan.

Rinderpest. This disease rarely occurs in Baluchistan. This is almost limited to hot and plain districts of Baluchistan, such as Sibi and Loralai. Since the formation of the Civil Veterinary Department in Baluchistan viz in the year 1910, the disease appeared twice in Sibi, once in Barkhan Tahsil of the Loralai district and four times in the Quetta city. In either case the virus came from Sind or Dera Ghazi Khan.

Symptoms. No special symptoms have been noticed by the Veterinary Department in Baluchistan. As is common here and everywhere else, every animal in the initial stage suffers from shivering which results in high fever; gets dull, head drooped and back arched; suffers from constipation, rapid pulse, and difficult breathing with cough. The appetite is depressed and thirst sometimes increased. Rumination is retarded and later suppressed. The visible mucous membranes are congested; the eyelids are greatly swollen and tears flow from the narrowed palpebral fissure. In the second stage, the animal gets eruptions and ulcers under the tongue, lips and also on the mouth; saliva with air bubbles and often with blood; colicky pains with shooting diarrhoea with blood and the result is that the animal dies within 10 days.

Treatment. Inoculation with serum alone is indicated chiefly for the temporary protection of animals from the danger of immediate infection but in the year 1920-21 when the disease broke out in the Nasirabad Ilaqa of the Sibi District, 95 % of the affected animals were saved through intravenous injection of serum and in the year 1932, all the 10 animals which suffered at Quetta were saved by the application of this injection. The dose used was 20 to 40 c.c. according to the size and age of the animal.

THE PRESENT POSITION IN REGARD TO THE INCIDENCE OF RINDERPEST IN LIVESTOCK OF BARODA STATE

BY

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*Deputy Director, Veterinary and Animal Husbandry Services,
Baroda State*

General: Baroda State comprises an area of a little over 8000 square miles and is divided in five almost flat territorial blocks cut off from each other by British Indian territory and Indian States.

Livestock population: According to the latest Census Report of 1940, the population of the livestock in the State is about two millions, out of which about one and half millions are cattle and buffaloes — practically half to half — and the remaining includes sheep, goats, horses, camels etc.

Breeds: There are two well-known breeds of cattle namely Kankrej and Gir and amongst buffaloes, three, namely Mehsana, Charotar and Jaffarabadi.

Most of the Agriculturists do not keep cows but maintain a pair of working bullocks and a she-buffalo for milk and its products. The male buffalo calves are practically starved to death as unwanted or sent to Pinjrapoles, thus no surplus animals are to be found with the Agriculturists.

Big herds of cattle are being maintained by cattle breeders known as Rabaris, who sell their animals especially working bullocks to the cultivators. A large number of flocks of sheep and goats are maintained by a certain community known as Bharwars.

The incidence of Rinderpest in the State on the whole is less when compared to other Provinces and States, on account of the almost flat territorial blocks, very few grazing areas, want of trunk roads, facilities of the Railways for the transport of Agricultural products, and big rivers as the Narmada, the Tapti, the Sabarmati, the Mahi and the other rivers acting as barriers for the free movements of nomadic herds.

Susceptibility: There does not seem to be marked difference in the susceptibility of different breeds of cattle mentioned above but in buffaloes it has been observed that they are more susceptible than cattle.

The symptoms, incubation period and duration of the disease have been noted to be alike as in other Provinces and States.

The percentage of mortality amongst the buffaloes has been recorded to be more in natural outbreaks than in cattle *i.e.* over 70% in buffaloes and 30 to 40% in cattle.

The Source of Infection and Mode of Spread: The State scattered areas are surrounded by British Indian Territory and Indian States. There are petty Indian States on the boundaries of the State areas, where there is no adequate Veterinary Service. There are Veterinary Services in some of the States, but on account of the insufficient and inadequate staff, there is no effective check over the spread of the contagious diseases especially on the boundary areas, *e.g.* Gir jungle, where animals infected and non-infected with contagious diseases, from surrounding States are taken for grazing usually in cold season, and especially when there is scarcity of food and fodder and want of rains. When these animals return to their respective places, they carry infection with them and thus spread the disease. Another grazing area in the State is on the North and South banks of the Narmada River, which flows through the State territories. Animals from an area where there is paucity of water and want of food and fodder are taken away in these areas and if some of the animals are infected with some contagious and infectious diseases, they spread infection, wherever they go.

Another source by which the infection is spread is by the movements of cattle owned by Sindhis and Lamans who travel throughout the State,

selling their cattle on the way, affected and non-affected. These are found moving with their herds from September onwards every year in addition to the Rabaris, and Bharwars. The Pinjrapoles animals also are responsible for such spread.

Cattle Bazar and Fairs: No cattle fairs are held in the State Territory as well as cattle bazar except one at Baroda proper, which is held weekly. There is no doubt that cattle fairs or bazar places give chances to the cattle owners or breeders to dispose off their animals with all the attending risk of spreading contagious diseases. Such centres form a nucleus of spreading infection into non-infected areas, wherever such animals are taken away. These cattle owners or breeders after purchasing or selling their animals from infected and non-infected areas travel with their animals by the roads, through the villages and towns that they come across and due to these, outbreaks not only of this disease but others of contagious and infectious nature occur in villages and towns through which such infected animals pass.

Nomadic Herds: Outbreaks do occur by the movements of the nomadic herds affected with contagious and infectious diseases. In the State cattle breeders and dealers *viz.* Rabaris and Bharwars, who maintain and rear a large number of sheep and goats move about six months from village to village especially when there is scarcity of water and fodder or from the famine stricken areas, for grazing their animals, for manurial purposes and disposing or selling whenever possible on their way. Though the migration of these animals is generally seasoned, it is the main source of infection in spreading the infection of the disease.

When the disease is known to be prevalent in a village, the headman or Patel of the village is expected to report the occurrence of the outbreak to the Veterinary Officer and Vahivatdar of the Taluq concerned. The information is sent duly filled in the prescribed forms supplied to him. He is then expected to send weekly returns of the progress of the disease to the officers concerned till the disease stops. He also maintains a register of the contagious diseases that occur amongst the animals of the village. The register is checked by the Revenue Authorities whenever they are on tour. The Veterinary Officer concerned, on receipt of the report of an epidemic attends immediately. He inspects all the animals affected and non-affected and makes necessary inquiries and confirms the disease and advises preventive measures against it, urging people to get their animals protected against further attack of the disease. The Veterinary Officer then submits E. D. Reports to the Dy. Director of Veterinary Services through the Veterinary Inspector and gets vaccine by wire and vaccinates the non-infected animals of the village. He, after vaccinating the animals again visits the village and after full enquiry and inspection of the vaccinated

animals sends returns to the higher authorities who then check the work done by the Veterinary Assistant Surgeons.

Serum Alone Method of Inoculation.

This method was in vogue till 1937, when the reorganisation work of the Veterinary Department was started. Out of many changes that have taken place during the organisation work of the Department, the introduction of Goat-Virus method of vaccination stands first from professional point of view. The serum alone method on account of its well-known disadvantages was discontinued.

Goat-Virus Vaccination Method.

This method of active immunisation to control the epidemics and as a prophylactic was undertaken from 1937, and is in progress throughout the State year by year. This method has been found to be cheap, safe and effective in controlling the actual outbreaks and as a prophylactic and as a result of it, the disease has been considerably kept under control. It is gratifying to note that by introduction of this method in the State about one and half lacs of animals have been protected in affected and non-affected areas against this dangerous disease during the last three years with an insignificant percentage of mortality amongst the vaccinated animals.

The usefulness of vaccinating a large number of animals has been proved in famine stricken areas of the State this year. On account of the movements of the cattle from place to place in all the directions in search of fodder, Rinderpest broke out at various places but due to the vaccination work the disease was controlled very easily.

The Prophylactic vaccination work is usually undertaken in the cold season free of charge and the Goat-Virus is obtained from the Bombay Veterinary College.

Rinderpest in Sheep and Goats. There is no record of the occurrence of this disease amongst goats and sheep.

PROBLEM OF RINDERPEST IN BIHAR

BY

M. I. MALIK B.Sc., M.R.C.V.S

Director, Veterinary Services, Bihar

Rinderpest is one of the serious scourges that India has to contend with and Bihar is no exception. As a matter of fact in this Province situated as it is on the main high-ways through which cattle move from west to east of India the problem is much more acute than in the areas where little or more migration takes place. Every year infection is brought into this province from cattle that pass through or attend the various cattle fairs or come in for grazing in hills from western Provinces and we are perpetually faced with the problem of keeping this dread disease in check. For obvious financial reasons as well as backwardness of stock-owners no attempts have been made to eliminate the disease from this Province nor do I think this would be possible unless this campaign is country-wide.

The Province of Bihar and Orissa was created in the year 1912 and the Veterinary Department then in its infancy was placed under Mr. Quinlan as Superintendent who was under the administrative control of Director of Agriculture. In 1920 the Department was made independent with Mr. Quinlan as the first Director and Veterinary Advisor.

In the early days it was an uphill task to persuade the ignorant villager to accept serum inoculation as a prophylactic measure. At times the zeal of the Veterinary staff against the profound ignorance and superstitions of the people created ugly situations. In some cases these resulted in assaults on the veterinary staff who were actuated only by the highest motives for the ryot whom they were serving. Luckily those times have changed and today the Department finds that it has not sufficient funds at its disposal to provide sera and vaccine where it is demanded by the ryot.

Originally control of Rinderpest by 'Serum alone' method was practised throughout the Province of Bihar and Orissa, and an average of about 90,000 animals were protected annually. In those days serum was indented directly from Mukteswar but as the demand grew more a serum depot was opened in 1922 at Muzaffarpur. This serum alone method continued to be adopted till 1928-29 when 'serum simultaneous' method was first introduced in this Province by Major Riley. In this operation bull virus was used. From

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now onwards 'serum simultaneous' method was practised in selected herds while 'serum alone' method was employed amongst the cattle of ryot. In 1932-33 'goat blood virus alone' was tried out by Mr. Malik at Kanti on 337 animals. Thence onwards this method was employed in selected herds in the Province. As is well known this method had several advantages over the older 'serum simultaneous' method the details of which need no elaboration. For the next 3 years 15,255 animals were immunised by this method in addition to 'serum alone' method. In 1934-35 'Goat Tissue Virus' was introduced in the Province by obtaining the tissue from the Imperial Veterinary Research Institute, Mukteswar. As this method was a decided improvement on the 'Goat blood virus' method it replaced that method and in 1936-37 the goat blood virus method was altogether discarded. By the end of the year in the Province alone 348,087 animals have been vaccinated by 'Goat tissue virus' method.

In practice certain difficulties were encountered in the use of 'goat tissue virus' in so far as buffaloes of pure Murra breed and these having infusion of that blood reacted severely to 'goat tissue virus' if the action of that virus was not controlled by the use of serum. It was therefore necessary to elucidate the factors governing its reaction and adopt measures to control the reaction. Experiment carried out by Mr. Sahai, the Disease Investigation Officer, revealed that the variation of dose of virus had no effect on the resulting reaction while the simultaneous injection of serum in doses of 4 c.c. per 100 lbs. body weight was adequate to control the severity of reaction. Since then in cases of susceptible buffaloes serum is simultaneously used with 'goat tissue virus' in the dosage noted above. It was necessary to control those severe reactions as besides the slight malaise, the milk yield was considerably reduced and the ryot did not welcome this phenomenon.

A disadvantage attached to goat tissue virus is that it cannot stand well transport during summer over long distances. We were therefore forced to start the production of goat tissue virus locally and a section has been opened at the Bihar Veterinary College this summer.

Below is given a chart showing the number of outbreaks of Rinderpest with other relevant information since the year 1927. This chart is likely to mislead if its implications are not explained. The chart does not show much difference between the figures of 1927-28 and 1938-39 but it may be pointed out that the reporting of the disease has become much more efficient both with increase of the staff and consciousness that has come over the ryot during the period of 12 years, with the result that while many outbreaks, attacks and deaths remained unreported in 1927-28 few escaped the attention of the staff and public in 1938-39. On average now 3,41,887 animals are annually vaccinated by this method.

The present policy of keeping the disease in check is likely to continue in the Province till such time as the problem of eradication is taken up on an all-India basis.

Year.	No. of outbreaks.	No. of animals involved.	No. of death.	No. of animals i/c by 'serum alone.'	Deaths percentage in inoculated animals.	Remarks.
1927-28	1,143	14,623	6,405	92,182	0.3	
1928-29	2,047	39,966	16,385	149,098	0.59	'Serum simult' introduced.
1929-30	3,054	58,762	27,212	164,641	0.73	...
1930-31	3,493	64,575	28,541	58,369	0.97	...
1931-32	2,428	38,432	16,053	87,830	0.27	...
1932-33	2,434	35,667	15,215	106,649	0.11	'Goat Virus alone' introduced.
1933-34	1,349	19,129	8,467	84,929	0.1	
1934-35	1,666	21,171	10,531	94,888	...	G. T. V. introduced.
1935-36	1,246	14,080	6,427	76,559	0.1	'Goat virus alone' discarded.
1936-37	1,532	16,849	7,818	77,261	0.29	...
1937-38	611	7,724	3,182	27,973	0.05	...
1938-39	1,569	16,756	7,826	77,478	0.15	...

A SHORT HISTORY OF RINDERPEST IN GWALIOR STATE

BY

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It was in 1920 that rinderpest first drew the attention of the authorities concerned. Reports of outbreaks were received from 11 villages and four thousand preventive inoculations were carried out. But then the veterinary staff was very limited and the serum grant was insufficient. Moreover our path was beset with religious obstacles born of ignorance the removal of which called for strenuous propaganda. This condition prevailed till 1930, when under Durbar orders the Veterinary Department was re-organised with the result that from the year the fight against rinderpest began to be carried out with great zeal.



Upto 1930, 1,04,614 animals were inoculated against rinderpest by serum alone method and 83,018 animals in 1379 villages were saved from falling a prey to this disease. The percentage of mortality dropped by 70 to 30%.

In 1932, the use of Kaolin for the treatment of rinderpest in the diarrhoea stage was started. This mode of treatment proved very successful and became the means of saving the lives of thousands of cattle. From 1931 to 1939, a period of nine years, 1,42,083 animals were inoculated and nearly 10,03,106 cattle were saved from the clutches of this disease by serum-injection and medical treatment.

The preventive dose used is 10 to 20 c.c. of the ordinary A. R. P. serum; the curative dose is upto 60 c.c., the quantity of serum being determined according to animals and circumstances.

The Kaolin treatment consists of feeding the animals 2 to 8 ozs. of the stuff, according to the severity of the attack, in warm rice gruel, thrice or four times in a day.

In 1938, Goat Tissue Vaccine method was introduced in the Gwalior State for the first time and 4000 animals were inoculated. In the year 1939-40, the G. T. V. method was taken in hand in right earnest and by the end of June, 1940, 58,644 animals were protected against rinderpest.

The rate of mortality is now 10 to 20% of the total number of animals affected by this disease, the cattle population of the whole State being 45 millions.

A BRIEF NOTE ON RINDERPEST IN H. E. H. THE NIZAM'S DOMINIONS, HYDERABAD (DECCAN)

BY

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This disease has engaged the attention of the department always. There have been waves of mortality every ten years. The upland and dry parts viz. Marathwara and Karnatak are much less affected than the damp and swampy areas of Telangana and the disease is mostly confined to central, eastern and south-eastern parts of the Dominions. The disease slowly infiltrates from the infected areas, attacking susceptible animals and spreading from village to village. Buffaloes being more susceptible than cattle are usually its first victims, followed by cattle and if close contact exists, by sheep and goats. It is usually severe in areas where it breaks

out after a long interval. A common cause has been the sale of infected animals from market places or infected animals passing through the villages.

Method of control :—Isolation, disinfection and the use of Anti-Rinderpest serum as a protective was practised till about 1930. "Serum simultaneous" method of protection then followed till 1932. "Goat-virus" made its entry in the field of control in 1932, following the preliminary research made at Mukteswar. Hyderabad took its share in the pioneer work of introducing and popularising this method of control in the field. It was established that goat-virus could be produced easily in the field and its use was perfectly safe in cattle, both as a protective and to control out-breaks of the disease. Besides being very effective it is cheap, and as such, it became a method of universal control of the disease. Heat of the plains being responsible for early deterioration of this product, it became necessary to introduce goat-tissue-virus, which has better keeping qualities and is cheaper still. We have in Hyderabad a centre for producing both goat blood and tissue virus and this is regularly supplied to the district staff to deal with Rinderpest. In buffaloes, the reaction has been severe attended with mortality and therefore a small amount of serum is generally always used along with the virus. Keeping qualities of the vaccine produced locally have been tested in different seasons of the year. The testing of immunity following the use of goat virus has been done from time to time, with bull virus from the Madras Serum Institute or Virus from natural out-breaks. Immunised animals have remained free in outbreaks.

From the year 1932 to the present time, many lakhs of animals have been protected both in infected and non-infected areas and the present method has greatly facilitated, in bringing the mortality from this disease, under control. This is clear from the statement below :—

Year.	Inoculation	Mortality
1931-32	1,44,000	20,348
1932-33	1,75,000	14,506
1933-34	2,12,000	14,228
1934-35	2,20,000	14,096
1935-36	2,70,000	6,791
1936-37	3,35,000	2,501
1937-38	2,45,000	1,407

Attention has been concentrated in the past to control outbreaks first, and form immune belts to restrict the infection. A great success has followed the policy of protecting the animals in the road side villages by preventing the infiltration of the disease further interior.

A large number of cattle enter the Dominions for grazing and many agricultural animals are brought in for sale from Nellore and Guntur districts. Measures are under consideration to have quarantine stations to immunise the animals before allowing them to enter the Dominions. Legislation for compulsory inoculation is also under consideration.

CONTROL OF RINDERPEST IN JODHPUR STATE (MARWAR)

BY

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Jodhpur State is predominantly a pastoral country. It has vast grazing areas as compared with the arable lands. Rearing of livestock has from time immemorial been the major occupation of the people along with the famous breeds of Nagori, the Sanchori (Kankrej) and Mallani (Tharparkar.) The Marwar sheep, camels and goats too have a prominent place in the economy of rural life.

Of 36,021 sq. miles comprising the Jodhpur State, 30,146 sq. miles constitute Jagir area for which no data regarding census of livestock are yet available. Out of the rest of 6,875 sq. miles pastures extend over 3,931-sq. miles, which maintain seven million cattle and 22 lakhs of sheep.

For the purpose of livestock (Cattle) the country can be divided into three main tracts or areas i.e. West and North-West, North and North-East, South and South-East, where the famous breeds of Mallani (Tharparkar), Nagori, and Sanchori (Kankrej), cattle are bred and reared respectively.

The Animal Husbandry Department was established in the year 1936, one of its sections being the Disease Control Section which is the most important to preserve the cattle and other livestock wealth. As any other country in India, Jodhpur State is not free from the scourge of Rinderpest, which takes away the heaviest toll. Steps were immediately taken to combat this disease to raise and rear Rinderpest immune cattle.

Before the establishment of the Animal Husbandry Department, there was only one Veterinary Hospital at Jodhpur city. On the establishment of this Department it was programmed to open three Veterinary Hospitals every year until each district will have its own Veterinary Institution. In addition one touring dispensary was also instituted. By now ten out of twenty one districts have their own hospitals. A Veterinary Investigation Laboratory was also established at Jodhpur City with a view to tackle the problems connected with the systematic investigation of local

conditions with regard to the diseases of the livestock, and to prepare various biologicals wherever possible. The preparation of goat (blood) virus was undertaken in the Laboratory. Arrangements were made to record outbreaks of Rinderpest by the Veterinary Hospitals and to take up the preventive inoculations with Goat (blood) virus alone. Later the work was started to immunise cattle in disease-free villages with a view to create immune belts. As no solid immunity can possibly be induced among calves, aged below one year, it was decided to take up the immunisation in these immune belts of the new young stock every two years by which scheme the Rinderpest immune cattle are easily raised. For this purpose the work was taken up in the villages district by district. The immunisation of Government animals at the Cattle Breeding Research Stations is also done on the same lines.

During the recent famine Livestock of Marwar migrated to Malwa (Central India). An opportunity was taken to inoculate all these cattle against Rinderpest when they returned to Marwar. For this purpose two centres were established with sufficient Veterinary staff — one at Nasirabad (Ajmer-Marwara) and the other at Chitorgarh (Udaipur State) which lay on the principal routes of immigration. Arrangements were also made for halt and free feeding arrangements for both the cattle and men at these centres.

By this scheme within a period of two months from April 16, 1940 to June 20, 1940, 72,070 head of cattle were inoculated. In addition 2,212 head of cattle were inoculated in Malwa by one of the Veterinary Officers specially deputed for the purpose.

Conclusion.

1. Immunisation of cattle on the scene of outbreak with goat (blood) virus alone is being carried out.
2. Systematic inoculation of Cattle in the villages free from Rinderpest with a view to create immune belts has been undertaken.
3. Protection of new young stock in the immune belts and at the Cattle Breeding Research Stations is carried out once in two years systematically.

Statement showing the number of cattle inoculated against Rinderpest with goat (blood) Virus.

Year	Number
1937-38	2,174
1938-39	17,116
1939-40	74,574
1940-41 (upto December 1940)	10,829
Total :—	104,693

RINDERPEST, ITS INCIDENCE AND PREVENTION IN THE PROVINCE OF MADRAS

BY

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Rinderpest is more or less an enzootic in this province and is responsible for a large number of deaths annually. Out of a total mortality due to all contagious and infectious diseases of cattle, Rinderpest alone claims about 50% of the deaths. The records show that this province has never been free from Rinderpest with the result that the economic loss caused to the province by this disease alone, although difficult to estimate, must be colossal. The following figures of the recorded mortality of Rinderpest as compared to the total mortality will serve to indicate the large percentage of deaths caused by Rinderpest.

Year.	Deaths caused by Rinderpest.	Total number of deaths caused by all contagious diseases.
1918-19.	44,164.	76,114.
1919-20.	31,237.	59,297.
1925-26.	23,724.	45,147.
1930-31.	59,323.	99,890.
1931-32.	28,412.	56,634.

It is worthy of note that the disease has been found to occur in the form of waves, the peak of each wave being reached every 10 years.

The following figures of mortality caused by Rinderpest will show the tendency it has to increase and decrease every 5 years :—

Years.	Deaths due to Rinderpest.
1908-09.	149,666.
1913-14.	8,871.
1918-19.	44,164.
1923-24.	3,434.
1928-29.	129,583.
1933-34.	5,209.
1938-39.	8,649.

A high mortality was expected to occur about the year 1938-39 but this did not happen presumably due to the intensive inoculations which have been carried out in this province over a number of years.

Attempts to combat the disease in the province:— Rinderpest has been kept under control in the Madras Presidency for some years now and has been restricted to certain areas; so much so that some of the sporadic outbreaks which have occurred have afforded ample evidence to show the source of infection and mode of spread. A scrutiny of the statistics pertaining to the incidence of Rinderpest in Madras and the adjoining States indicates that the incidence depends to a large extent on the migration of cattle either for sale or grazing, and there is no doubt that the movement of animals in large numbers is responsible for its spread. Such movements of animals on a large scale occur during,

- (i) the migration of cattle for grazing,
- (ii) importation of cattle into the province, and
- (iii) movement to and from large cattle fairs.

The migration of cattle in search of grazing is seasonal. During certain periods of the year in the Madras presidency, considerable numbers of cattle proceed from the Delta areas where cultivation does not allow of pasture, to grazing areas in the forests. The cattle sometimes have to travel long distances before reaching the grazing areas, and they usually remain there for months before returning. If Rinderpest breaks out among these herds, it is found that its spread depends on the stage at which the moving herds become infected enroute. If infection occurs at the beginning, centres of infection will be found at various places on the route, but if at the end the infection is located in the grazing area and animals returning are responsible for spreading the disease on their return journey.

Another serious problem is the migration of cattle into the province from fairs for sale. If Rinderpest is prevalent at the time these fairs are held, it is found to spread in all directions. There are a number of cattle-fairs held annually in a State adjoining Madras from which large numbers of animals are imported into the Madras Presidency. It has been found that if this State is free from Rinderpest at the time these fairs are held, the districts in the Madras Province into which these cattle are imported remain more or less free. The position of Rinderpest, therefore, in a province which imports large numbers of animals depends to a great extent on the prophylactic measures adopted in the adjoining provinces.

As stated above, it has been found that Rinderpest is most prevalent in areas where there is a large traffic in animals, and in places where large numbers of animals are brought into contact. Large cattle fairs, routes along which cattle migrate annually into grazing areas and the main thoroughfares throughout the presidency form the endemic centres. These are the places where concentrated work will have to be done in order to keep Rinderpest under control, and for this purpose, two essentials are necessary—a "Stand still" order and active immunisation of all cattle in the infected area.

In this province there is practically no control over the movement of animals, and the policy has been to immunise either passively or actively as many animals as possible in an outbreak.

Inoculation by "Serum Alone" method was undertaken for the first time in this province in the year 1900-01 when 60 inoculations were conducted. This method of inoculation was gradually increased until the year 1927-28, when 184,321 animals were inoculated. This method of controlling Rinderpest must be considered very doubtful and from the year 1929-30, it was gradually replaced by "Serum Simultaneous" method with bull virus. This method was started on an experimental basis in the year 1920, from which year the number of animals immunised gradually increased as shown below :—

1919-20	...	69
1924-25	...	212
1929-30	...	168, 780

The Serum required for inoculations used to be obtained in former years from Mukteswar. During the year 1929-30 alone serum worth Rs. 4.58 lakhs had to be purchased. In view of the large amount of money expended annually on this account, the local Government decided to start a Serum Institute in Madras, and accordingly in April 1932, the Madras Serum Institute was started.

Various methods of immunisation employed :—

One big objection to "Serum Simultaneous" method with bull virus is its cost and to overcome this many methods have been tried.

(1) During the year 1932-34, experiments were conducted on the use of goat blood virus in immunising cattle against Rinderpest as an alternative to Serum Simultaneous inoculation with bull virus. 2,769 head of cattle of various classes and breeds were vaccinated and the results were found encouraging. From the year 1934-35 onwards this method was given an extensive trial and 1,56,930 head of cattle were vaccinated during the years 1934-37. Of these 154 deaths were reported, mostly among buffaloes. This number cannot be considered high but the reactions produced on the whole were considered too severe to make it an ideal product for general use. The method was ultimately given up.

(2) *Rinderpest goat spleen tissue glycerinated vaccine.*—Experiments with this product (prepared in 60% aqueous glycerine) were started in the year 1936-37. From the year 1937-40, 2,66,752 vaccinations were conducted by this method. Subsequent tests however proved that the immunity conferred did not last very long. Its potency under field conditions was also very often in doubt, and after extended trial, due to its erratic behaviour in the field, it was discontinued.

(3) *Rinderpest goat spleen tissue vaccine in normal saline.*—An emulsion of 1% strength of goat spleen tissue prepared in the field, with a piece of spleen tissue supplied from the Serum Institute, by trituration in 5% saline solution was used in vaccinating 8,007 animals during the years 1931-40. This method has also since been discontinued as the reactions produced by it were found to be too severe.

(4) *Dessiccated spleen tissue vaccine.*—A 1% solution of dessiccated spleen tissue in normal saline freshly prepared in the field from dessiccated spleen tissue taken either from goats or bulls and supplied from the Serum Institute is now under trial in the districts.

(5) *Serum Simultaneous inoculations with goat blood virus and reduced doses of serum.*—Serum at the rate of 2 and 5 c. c. per 100 lbs. body weight for cattle and buffaloes respectively is considered to be the best method of immunisation so far evolved, and further trials are now being made to ascertain the safe minimum dose of serum for the various classes and breeds of cattle.

Policy adopted in checking Rinderpest and Legislation undertaken.—In their report the Royal Commission on Agriculture observed that more attention to the question of controlling Rinderpest has been given in Madras than in other provinces. A cattle disease Act was passed in this presidency as early as 1866, and is still in operation. Under the powers conferred by the Act, notification of certain diseases has been made com-

pulsory, movements of cattle can be restricted, cattle fairs can be closed in affected areas, and carcasses of animals which die of disease can be suitably disposed of. But this Act only allows the "serum alone" method to be adopted which is not very satisfactory. It is desirable therefore to have legislation which will control the movement of animals and allow of compulsory inoculation being carried out by some agent which will produce active immunisation. A Rinderpest Act which is now under the consideration of Government will give these powers and by means of this Act, Rinderpest in future can be more effectively controlled.

The Act will provide for —

- (1) Compulsory inoculation of cattle in places to be notified by the Government from time to time,
- (2) The prohibition or regulation of the movement of animals alive or dead or of any products of animals or anything used in connection with such animals which are believed to carry infection,
- (3) Control of places where cattle are assembled such as fairs, markets, exhibitions, etc.
- (4) Isolation and segregation of animals which are believed to be infected and the inspection and treatment of such animals,
- (5) The prevention of infection by prophylactic measures such as the cleansing and disinfection of vehicles, infected premises, etc.

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RINDERPEST ERADICATION IN INDIA

BY

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I. Introduction

Rinderpest or, as it is more popularly known as cattle plague, has attracted the attention of Veterinary investigators from very early times because of the severe economic losses for which it is responsible, of its infectious and rapidly spreading nature and of the high animal mortality which it causes. The problem has been so large and intricate that numerous workers have devoted much time and attention to discovering means for preventing and for controlling the spread of this disease. The local conditions in a country the susceptibility of its cattle or of other species of domestic animals to the disease and the resources that have been available have largely determined the degree of actual success that has been recorded in checking the incidence of this affection. While some countries have been rendered completely free from the disease, there are many others where only a partial success has been achieved in this respect. Experience has repeatedly shown that the most rational method of checking such epizootic diseases as Rinderpest is a well planned and intensive campaign carried out simultaneously all over the country. Prophylactic methods of different kinds have been devised in countries where the disease occurs but it is noteworthy that the degree of success which has followed the adoption of one particular method in one country has not been the same as that obtained from its use in another country. Local investigation and the elaboration or adaptation of methods specifically suitable for use in individual countries are, therefore, essential.

Taking the case of India, which is remarkable for the teeming millions of its livestock and its vast area without any considerable geographical barriers against the spread of contagion, once Rinderpest is established within its borders, conditions for its spread are unusually favourable. The task of controlling the disease by human agency thus assumes considerable magnitude. Agriculture continues to be the mainstay of the people and livestock forms the bedrock upon which the whole foundation of agricultural prosperity and even its very existence depends. Improvement of livestock productivity or quality can never be practicable until efficient methods for guaranteeing the maintenance of animals in health and their protection from untimely death through the ravages of epizootics have been assured. Rinderpest still

continues to be the nightmare of farmers and until the security of their livestock wealth can be guaranteed against this scourge, they can scarcely be expected to undertake measures for the improvement of their stock. In view of the fact that efficient methods of providing this guarantee are now available in the shape of rinderpest prophylactics, the time is ripe for a stock-taking and the formulation of plans for meeting the situation in the future.

In a brief survey of the evolution of rinderpest work in India, it is only necessary to take note of what may be called the "land marks of rinderpestology." Attention may be said to have been focussed upon rinderpest in India since 1869 when the Indian Cattle Plague Commission was appointed by the Government of India with Mr. H. B. Hallen as its Chairman to enquire into facts regarding this scourge. As a result of the findings and recommendations of the Commission published in 1871, the first organisation for the investigation of suitable prophylactics against the disease came into being in 1890. This organisation was then called the Imperial Bacteriological Laboratory and it is now known, in its present enlarged form, as the Imperial Veterinary Research Institute. The first head of this organisation was Dr. Lingard, who commenced his experiments on rinderpest in 1895, a few years after his appointment as Imperial Bacteriologist. In 1897 Prof. R. Koch the famous German bacteriologist, was invited by the Government of India to demonstrate the bile method of rinderpest immunisation which had already been evolved and proved efficacious in South Africa. This demonstration was given by him to a group of veterinary officers, including Lingard himself (Lingard, 1897). This formed the beginning of actual experimental work upon rinderpest and may be considered to be the first stage of rinderpest work in India.

The bile method of immunisation was, for reasons to be stated later, not found suitable and the second stage of rinderpest work in India commenced with the attempts to discover other methods of control. Koch had already demonstrated the protective value of serum from animals which had recovered from a natural attack of the disease (salted animals) (1896) and Kolle and Turner (1897) envisaged more satisfactory immunisation with a dose of the virus following previous serumisation. In the work that followed in India, the serum method became the method of choice and researches were mainly concentrated upon the questions of the development of potent sera and of their application. Schemes of hyper-immunisation were tried and the buffalo was eventually chosen as the best animal for use in serum production. Method of passive immunisation by 'serum alone' and active immunisation by the combined 'serum-virus' method were thus originated and adopted to varying extents in different parts of the country. It was realised that the active protection resulting from the 'Serum simultaneous'

method was the most satisfactory, although it was liable to entail a certain amount of mortality among highly susceptible animals. As the occurrence of such mortality might prejudice immunisation work of all kinds amongst cattle owners and thus cut at the very root of veterinary development in this country, the "serum alone" method was commonly practised and the use of other method remained restricted to Government herds. Rinderpest immunisation in the field was placed under the charge of a staff specially trained for the purpose at Mukteswar. The extent of actual immunisation work had, however, to be considerably curtailed owing to an insufficiency of adequately trained staff. The third stage may be said to have been ushered in with the elaboration of the "goat blood virus" method. Koch had already found that goat-adapted virus was less virulent for bulls and Tapacio in 1926 had clearly shown that a very cheap and safe method of immunisation in cattle by the use of 'goat virus alone' could eliminate partially or completely the necessity for the simultaneous use of anti-serum. Goat-adapted virus was first used in India in 1928 at the Karnal farm and the credit for demonstrating the possibilities of this method of immunisation belongs to Dr. Edwards. Previously, the possibility of setting up a concurrent infection with protozoa, either resuscitated in the inoculated animal or introduced with the bull virus had been a serious obstacle in Rinderpest immunisation. In the goat virus method, Edwards found a valuable instrument for cleansing the virus of piroplasms by passaging it through this species of animal. Edwards' findings were followed up by Haddow (1934), who demonstrated that the spleen of infected goats was preferable to the blood. He showed that the virus was present in a richer concentration in the spleen and remained viable there for a longer period under field conditions than was the case with the blood virus. Experience soon showed the advantages of the goat virus method in the practical immunisation of Indian cattle, particularly in view of its extremely small cost.

The fourth stage may be called the stage of decentralisation of rinderpest work. In the stages which preceded it, rinderpest virus and anti-sera were produced exclusively at the Mukteswar Institute and distributed thence to the provinces for field work. The method of immunisation having been perfected and a certain number of Provincial officers trained at Mukteswar in work of this kind, the stage was set for the decentralisation of the activities connected with virus and serum production. Mysore and Madras took the initiative in this respect and started their own virus stations and their example has since been followed by Veterinary departments in certain other provinces. This has led to the further development of the method of immunisation by 'goat virus alone'. In the course of these trials it was found that the method was not only safer and more effective than previous methods but at the same time did not involve any risk

of mortality among the animals inoculated. The use of this product has now been extended to most parts of India, largely through the efforts of the Veterinary investigation officers appointed by the Imperial Council of Agricultural Research and the staffs of the Provincial Civil Veterinary Departments.

In the section that follows, it is proposed to discuss in greater detail the sequences of events in rinderpest control work in India, with special reference to the relative values of the different methods of immunisation outlined above.

II. Methods of Immunisation against Rinderpest

Bile method. Koch (1897), working in South Africa, introduced this method of immunisation for combating rinderpest. It consists in the injection, in 10 c.c. doses, of fresh bile unstained with blood. The bile is removed from animals dead of acute rinderpest under strictly aseptic conditions. Immunity is established about ten days after the inoculation of bile and lasts for about 6 months.

The disadvantage of the bile method of immunisation 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. Rogers (1900), working in India, failed to produce immunity in the Himalayan cattle by bile inoculation but was able to do so in the less susceptible cattle of the plains and in these cases the immunity lasted for about four months. The immunity was not established immediately after inoculation but only about ten days later and hence this method was of little use in immunising cattle during an actual outbreak. This method had the further drawback that a sufficient quantity of bile was not always available for immunising large herds of cattle. In addition, the opening of the carcasses was likely to cause resentment, on religious grounds, amongst certain sections of the people in India. Rogers found that the inoculation of filtered bile produced a passive immunity without setting up infection and this product had the further advantage of being odourless. The filtered bile method, however, conferred immunity only for from three to six months and hence Theiler (1897) suggested the repetition of the inoculation every three months. As such repetitions entailed considerable inconvenience, the bile inoculation was followed weeks later by an injection of virulent blood. Both the methods described above, however, soon fell into disuse on account of the difficulty of obtaining the requisite quantities of bile from rinderpest affected animals.

Immunisation with defibrinated blood. This method of immunisation was first tried out in South Africa (1899). It consisted in injecting sub-

cutaneously defibrinated blood taken from animals that had already recovered from an attack of rinderpest. Koch had found that 100 c.c. of defibrinated blood inoculated into healthy cattle afforded protection but that the resulting immunity was of a passive nature. In order to fortify active immunity, the defibrinated blood inoculation was followed immediately by the rubbing over of the mouth with the discharge of infected animals. This method, however, had the following disadvantages: (1) it involved the risk of transmitting other diseases, particularly red water and surra; (2) the dose of defibrinated blood required was greater than that of the 'serum alone' and consequently a larger number of animal donors were required; (3) the method proved expensive, (4) the viability of the blood virus was of short duration under normal conditions of storage, and (5) the use of large quantities of blood was resented by certain sections of the people in India.

Serum alone method of immunisation. As early as 1893, Semmer observed that the inoculation of serum from an animal that had recovered from rinderpest gave protection to healthy cattle against the disease and that this method of immunisation was also economical and effective in controlling the disease. The method has since been adopted on a wide scale in Africa, India and other countries. It can be employed during an outbreak as well as before or after it. In milch cows undergoing this form of immunisation, neither the quantity nor the quality of milk is affected. Cattle after serum injection can be sent out for grazing and be worked in the usual manner. Serumised animals, if allowed to mix with affected animals, contract a mild form of the disease and thereby they are actively immunised. This method, however, confers an immunity lasting only for from nine to fourteen days and the inoculations have therefore to be repeated at intervals throughout an epidemic and this obviously makes the method expensive. There has been considerable controversy in regard to the question of the duration of immunity produced by the 'serum alone' method. Holmes (1909), on the basis of the results of several experiments carried out in this connection in India, came to the conclusion that it conferred immunity lasting for from ten to fourteen days. If double the normal dose was injected, the immunity lasted up to twenty-one days and treble the dose prolonged the period of immunity to five months. Nicolle and Adil Bey (1899) in Turkey, and Reudiger (1909) in the Phillipine considered that the duration of the immunity conferred was from three weeks to three months. Stochman (1905), in South Africa, stated that it lasted only for ten days. Pool and Doyle (1922), working in India, found that a single dose of serum conferred immunity for nine days and that while increased doses prolonged the immunity, this increase was not proportional to the quantity of the serum used. It would, however, appear to be generally agreed that the duration of immunity following the inoculation depends upon both the quality, i.e., potency, and the quantity of the serum injected. Serum,

which is fairly fresh and has not been subjected to adverse conditions such as heat, has been found to possess a very high degree of potency. It is almost needless to point out that the extent of success that is likely to follow the application of this method depends upon the correct dosage and on the potency of the serum employed, the susceptibility of the cattle concerned and the virulence of the epidemic which it is being sought to combat. Failure to pay due regard to these points has not infrequently been responsible for mortality amongst the inoculated animals.

Serum Simultaneous method. This method was originally introduced in Africa by Kolle and Turner (1896), who obtained good results in about 90 per cent of the cattle inoculated, with a loss of 1.5 per cent. Other workers in Africa, however, had less successful results. Rogers (1900), working in India, successfully employed this method in the case of Himalayan cattle and even suggested that the animals which failed to react on the first inoculation should be given a second dose of 'virus alone', about a week later, to ensure their immunity against the disease. The serum simultaneous method of immunisation, however, was not adopted on any wide scale in India, as the inoculation of virulent blood involved a certain amount of risk and this was enhanced by the fact of the existence of several types of cattle whose degree of susceptibility to rinderpest was not known. Numerous casualties occurred from the application of this method both in North and South India and this once again led to a reversion to the method of immunisation by serum alone. Shilston (1916), while experimenting with different breeds of cattle of low resistance with a view to ascertaining the dose rate of serum that would be necessary to protect them against their simultaneous infection with virulent blood, obtained highly encouraging results and he later carried out successfully the serum simultaneous method of inoculation of the cattle of the military dairies with the help of two experienced officers of the Mukteswar Institute. This success led to a gradual revival of the serum simultaneous method in the civil dairies and also in the provinces and Indian States. The immunity conferred by this method may last for from a few years even to the life time of the animal concerned, the duration largely depending on the reaction brought about by the injection. In view of the obvious risk entailed in the use of virulent blood these operations have usually been carried out by persons specially trained for such work. The cattle subjected to this form of immunisation are kept under observation for three weeks and are not worked or let out for grazing, in order to avoid the spread of the infection. Another drawback of this method is that the inoculation of virulent blood may give rise to certain complications, such as piroplasmosis, surra and theileriasis and these are liable to cause mortality in a proportion of the inoculated animals.

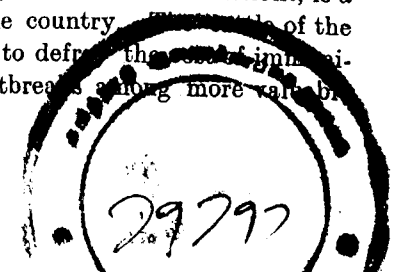
Goat blood virus method Some of the complications mentioned in the preceding section can, however, be prevented by the use of goat virus.

Edwards (1928), who was the earliest to introduce the use of the goat virus in India, had two objects in view in recommending the use of this product as a method of immunisation against rinderpest. Firstly, goat virus, as already stated earlier in this article, is free from protozoan parasites and secondly, the virus is sufficiently attenuated for safe injection into susceptible cattle. The goat virus method, apart from its freedom from the risk of introducing protozoan parasites, has been found to possess the further advantage that it usually produces a 'blocked out' reaction. The goat virus method of immunisation has since been adopted fairly extensively in the military dairies in India, while Stirling (1932) in the Central Provinces and Kerr and Menon (1931-32) in Bengal have also employed the method successfully in the field.

The introduction of goat tissue (spleen pulp) vaccine marks the latest phase in rinderpest control work in India, and the use of this product has been attended with highly satisfactory results (Kerr and Menon, 1934 and others). This method is now practised in many parts of India. It would appear from the reports of the Veterinary Investigation Officers, as well as from those of the Civil Veterinary Departments that this method is both safe and efficient for the immunisation of cattle even during an outbreak. The maximum period of immunity claimed to have been obtained by this method by different workers is 4 years or more. The distribution of this product is inexpensive and it can be easily applied in the field. 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, such as imported Friesians and Aryshires and in buffaloes. A dose of serum has to be supplemented in these cases to prevent any mortality resulting among the vaccinated animals.

III. Rinderpest control in prospect and retrospect

As is apparent from what has been already stated, we have at our disposal a fairly satisfactory working knowledge of the relative values of the various methods of rinderpest immunisation in relation to Indian conditions. Methods have already been developed for the manufacture and distribution of products for the control of the disease at a low cost. The decentralisation of the activities in connection with the manufacture of products for combating rinderpest has already progressed to a considerable extent. The object at the present moment is, above everything else, to derive the maximum possible benefit out of the resources and knowledge we already possess. Our aim is to bring the benefit of research into the biological control of this disease to the very door of the cattle owners of this country. The existence of this disease, even to a minor extent, is a potential source of danger to cattle all over the country. The cattle of the poorest farmer, who may not be in a position to defray the cost of immunisation, may become the starting point of outbreaks among more valuable



animals. The complete eradication of the disease from the sub-continent of India should remain the ideal at which we should aim. The main problem for the future therefore resolves itself into that of an intensive anti-rinderpest campaign carried out simultaneously all over the country. To simplify the work it will be necessary to divide the country into individual units and to establish around them immunised belts to keep the foci of infection localised, till the disease is finally eradicated. The cooperation of the local authorities will have to be secured. When the administrative authorities have been convinced of the urgency of the work in the larger interests of the country, there can be little doubt that the requisite conditions for rapid progress in disease control will have been achieved.

It should not be presumed from the above remarks regarding the extension of rinderpest immunisation work throughout the country that a stage has been reached for crying a halt to further laboratory research. It must be clearly stated that research should still be prosecuted with the same intensity as in the past to elaborate and improve the present method of control. It is not necessary for the purposes of this article to discuss the specific direction in which such research may be most profitably pursued. It will be sufficient to suggest one item of research by way of illustration. An investigation might be undertaken to test the possibility of the vaccine being produced in the form of a dried powder which could be dissolved in water as and when required for administration to animals. A dried vaccine would obviously be easier to handle and, if produced in quantity, should prove less expensive than the bulkier products at present in use. Further a vaccine of this kind should be capable of being more readily and effectively standardised than is possible in the conditions under which vaccine is produced at present. In order to produce a dried powder of this kind, it will be necessary to devote considerable time and attention to ensure that it retains its maximum potency over a sufficient length of time. Moreover the actual duration of the immunity which will be set up by such a product will have to be accurately determined by a considerable series of controlled tests in order to avoid the occurrence of untoward results from its application in the field. The optimum age of the animals for such protective inoculation will also have to be determined.

Concurrently with the prosecution of the laboratory research on such specific points, the attention of field workers must needs be concerned with the question of the progressive extension of the method already in use, in order to obtain the maximum benefit from existing resources. The policy of whole-sale slaughter of diseased and in-contact animals, can never be expected to be popular in India, as it is entirely against the traditions of this country. Goat vaccine work, therefore, forms a great scientific experiment in the control of rinderpest and the result will be awaited with interest all over the world.

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RINDERPEST CONTROL IN MYSORE.

BY

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"Rinderpest is taking a heavy toll of cattle; agricultural operations have come to a stand-still. Many ruined ryots are leaving their homes to distant places with their few remaining cattle."

That was the story of Mysore till just a decade and a half ago. This terrible scourge which was causing a great havoc annually and was considered more a supernatural course on the erring humanity has at present lost most of its horror and dread, thanks to the consistent work of the Veterinary Department in Mysore for the past thirty years. The innocent farmer instead of bewailing his fate and remaining content with merely offering sacrifices to the village diety and resigning himself to his fate, now with perfect confidence sends a report to the nearest Veterinary Institution for the protection of his cattle.

An account is given below, how, all this has been made possible in Mysore—a State which has earned a name of having tackled the problem of this disease very successfully.

Thirty-three years ago a Veterinary Department was started in Mysore with an officer designated as "Inspector of Cattle Diseases" with two assistants under the Revenue Commissioner. Year by year additional hands were employed and new hospitals were opened in the State. From the very beginning control of Rinderpest engaged the main attention of the department and we find in the Annual report of 1909 of the department the following:—

As Rinderpest had spread over the whole State, a regular campaign of inoculation work was organised and all the Assistant Veterinary Inspectors were contending hard against the dire disease.

"The results of inoculations were very encouraging and cattle owners had begun to appreciate the benefits. Consequently a large quantity of Rinderpest Serum had to be indented for from the Mukteswar Laboratory."

Inoculations were conducted by serum alone till September 1925 when serum-simultaneous method was first introduced and the following paragraphs are extracted from the 1925-26 annual reports.

"As Serum alone method of inoculations which has been in vogue on a very large scale ever since the department was organised and which was

conferring an immunity for the very short period of nine days, it was considered it would not serve much useful purpose to the ryots when the disease was spreading so very rapidly and as such Serum-simultaneous inoculations were undertaken since September last and necessary arrangements for the production of Virus were also made locally. There was, however, some opposition at the beginning of this campaign but as the results were very satisfactory, this method not only became very popular but was also in great demand. It is gratifying to note that according to the statistics collected, the percentage of mortality among the cattle protected by S. S. method works out at 0·8 in Mysore.

"Mr. J. T. Edwards, B.Sc., M.R.C.V.S., Director, Imperial Institute of Veterinary Research, Mukteswar, says in his report "considering the large extent to which passive immunisation by "Serum alone" method is practised in India, it is rather surprising to find that the system of conferring a permanent immunity has been undertaken on a relatively diminutive scale, especially when account is taken of the wide application the method finds in African territories beset with the disease. The reasons why the system has not hitherto found much favour in India except on Government owned establishments, where it is largely now systematically adapted, are to be found in the disfavour of cattle-owners towards the inoculation of blood and also in the risks, though perhaps small in degree, and the trouble connected with this form of inoculation.

"That the prejudice of cattle-owners on aesthetic grounds against this mode of inoculation can be overcome with some tact and made very popular without minding the small risks and trouble connected with this method of inoculation is proved by the large number of inoculations done before the levy of fees, as the advantages outweigh the disadvantages. The results achieved so far are very satisfactory and encouraging in that Rinderpest has completely subsided in all places where active immunisation was carried on and as such I firmly believe that with an adequate staff, a sufficient and continuous supply of serum, it will be possible to stamp out the disease in the near future by the active method of immunisation of cattle, if the question of levying fees is reconsidered." (Now the inoculations are all conducted free).

At the commencement of the active method of inoculation campaign, it was considered sufficient to get the virus from the naturally infected animals in the infected villages and make use of it for inoculations. But the time-honoured prejudices of a Hindu against bleeding a cow prevailed in many places and there used to be much trouble in securing virus in time. Also where such prejudices could be overcome by education, the process of collection of material could not be quite scientific as it was not possible to

look to strict aseptic precautions in the villages. In order to meet both these objections a depot was opened at Bangalore on 9th December 1925 where susceptible animals were artificially infected, their virus drawn and despatched after proper tests, for use in infected areas."

"With a view to meet adequately the need for copious supply of Serum for facilitating active immunisation on a large scale at less cost than hitherto, the manufacture of serum locally is under contemplation and experiments in that direction are being arranged for."

The Virus Depot referred to above was the beginning of the present Mysore Serum Institute, which developed into the present huge concern.

By the S. S. method started from September 1925 till the end of June 1938, 7,62,554 head of cattle have been protected.

The work of goat virus was started in April 1931 in the Mysore Serum Institute and the virus was put to field use in April 1934. The following is an extract from the Annual Report of the Mysore Serum Institute for 1932-33.

"In addition to the large amount of work done so far in the Institute and by the Civil Veterinary Department in the previous years, further work on the use of goat virus as a single vaccine for immunising cattle against rinderpest was continued during the year. Finding that the virus obtained by mere passaging of virulent bovine virus through goat at any stage either unsafe or unreliable as regards its reaction on cattle, attempts were made to cultivate in the body fluids but this also was found unsatisfactory. Attempts to fix the virus in the uterine fluid of a pregnant goat were undertaken and although there were a few failures in the beginning we have been successful in evolving a strain of virus that has undergone twenty-six passages through goats during the year without getting unduly exalted or attenuated. Periodical tests by inoculation into bovines have demonstrated that the fixed virus can be relied upon to set up only a definite and decided reaction in plains cattle."

Goat Virus inoculations under field conditions were conducted on a Government herd No. 3, of Amritmahal Department. "213 animals of different ages belonging to this herd were inoculated with goat virus during February 1933. The temperature of 155 animals was regularly noted and recorded for ten days after inoculation. Over 93% of these showed more or less a febrile reaction only which soon subsided. Another interesting fact that was revealed in the course of observations was that the higher thermal reaction was recorded more among animals under two years of age.

After three weeks in March 1933 an immunity test was held on 48 of the goat virus protected animals of different ages by inoculating them with bovine virus and their temperature recorded for ten days. None among the 48 showed any response to the Bovine virus whereas the control reacted to the Bovine virus".

As very good results were obtained both in the laboratory and in the field, goat blood virus was adopted and it completely replaced the S. S. inoculations. This has lowered the cost of inoculations very considerably. Since 1931 till the end of June 1939, 2,04,375 heads of cattle have been protected by goat blood virus method.

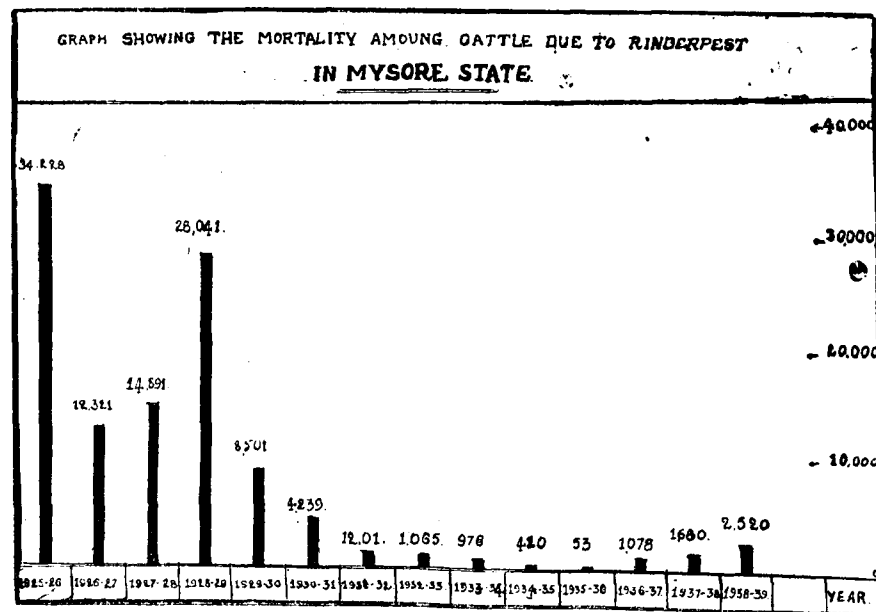
Experiments on Goat Tissue Vaccine were also conducted at the Mysore Serum Institute but goat blood virus was found to be more economical and this is what is generally used in the State. An account of Goat Tissue Vaccine is extracted below from the 1935-36 Annual Report of the Mysore Serum Institute.

"However it may be mentioned here that as far as Mysore State is concerned goat tissue vaccine is more or less of mere academic interest, as the ready and reliable product in the form of goat blood virus prepared in this Institute is definitely known to keep potent for at least a week and as it can be conveniently supplied to any part of the State within 24 to 48 hours. Further as the incidence of rinderpest has considerably declined in our State and as the blood virus drawn out of goats used for the mere maintenance of the fixed strain of the virus alone, is enough to meet the present demands from the Mysore Civil Veterinary Department, it is found neither desirable, nor necessary, nor profitable, at any rate at present, to prepare goat tissue vaccine in this Institute by infecting some more goats with fixed goat blood virus and killing them at the height of the reaction in order to get their spleens for making this product. Besides, in view of the fact that the tissue vaccine is required to be emulsified in Normal Saline prior to use on the field, it involves the possibility of the material getting contaminated in the process of preparing the emulsion as strict aseptic precautions cannot always be observed by the field workers under the limited facilities generally available there."

The fixed strain of goat rinderpest blood virus is despatched from the Mysore Serum Institute in 15 c.c. bottles to be used before the date of expiry marked on the bottle. The dose is 1/2 to 1 c.c. per animal. Buffaloes, cows, in advanced pregnancy and imported cattle, as they sometimes show a very severe reaction, are required to be given a protective dose of serum simultaneously at the rate of 5 c.c. per 100 lbs., body weight. This dosage is only for guidance and the field worker may compute the dose of serum depending upon the susceptibility of the individual herd to be vaccinated.

Legislation for the prevention of the movement of cattle from the disease affected parts was passed during 1929 and this has greatly facilitated the control of the disease. It is under consideration to make inoculations compulsory.

The system of reporting the outbreaks has also been brought to some order. The patel or the village officer is required to send information to the nearest Veterinary Institution on the prescribed form on the outbreak of any contagious disease and also send a return of the cattle mortality, monthly, noting the disease suspected, etc., to the Taluk Office. These cattle mortality returns are checked personally by the Veterinary Inspectors thrice a month. The Veterinary Inspectors are also required to tour for 10 days a month for rural veterinary work and detection of contagious diseases. At present there are 79 Veterinary Institutions in the State with an average area of jurisdiction of 373 miles and cattle population of 64,460. Hence it rarely happens that an outbreak remains undetected for a long time or action is not taken at the proper time. Several statements have to be submitted by the Veterinary Inspectors by which the Superintendent of the Department is enabled to gauge, daily, the work done and the progress of the disease in the Rinderpest affected areas.



Conclusion :— It is gratifying to note that on account of the systematic work for the last about 15 years rinderpest has been brought under control and the mortality owing to it, is gradually and very considerably reduced. The graph above illustrates this statement.

RINDERPEST IN N. W. F. PROVINCE.

BY

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Rinderpest occurs practically throughout the N. W. F. Province, mostly during winter. From the past record it appears that the disease was almost always imported from Transborder area at the time of incoming of Tribal people with their animals. As those people are always on the move, the disease once started in the Province, spreads all along the road-side villages. Quite often the infection is also imported from Punjab, as large number of cattle come to this Province regularly for sale.

Along with the arrival of these animals from the Punjab, weekly livestock markets are held throughout the Province on roadside places starting from the entrance to the Province. This helps the spread of the disease from one end to the other end of the Province.

No segregation of the sick is carried out and on most occasions no report is sent to the Veterinary Department. After the disease has had its hold in a village and large number of animals start showing symptoms, the Department is informed.

No animal is allowed to die its natural death. All sick animals are slaughtered when they are considered hopeless and the meat consumed. Some owners slaughter the animals in the early stages of the disease during an outbreak, lest the animal should lose flesh due to prolonged illness.

Uptil now Rinderpest has been recorded in cattle and buffaloes only in this Province. Symptoms observed are as elsewhere.

Outbreaks in hilly tracts are very severe and last over a longer period and large number of animals are involved while in plains' cattle the disease is of milder nature, excepting Buffaloes which seldom survive.

In the past Anti-Rinderpest Serum alone was used to control the outbreak. The method was very expensive and ineffective. Goat Tissue Virus was started as late as 1935 and even then the results obtained were not satisfactory owing to various defects in the manufacture of the Vaccine. It was not till October, 1939 that the production and use of the Vaccine was placed on a sound footing and properly controlled field experiments undertaken.

The virus is now being prepared locally at the Provincial Veterinary Laboratory, Peshawar. To be on the safe side, the virus is sent to outside

places in thermos flask containing ice. In the absence of reliable sealing arrangements of the ampoules, the virus is despatched in test tubes with a sterile cotton wool plug dipped in paraffin wax.

Tissue virus is emulsified in distilled water instead of normal saline solution and is giving satisfactory results.

Goat Tissue Virus has been found quite effective in the control of Rinderpest. As a prophylactic it has proved very safe in plains as well as hill cattle. Goat Tissue Virus Vaccination was carried out in plains' cattle last winter on an experimental scale and this summer in hill cattle to find out the susceptibility of local cattle and it has been observed that Goat Tissue Virus alone is quite safe alround, excepting that milch cattle specially buffaloes show considerable reduction in milk yield, which depends on the severity of reaction. Anti-Rinderpest Serum in different doses was given to a few milch animals to see the effect. In spite of the Anti Rinderpest serum the milk yield was affected but the milk returned to normal after 10th day and in rare cases within 20 days after vaccination. Reaction is more severe in Hill-cattle and Buffaloes and young calves. Some animals develop diarrhoea but recover.

Necessity of legislation and compulsory vaccination is keenly felt as the villagers so far do not realise the importance of prophylaxis against Rinderpest. The progress of vaccination is, therefore, slow at present. The policy of the Department to carry out wholesale vaccination with Goat Tissue Virus is being abandoned for the same reason.

It is proposed to carry out Goat Tissue Virus Vaccination during outbreaks only for some time, to create an impression on the villagers as to what Goat Tissue Virus can do. This measure, it is hoped, will create an interest in the mind of the villagers to have their animals subjected to inoculation and save them from Rinderpest.

THE CONTROL OF RINDERPEST IN THE PUNJAB

BY

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Organisation for the control of the disease. The Civil Veterinary Department, Punjab, maintains a network of 314 Veterinary Hospitals to serve 29 districts consisting of 36,915 villages with a livestock population of 24,827,029 as detailed below :—

Revenue division	No. of Veterinary hospitals.	Average number of villages to each hospital.
Jullundur	54	123
Multan	70	120
Ambala	66	102
Rawalpindi	59	92
Lahore	65	142

Details of population of livestock :—

Bulls	11,231
Bullocks	39,93,647
Cows	26,53,056
Young stock oxen	31,34,306
Male buffaloes	4,86,890
Female buffaloes	30,52,866
Young male buffaloes	25,08,505
Sheep	44,24,147
Goats	41,64,496
Horses	1,22,153
Mares	2,16,011
Young stock	60,584
Mules	29,187
Donkeys	6,62,919
Camels	3,07,031
	2,58,27,029

The average charge of a Veterinary Assistant or Veterinary Assistant Surgeon in addition to maintaining a hospital is from 92 to 142 villages with approximately 79,067 livestock. Our organisation further provides a 15% reserve and a number of extra staff for special areas where the activities of the Department demand it. 28 stock-assistants have also been employed to assist the Veterinary Assistants and Veterinary Assistant Surgeons in inoculation work in addition to their duties in connection with livestock improvement. The Veterinary Assistants and Veterinary Assistant Surgeons are held individually responsible for the control of the disease in their respective ilaqa. Their duties in this respect have been clearly defined in departmental circulars. Special attention is paid to the work on tour. Every Veterinary Assistant or Veterinary Assistant Surgeon tours 15-20 days in a month. He is required to visit every village of his ilaqa at least twice a year and make personal acquaintance with local revenue officers, Zamindars, local members of District Board, headmen of villages and the

leading Zamindars. Besides castration, treatment of non-contagious cases and livestock improvement work, he carries out propaganda in connection with control of contagious diseases. Four outlying dispensaries are attached to each hospital and these are fortnightly or weekly attended by the Veterinary-Assistant Surgeons on fixed dates. 336 first aid centres which are being run by the trained members of the Co-operative Societies are also visited by them and necessary instructions regarding treatment etc. are given.

The nature of the disease and the mortality caused by it. The disease is endemic, and is always present more or less in some parts of the province. It is also brought into the province from the adjoining Indian States and other British provinces. It has been noticed to increase in virulence, from time to time and remain at its height for 2-4 years. The mortality from disease as reported by Patwaries during the years from 1923-24 to 1934-35 was as follows:—

1923-24.....12,460	1928-29 to	} 13000 each year on an average.
1924-25.....31,750	1932-33	
1925-26.....27,626	1933-34.....34,020	
1926-27.....27,626	1934-35.....26,025	
1927-28.....25,780		

The use of goat virus vaccine was made to immunise cattle in 1934-35 and the mortality brought down to its previous low level next year *i. e.* in 1935-36. After that the disease has not so far assumed any great proportions on account of large scale vaccination of susceptible animals. The results of this vaccination have been very satisfactory in Haryana tract, the home of Murrah buffaloes and Haryana cattle. During the last three years 123,402 cattle have been vaccinated in Hissar district, 186,095 in Rohtak district and 268,432 in Gurgaon district. It was only on account of these vaccinations that in spite of these districts being in the grip of severe fodder famine and there being every possibility of spread of infection, the mortality from this disease was only 630 during the year 1939-40, a low figure never recorded before, as far as the record of this office shows. It is gratifying to note that the mortality in the Hissar district most severely affected with the fodder famine was only 6.

The chief sources of spread of infection are the large movements of stock to and from cattle fairs which are numerous in the province and the adjoining Indian states, the migration of cattle from barani to canal irrigated areas in search of grazing, the cattle dealers and the nomadic tribes. The cattle of the plains possess considerable resistance to the disease and mortality amongst them is 10 to 40 per cent. But the cattle of the hill tract

(Kangra and Simla districts) are very susceptible to it and the mortality in them is very high. The buffaloes are much more susceptible to the disease than cattle. The disease generally starts in buffaloes, there are instances in which it started in buffaloes and ended in buffaloes without affecting cattle. The incidence of the disease is not common in the District of Jelum, Attock and Rawalpindi where the number of buffaloes is not so great as in other districts of the province.

A few outbreaks of the disease amongst sheep and goats are reported every year. Deer affected with the disease have been met with.

Method adopted for the control of the disease.—The system of control is to eliminate the disease by raising the natural resistance of susceptible animals to the disease by the most reliable and economic method of conferring an active and lasting immunity. Our policy is to (1) confer lasting immunity on as many cattle in the province as is possible with goat virus vaccine (2) control out-breaks as they occur by vaccinating all animals in the vicinity (3) employ serum simultaneous method of inoculation to immunise cattle of European blood or cattle of known high susceptibility.

The goat virus vaccine is prepared and issued by the Pathological Section of the Punjab Veterinary College, Lahore. It is supplied in 1 gramme and 2 grammes quantities.....in sealed tubes. The tubes containing the vaccine are brought in thermos flasks packed with ice by special messengers to the district headquarters hospitals. The material reaches the hospitals in fully virulent state even in the hottest months of the year. It is stored in refrigerators provided to the district headquarters hospitals for this purpose and distributed in thermos flasks packed with ice to the other hospitals of the district when needed. A sufficient quantity of the vaccine is always stored in these refrigerators so that it is always available for immediate use and many journeys to and from Lahore are avoided. The vaccine is not used after 3 weeks of its manufacture the date of which is given on each tube. The arrangements are so satisfactory that there has not been a single complaint of the non-viability of the virus.

The outbreaks of the disease are reported by the patwaries who have been supplied with service post cards for this purpose. The patwaries who show promptness in reporting the disease are awarded cash prizes. The reporting agency on the whole is working satisfactorily, however there are cases in which the disease is not reported till it has assumed alarming proportions and caused severe losses. If the disease is reported in time there is no difficulty in bringing it under control with our organisation for carrying out immediate vaccinations. The vaccinations are carried out in the face of outbreaks by vaccinating cattle of the surrounding villages, to check

the spread of infection from village to village. The animals actually suffering from the diseases are treated symptomatically and inoculated large doses of serum. The disease is brought to an end within 10-15 days of vaccination. Some of the district boards have framed rules and regulations under section 56 and 57 of the District Boards Act 1883 against the movement of animals from the infected areas.

A greater number of the animals are vaccinated in the clean areas as a prophylactic measure, especially near the main roads, on cattle routes, and in the cattle breeding tracts. Vaccinations performed with goat virus vaccine during the last 5 years are as below :—

1934-35	73,018
1935-36	90,668
1936-37	1,69,116
1937-38	8,05,034
1938-39	6,96,354

These vaccinations have had a marked effect in decreasing mortality from the disease. The reaction amongst the vaccinated animals is watched on the 4th, 5th and 6th day of vaccination. The reaction in buffaloes is somewhat severe in some areas, but the complaints of severe reaction such as abortion and diarrhoea are very few and a large number of these animals is vaccinated without any untoward results. Usually the reaction is confined to a thermal rise which occurs on the 4th, 5th, or 6th day after vaccination and lasts for 2-3 days. The severe reactions if any are controlled by the administration of large doses of anti-rinderpest serum. The general complaint is reduction in milk yield, subsequent to vaccination. The reduction, however, is not due to reaction alone as in many cases it is reported on the very day of vaccination or the next day of vaccination when there is no reaction. Any inoculation, operation, or physical interference with the buffaloes can reduce their milk yield for a day or two. The animals which show mild thermal reaction regain their yield as soon as the temperature comes down to normal, which does not take more than 2-3 days after recovering from reaction. Some of the buffaloes, however approaching the end of their lactation go dry after severe reaction. In some areas a dose of 15 c.c. Anti-rinderpest serum was used with goat virus vaccine in buffaloes with a view to controlling severe reactions but the practice was stopped under orders of the Director, Veterinary Services, Punjab, because it had no appreciable effect on reaction and the cost involved was avoidable when a large number of buffaloes were being vaccinated with goat virus alone without any untoward results.

The reaction amongst the cattle is very mild, however, some of the bullocks which are not given rest during the reaction period develop severe

reaction. None of the 6109 cattle maintained at Government expense at the Cattle Concentration Camp, Hissar during the fodder famine of 1938-39 when vaccinated with goat virus vaccine developed severe reaction. A very small percentage of the 4,630 cattle vaccinated with goat virus vaccine at the Government Cattle Farm, Hissar in an out-break of the disease amongst the young stock, showed thermal reaction.

Diarrhoea.—This complication is of rare occurrence especially when severe thermal reactions are controlled by the use of Anti-rinderpest serum and the male buffaloes are given rest after vaccination for a few days.

Resuscitation of Piroplasmosis Theileriosis, Coccidiocis and Trypanosomiasis.—These complications have not been encountered in the field after vaccinations.

The possibility of new centres of infection being set up as a result of vaccination or the possibility of spread of infection from inoculated animals to non-inoculated healthy incontacts is very remote, however, a large number of animals are vaccinated in each village to avoid such risks. The disease has always been brought to its end within a fortnight of vaccination and its spread from village to village as was the case before the introduction of goat virus vaccine was checked. It may, however be stated that the young calves vaccinated at the age of 8-9 months do not develop a solid and lasting immunity. The disease broke out amongst a herd of 1151 heifers at the Government Cattle Farm, Hissar which had been vaccinated at this age and there were amongst those attacked a number of heifers which had been vaccinated only 3 months back.

A statement showing the number of reactors in goat virus vaccination in different villages in Gurgaon district is appended. The vaccinations were performed and the reaction noted in my presence. The number of reactors differ from village to village and it may differ from district to district, nevertheless, it will give an idea as to the extent the reaction is obtained in the Ambala division. It will be noted that the highest number of reactors is in the young stock upto 3 years of age which is about 33 per cent in buffaloes and 14 percent in cows.

In the past before the introduction of goat virus vaccination, we employed both the serum simultaneous and the serum alone methods for the control of the disease. The serum simultaneous method of inoculation was employed only for the protection of more valuable animals and not as a general routine method for the control of disease in the field. The serum alone method was used in the face of the actual outbreaks but the inoculated animals were still open to infection after 9 days of inoculation, and

the Veterinary Assistant Surgeons had to visit the scene of outbreak every week and carry out re-inoculations where the owners were willing to have their cattle inoculated but in spite of all this the disease continued for several months in big villages. In the year 1912 the Punjab Government levied a fee on Anti-rinderpest inoculation, but made it free again in 1913. The dose of Anti-rinderpest serum used was according to the percentage of mortality as follows.

Plains animals per 600 lbs. body weight.	15 c.c. for mortality not exceeding 25%
	25 c.c. " " from 25% " 50%
	45 c.c. " " " 50% " 75%
	60 c.c. " " " 75% " 85%
	90 c.c. " " " 85% " 100%
Hill animals	90 c.c.

The department's future policy for the control of the disease is:—

1. to open at least 150 more Veterinary Hospitals in order to make the ilaqa attached to each Veterinary Hospital controllable from contagious disease point of view.
2. to employ 250 stock assistants to supplement the work of the department in carrying out vaccinations, castrations and other livestock improvement work for the training of whom six month's class has been started at the Government Cattle Farm, Hissar.
3. to confer lasting immunity on as many cattle in the Province as possible with goat virus vaccine.
4. to control outbreaks as they occur by vaccinating all animals in the vicinity.
5. to employ serum simultaneous method to immunise imported cattle, progeny of imported cattle, cattle containing an admixture of imported blood, and cattle of known high susceptibility.
6. to employ A.R.P. inoculation to control severe reactions in the goat virus vaccination and to protect cows and buffaloes in advanced state of pregnancy which cannot be safely vaccinated.
7. to make use of the rules and regulations framed by the District Boards (copy enclosed as annexure II) to restrict the movements of animals from infected areas till legislation for the control of contagious diseases is enacted by the Government.

Name of village.	Buffaloes young stock upto 3 years.			Buffaloes over 3 years of age.			Cows young stock upto 3 years.			Bullocks and cows over 3 years.			TOTAL.		
	No. of animals vaccinated.	No. of animals temperature recorded.	No. of reactors.	No. of animals vaccinated.	No. of animals temperature recorded.	No. of reactors.	No. of animals vaccinated.	No. of animals temperature recorded.	No. of reactors.	No. of animals vaccinated.	No. of animals temperature recorded.	No. of reactors.	No. of animals vaccinated.	No. of animals temperature recorded.	No. of reactors.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Knetela	59	59	7	53	53	2	26	26	—	57	57	2	195	195	11
Mangla-Ahsanpur	51	51	5	43	43	—	35	35	6	66	66	4	195	195	15
Lalawari	82	82	25	101	101	4	72	72	8	96	96	—	351	351	37
Kamrawli-Mangla Boro-wali	14	14	4	21	21	—	22	22	4	38	38	2	95	95	10
Nandaula Borawali	19	19	2	19	19	1	19	19	2	36	36	5	93	93	10
Pema khara	92	92	9	37	37	4	66	66	7	76	76	6	271	271	26
Hissainpur	24	24	9	18	18	12	35	35	9	67	67	3	144	144	33
Narsainpur	11	11	7	12	4	4	26	26	8	38	38	4	87	79	23
Gowshala-Rewari	—	—	—	—	—	—	31	31	4	32	32	4	63	63	8
Jhera	132	82	24	310	110	5	124	74	9	299	99	—	865	365	38
Andhaka	29	29	15	30	30	3	13	13	2	19	19	—	91	91	20

Continued from Page 247.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Bainsi	86	86	45	83	83	19	104	104	6	179	179	9	452	452	79
Khera Khurampur	19	19	8	10	10	4	60	60	10	12	12	—	101	101	22
Dhani Kishampur	5	5	2	3	2	—	21	17	3	17	12	—	46	36	5
Meshadpur	56	56	14	26	26	7	24	24	6	42	42	2	148	148	29
Jarson	32	29	17	36	22	6	68	26	3	68	17	4	204	94	30
Gagana	25	15	10	18	11	4	139	31	11	114	32	7	296	89	32
Garhi Nathe-Khon	30	27	7	23	22	4	46	31	1	73	29	1	172	109	13
Mubarakpur	16	13	7	16	10	3	58	32	1	66	28	2	156	83	13
Dunman	28	24	5	23	20	2	85	64	9	163	136	13	299	244	29
Ghilhar	47	37	10	39	39	6	54	54	5	144	144	4	284	274	25
Ferozepore-Namak	74	41	25	78	26	16	77	11	6	166	18	12	395	96	59
Ilamudinpur	13	5	7	13	8	2	22	12	5	62	39	3	110	64	17
Pakri	17	16	8	10	8	1	53	36	4	65	28	3	145	88	16
Total	961	836	272	1022	723	109	1280	921	129	1995	1340	90	5258	3820	600

II

Local Self Government Department

Boards.

The following regulations made by the District Board of..... in exercise of the powers conferred by section 56 of the Punjab District Boards Act 1883, and in pursuance of Punjab Government notifications Nos. 40598, dated the 27th November, 1935, having been confirmed by the Punjab Government (Ministry of Local Self Government as required by sub-section (2) of section 56 of the said Act, are published for general information. They shall come into force within the area subject to the authority of the District Board of.....on the.....

Regulations.

1. These regulations shall apply to all animals and birds which are domesticated or are kept in confinement.

2. An animal or bird shall be deemed to be infected if it is affected with a disease mentioned in the schedule appended to these regulations or has recently come in contact with, or has been in close proximity to, an animal so affected.

3. The District Board may appoint an officer of the Civil Veterinary Department as Inspector under these regulations for the whole or a part of the area under the jurisdiction of the Board.

4. The Inspector may examine any animal or bird to ascertain whether it is infected, and if he has reason to believe that it is infected he shall, by an order in writing, declare the area or place in which such animal or bird is kept to be an infected area or place. He shall then deliver a copy of his order to the owner, occupier or person in charge of the area or place and shall also forward a copy to the Chairman of the Board.

5. The person in charge of an infected area or place shall keep the animal or bird confined to the area or place specified by the Inspector till the infected area, or place is declared by the Inspector to be free from infection.

6. If the Inspector has reasons to believe that the area or place declared infected is free from infection, he shall issue a declaration to that effect in writing. He shall then deliver a copy of his order to the person in charge of the area or place and shall also forward a copy to the Chairman of the Board.

7. Any person who commits a breach of regulation 5 shall on conviction by a Magistrate be punishable with fine which may extend to fifty rupees and if the breach is a continuing one, with a further fine which may extend to five rupees for every day during which the breach is continued after the offender has been convicted of such breach.

Schedule.

Diseases of Equines.		Diseases of Bovines.	
English name	Vernacular name	English name	Vernacular name
1. Glanders	Badkinar	Rinderpest	Mata, Sitla, Wah, Munuan
2. Surra	Pheta, Tibarsa, Sokra	Foot and Mouth disease	Muhn Khur
3. Lymphangitis Epizootica	Zehrbad	Hæmorrhagic-Septicæmia	Galghotu
4. Dourine	Atshak-i-aspan		
5. Anthrax	Salt	Anthrax	Salt
6. Strangles	Kubak, Khunak	Blackquarter	Goli
7. Contagious-skin disease	Jildi imras mut-taddi	Sheep pox	Bheri ki mata
8. Giller	Gillar		
9. Pleuro Pneumonia contagious	Phiphori		

CONTROL OF RINDERPEST IN SIND

BY

J. H. G. JERROM, M.R.C.V.S., I.V.S.,
Director of Veterinary Services, Sind.

Upto 1932, outbreaks of Rinderpest were dealt with inoculating healthy animals with Anti Rinderpest serum. Then goat blood virus was obtained from Mukteswar and used in a few outbreaks. This was not satisfactory, as the blood was frequently received in a putrid condition and in other instances, was found to be inactive, on inoculation into susceptible animals.

In 1935 a Rinderpest Vaccine Station was started in Karachi and since then has supplied the Department with all its requirements of goat tissue virus. The virus is renewed every three months by obtaining a fresh supply from Mukteswar. This ensures that the locally made vaccine is always active and avoids the trouble and expense of having it tested periodically at Mukteswar.

The Goat Virus Producing Station, Karachi also supplies vaccine to neighbouring Provinces and Indian States when requisitioned.

RINDERPEST IN THE CENTRAL PROVINCES AND BERAR

BY

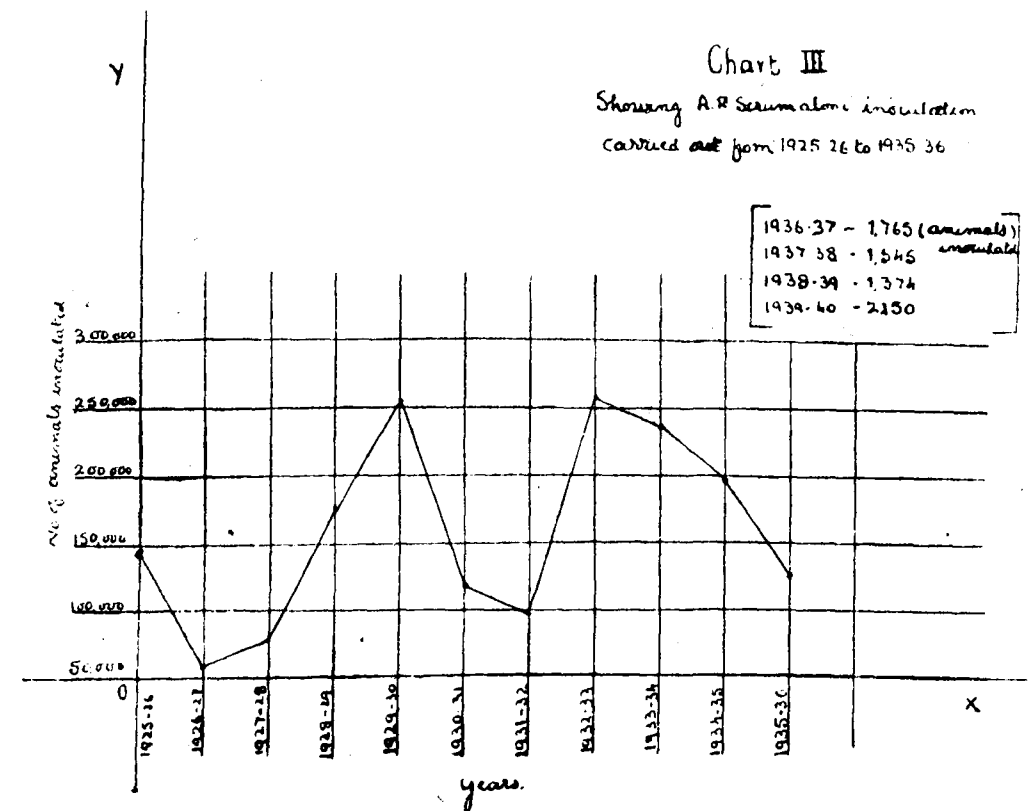
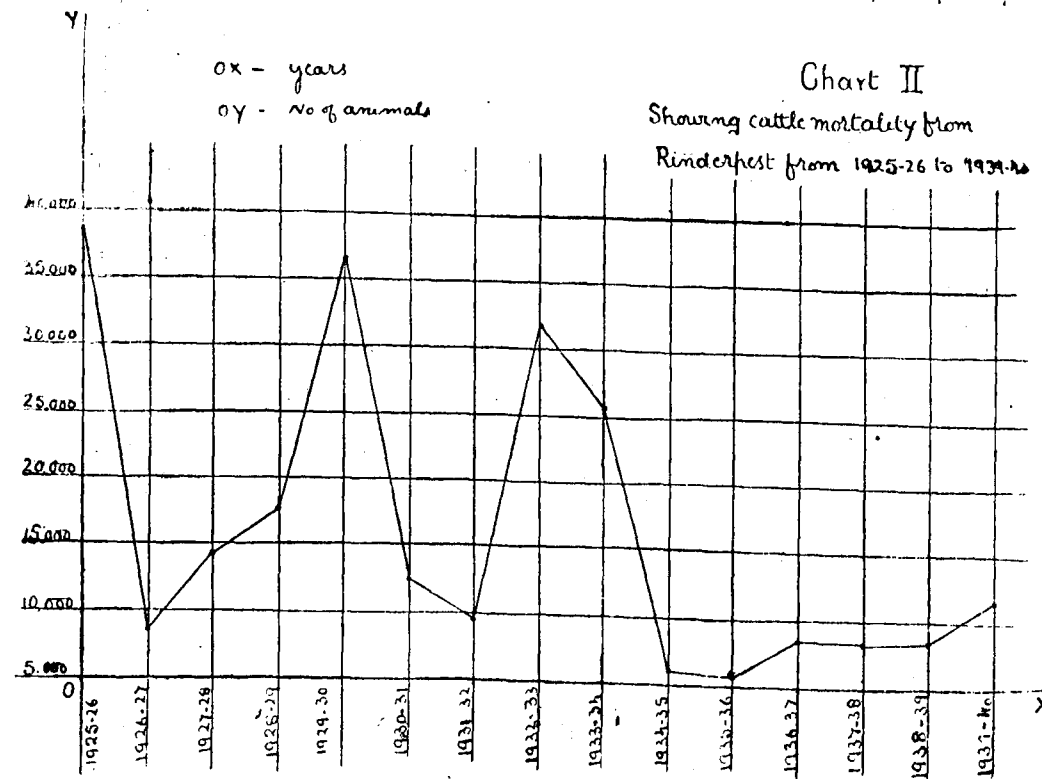
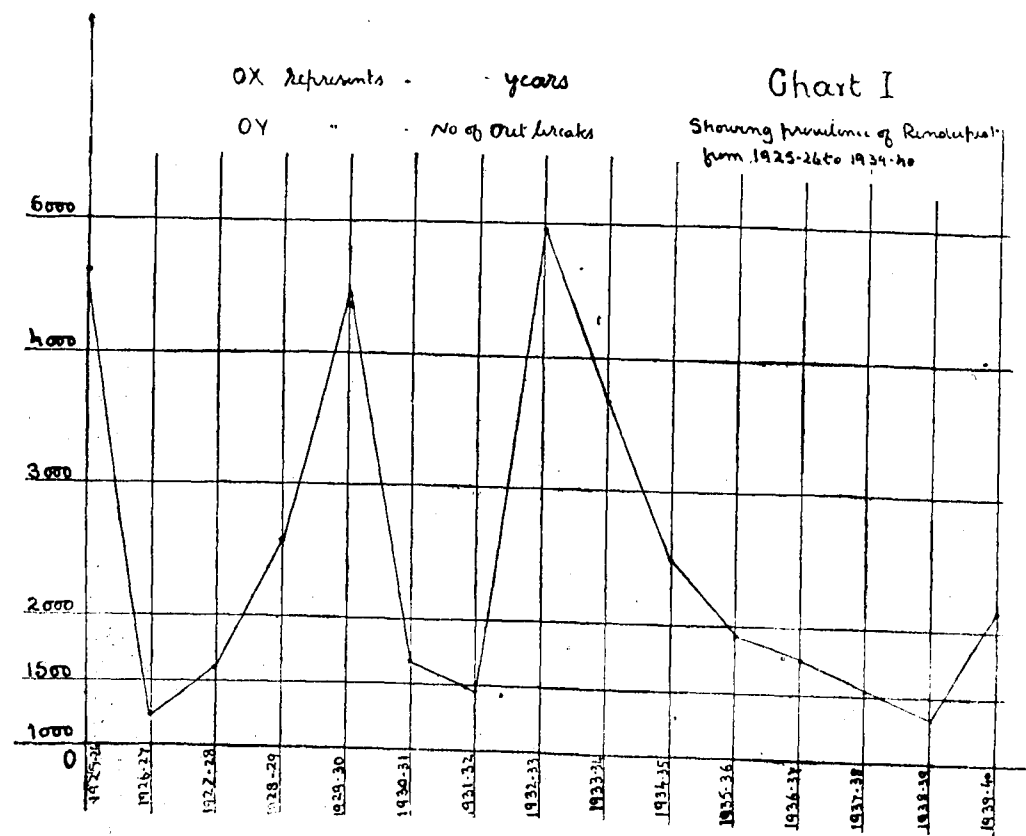
P. S. NAIR, G.B.V.C.,

AND

S. L. ZARGAR, G.B.V.C.,

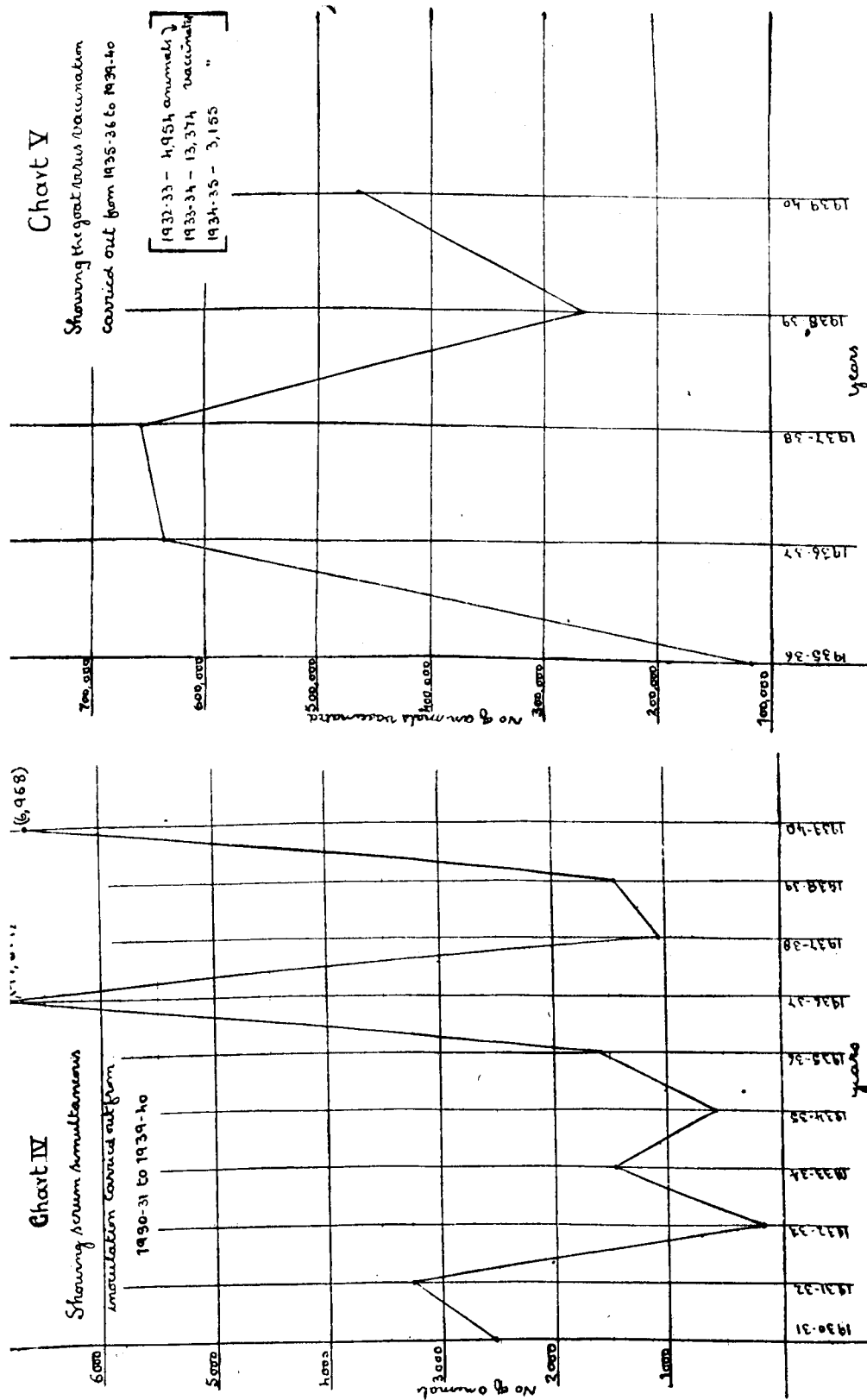
This major plague of cattle needs no introduction. As is true for other provinces and states in this vast sub-continent it is the most dreaded infection whose ravages and main clinical features are well known to the scientific and lay public alike. The havoc occasioned by the frequent outbreaks of this epidemic in almost every part of the country is common knowledge and needs no comments. Thanks to the epoch making advance ushered in about a decade back the picture now, regarding its possible control in the field through the agency of goat adapted virus presents a somewhat happier appearance. Like many other parts of the country, the incidence of the disease in this province reaches its zenith when nomadic tribes who are professional cattle dealers, enter and move about to various markets for sale of their herds. The province is surrounded on all sides by land frontiers and the dealers mostly hail from the adjoining states and provinces, in some cases as far north as the Punjab. As has been noticed in other parts of India, an interesting feature is the periodicity of outbreaks. The observations based on available records appear to indicate that the epizootic assumes a cyclic character reaching the peak in about every four years. A graphic representation of the total outbreaks and recorded mortality as depicted in charts I and II will reveal the position regarding this epizootic between the years 1925 to 1939. The total reported mortality during this period has reached the colossal figure of 23,50,000. Though the total mortality would be higher than this recorded figure, it would be seen that basing the observations even on these recorded figures, the loss sustained by the province during the period is enormous.

The problem of control of the serious loss recurring annually on account of this highly contagious infection has demanded the major attention of the limited field staff. In spite of tremendous handicaps the staff has, year in and year out and in all vagaries weather, done its best to restrict the mortality as also the spread with the biological products available at its disposal for control measures. It has not been possible to carry out any detailed investigation in respect of the nature of virus in cattle, buffaloes, sheep and goats. It is, however, common field experience to note that the disease assumes a very virulent form in buffaloes as compared with cattle and in some cases, though not yet confirmed in this province, there is a strong



suspicion that it has been responsible for heavy mortality in sheep and goats. The problem as to whether there is any difference in the strain of virus responsible for the disease in different classes of susceptible livestock or whether the virulence is simply dependent on the exaltation or attenuation of one and the same etiological agent depending on the susceptibility of the host, has not yet received detailed attention.

From the point of view of types of cattle existing in different areas the province can be divided into three distinct tracts. The first is the wheat growing area comprising of the northern districts of Saugor, Jubbulpore and Hoshangabad, the second is rice growing tract consisting of Chhattisgarh Division and a portion of the Nagpur Division and lastly the cotton growing area comprising of Berar and portion of Nagpur Division. The cattle population of almost all of these tracts is susceptible to rinderpest and outbreaks occur in all parts of the province. The degree of susceptibility however varies e.g., in the cotton growing area the animals are reared in better environmental and nutritional conditions and are therefore more robust and possibly possess greater resistance. Next in this respect comes



the cattle met with in the wheat growing tracts of the northern districts. In Chhattisgarh, however, as is true of all rice growing tracts, the cattle population is of a very poor type, the factor responsible for the deterioration being mainly nutrition assisted further by adverse climate and environment. Though the records reveal the prevalence of Rinderpest in almost all the tracts, Chhattisgarh has been particularly prominent, the reason for this extra incidence being the constant movement of dealers herd to this area which does not produce its own cattle but depends on supply from other regions of the province or surrounding states and United Provinces.

Resume of prophylactic measures.

Till only a decade back serum alone method was the main weapon available to the field veterinarian. In the absence of a more satisfactory biological product the antiserum was used extensively for the control of outbreaks. As is well-known due to the transient immunity it could confer, the desired degree of control could not be effected and infection lingered on in the affected areas. Gradually, however, with the progressive development of prophylactic technique the serum simultaneous method came into vogue and was adopted in a fairly extensive scale in this province. The work accomplished in connection with these methods is briefly summarised in the charts III and IV. Later, within the last decade the epoch making research relating to the attenuation of virus by passage through goats has led to the advent of a new era in regard to the control of this major cattle scourge. The history of the development of this work is well known and does not need any further recapitulation. It will, however, be interesting to record that the extensive detailed application of goat blood virus for prophylactic immunization was introduced in a mass scale in this province, for the first time in this country, by the late Major R. F. Stirling, the then Director of Veterinary Services, Central Provinces and Berar. In all 1736 animals were vaccinated and the preliminary yet extensive valuable spade work in respect of the satisfactory execution of this method in the field was accomplished. The extreme importance of this valuable pioneer work can only be assessed when the tremendous difficulty associated with the introduction of a new method in the field in this country is duly appreciated. As a subsequent development of this work, which *inter alia* was designed to study in thorough details the technique of this method, its pit-falls, possible complications etc., a scheme costing Rs. 46,700/- spread over a period of three years was submitted to the Imperial Council of Agricultural Research which was duly sanctioned and came in operation in the year 1935. Under this scheme 11 Veterinary Assistant Surgeons were employed and a detailed plan was adopted and worked out under the supervision of the Veterinary Investigation Officer of this province. The total number of animals

vaccinated during the period this scheme was in operation was 382,621. In addition to this number which was solely dealt with by the staff employed under the scheme, the departmental staff also carried out 11,95,558 vaccinations by this method up to the year 1938-1939 (Chart V). The vast amount of valuable information collected as a result of the working of this scheme is incorporated in the final report submitted by Captain Bachan Singh, M. R. C. V. S. The main conclusions recorded in this report are reproduced below :—

“The investigation has led to the following conclusions :—

- (i) A fixed goat virus (blood and tissue) “Muktesar strain” is virulent for goats but possesses a low virulence for cattle of indigenous breeds.
- (ii) Blood virus Muktesar strain has been found to be equally safe for local bred buffaloes in this province.
- (iii) A local strain virus has been found to be quite safe for cattle after the 40th “passage” through goats, and for buffaloes of local breed after 80th passage.
- (iv) Tissue virus prepared from both the strains “Muktesar” and “Local” have been given extensive trials.
- (v) Both types of vaccine (blood and tissue) have proved efficacious in dealing with rinderpest outbreaks.
- (vi) In imported breed of cattle, and in milking buffaloes (Murrha and Surti breed) virus-cum-serum method of inoculation is recommended. This obviates the risk of severe reaction as well as loss of milk yield.
- (vii) The lowest period of immunity tested so far was 3½ years in the case of blood virus, and it is anticipated that it would prove to be potent for longer periods.
- (viii) Besides its cheapness in cost, the other great advantage in the case of goat blood and tissue virus is that, if extensive inoculations are carried out in an area on a prophylactic basis, the chances for spread of infection from vaccinated to non-vaccinated animals are very remote.

In conclusion it may be mentioned that apart from the large amount of valuable scientific data dealing with the various aspects of goat virus vaccination obtained under this scheme, the Province has been materially benefited by this mass inoculation of cattle in certain areas where the cattle will remain immune to the disease at least for three or four years to come. Another great advantage is that goat virus vaccination has been made very popular among the local people and nomadic cattle dealers and has thereby

facilitated the working of the Cattle Diseases Act which will be enforced very shortly. With the successful working of the Act it is hoped that the incidence of rinderpest which is responsible for heavy mortality in cattle every year, will be greatly reduced in the near future.”

Quarantine stations.

A further advance which incidentally was the natural anticipated outcome of the extensive investigation and field work carried out in this province was the establishment of cattle quarantine stations. Experience has clearly shown that the control of rinderpest has to be tackled from two main aspects. The first relates to the stoppage of ingress of infection from outside the borders of the province and the second refers to the control of persistent centres of infection within our own territory. Of these the first is the most important as its successful execution automatically reduces the foci within our own precincts. With this object, therefore, in view nine quarantine stations costing approximately Rs. 30,000/- have been established in the northern districts *viz.*, Saugor and Hoshangabad, which experience has shown provided the greatest inlet for nomadic herds. In this connection an Act was passed by the Provincial Legislature in 1934 and actually came into operation from December 1938 when the construction of these stations was completed. Each station is located in a five acre plot of land and possesses wired cattle enclosure, isolation shed, goat shed, office and menials quarters. All cattle entering from the north have to pass through one of these stations where the sick and incontact are detained and treated and the rest are vaccinated with Goat tissue vaccine. It is as yet too early to assess with any precision the contribution made by these quarantine measure to our rinderpest control work. They have only been running for about two years and we have not had as yet any opportunity of observing as to how this control measure will effect the recurrence of the cyclic invasion of this epizootic. During the last two years, however, *i.e.* since the establishment of these stations, the number of outbreaks in the areas in which the nomadic herds entering from these stations move about has shown an appreciable decline. If this state of affairs continues for some 4 or 5 years more it will be possible to assert with more confidence that these stations have fulfilled the anticipations for which they were established. As experience gradually accumulates the question of establishing more stations will be taken up with the object of forming a ring round this province.

In passing it may be stated that it is not the intention to paint a perfect picture suggesting in anyway our wholesale success in the control of this epizootic. At this stage all that can be said with some confidence is that the position has considerably improved since a decade back and that

as we are proceeding further we are gaining more and more experience regarding the short-comings of our technique and appreciating the pit-falls and difficulties encountered in the field. The vaccine itself is still in a state in which its careless use is likely to do considerable harm and bring disrepute to the department. Problems regarding its production, storage, viability, transport and actual use in the field have to be supervised with meticulous care. A slight mishandling of this fragile product damages its potency and its use in an inert state only affords a false sense of security. The responsibility therefore of the laboratory and the field workers is equal, and provided that all reasonable requisite precautions are taken the product does yield the results which have been acclaimed for it from all parts of the country. At present both for prophylaxis as well as control of outbreaks Goat blood or tissue vaccine is being employed. Considerable work is still needed in respect of the improvement of the keeping quality of the vaccine. Till, however, the field worker has something better, the present technique, if adopted with due care, does provide a valuable weapon for the control of this serious and much dreaded epizootic regarding which we, till only recently, were utterly helpless.

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