

ANNUAL REPORT
OF
THE IMPERIAL BACTERIOLOGIST

FOR THE YEAR ENDING THE 31ST MARCH, 1917



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Muktesar Laboratories.

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CALCUTTA
SUPERINTENDENT GOVERNMENT PRINTING, INDIA
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Imperial Bacteriology

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FOR THE YEAR ENDING THE 31ST MARCH, 1917.

(A. LESLIE SHEATHER, B.Sc., M.R.C.V.S.)

I. ADMINISTRATION.

Mr. A. W. Shilston, M.R.C.V.S., held charge of the current duties of the Imperial Bacteriologist up to the 10th October, 1916, in addition to his own as Assistant Bacteriologist.

On the 11th October, 1916, I relieved him and held the post of Imperial Bacteriologist till the end of the year under report.

Dr. G. H. K. Macalister, M.A., M.D., D.P.H., held the office of Pathologist up to the 12th November, 1916, after which his services were placed at the disposal of the Army Department for employment in the Central Laboratory at Basra.

The post of Physiological Chemist remained vacant throughout the year owing to the services of Dr. R. V. Norris, M.Sc., A.I.C., D.Sc., having been temporarily transferred to the Military Department in October, 1915.

Mr. S. E. Andrews held the post of Engineer throughout the year.

Mr. A. J. Hearsey was appointed Farm Manager on probation for one year with effect from 14th July, 1916.

Mr. V. R. Phadke, a graduate of the Bombay Veterinary College, who underwent a course of training in Bacteriology and Pathology in England, was appointed to the new post of Veterinary Deputy Superintendent for the inoculation of cattle in the Military Dairies.

Fodder supply. During the past year the arrangements made for obtaining hay supply were very satisfactory. Three local contractors were engaged in place of one, and a much larger quantity of hay than usual was collected.

The yield of fodder from the Laboratory area was also in excess of that obtained in previous years, and efforts are being made to increase it.

The arrangements for grain supply were satisfactory, but on account of difficulty experienced in obtaining transport we were compelled to increase slightly the rates for carriage from Haldwani to Muktesar.

Forests. The Deputy Conservator of Forests, Naini Tal Division, has practically completed the working-plan for the forest areas, and it is expected that in future nearly 30,000 maunds of fuel will be available annually from the forests instead of only 10,000 maunds as prescribed under the old working-plan.

Water supply. The question of water supply is becoming more and more difficult every year.

Owing to heavy falls of snow during February and March, 1917, the supply of water was maintained without much difficulty during the concluding portion of the year. In the beginning of the year under report to overcome the scarcity of water, arrangements had to be made to augment the supply by the erection of three "Collecting Diggis" in the vicinity of springs. Considerable manual labour is required for the utilization of this water.

To economize in this direction a small portable pump has been ordered and will be used shortly to raise the water collected in the *diggis* to the well, from which it will be raised to the distribution tanks by means of our electrically driven pump.

Towards the end of March, the trouble connected with the water supply was rendered more acute by the stoppage of the pump.

The Public Works Department recently notified that the proposed electrical pumping scheme referred to in the last

year's report is being delayed on account of the difficulty experienced in getting pumps and pipe lines in this country.

Electric Centrifuges. The three new centrifuges referred to in last year's report have been erected and are giving satisfaction. The question of obtaining six more centrifuges of the same pattern in place of nine as originally proposed, has been approved of by Government, and an indent is being prepared by the Public Works Department for submission to the makers in England.

The three old condemned centrifuges which remained in workable condition at the close of last year have since all become unsafe to run.

Supply of hill bulls and plains animals. Under the arrangements in force no difficulty was experienced in procuring animals either from the hills or from the plains.

Bareilly Branch Laboratory. The Imperial Bacteriologist was unable to go to Bareilly in consequence of his arrival at Muktesar only in October, 1916. The Branch Laboratory was, however, kept open throughout the winter for the maintenance of a supply of rinderpest virus for the inoculations at Government Military Dairies.

Tours. Mr. Shilston visited Bareilly early in April and in October, 1916, to see the Agricultural Adviser to the Government of India regarding the construction of the new Branch Laboratory at Izatnagar and to consult with him on some other important subjects.

Mr. Shilston visited Mona Remount Depôt on the 23rd October, 1916, at the request of the Director General of Remounts, to investigate a peculiar disease amongst horses. On the return journey he saw the Chief Superintendent, Civil Veterinary Department, at Amritsar regarding dourine and halted one day at Bareilly to see the experiments there, returning to Muktesar on the 29th October. He again proceeded to Bareilly on the 4th November, 1916, to initiate inoculations against rinderpest by the simultaneous method in the military dairy farms, and visited Sitapur Military Dairy Farm. Between the 9th and 15th

November he toured in company with the Chief Superintendent, Civil Veterinary Department, Punjab, to demonstrate the method of collecting material for the diagnosis of dourine.

After this Mr. Shilston visited Military Dairies at Sitapur and Cawnpore for the purpose of inoculating cattle, and at the end of November he saw the Agricultural Adviser to the Government of India at Delhi.

During the 1st and 2nd week of December, Mr. Shilston visited Allahabad and Agra Dairy Farms to inoculate dairy cattle there, returning to Muktesar on the 12th December. On the 5th January he again went down to Bareilly and from there visited Karnal to inoculate dairy cattle. From the 19th January onward he toured in the Madras Presidency with the Superintendent, Civil Veterinary Department, Madras, at the request of the Madras Government, to enquire into the question of suppression of rinderpest in that province. Between the 3rd and 7th February he inoculated cattle at the Military Dairy, Bangalore, and subsequently visited Belgaum and Bombay.

Dr. Macalister carried out investigations in connection with *Kumri* in Assam and toured there with the Superintendent, Civil Veterinary Department.

II. PREPARATION OF SERUMS AND VACCINES.

Rinderpest serum. During the year 1916-17, 1,243,670 doses of anti-rinderpest serum were prepared and 1,409,220 doses were issued as against 1,186,550 doses prepared and 969,460 doses issued during the year 1915-16.

The increase in the demand was due to the prevalence of this disease in nearly all provinces.

The total amount of the bills for sale of anti-rinderpest serum issued during the year under report comes to Rs. 1,60,021* as against Rs. 1,09,566, realized during the previous year.

* This amount includes Rs. 17,186 realized for the year 1915-16. Bills amounting to Rs. 16,228 are still awaiting payment and have to be carried over to next year's account.

By adding to this the cost of 154,750 doses supplied free to the Military Department, the total revenue from this source would amount to Rs. 1,79,364.

The subjoined table compiled from the returns received in this office shows the results of anti-rinderpest serum injections carried out in the field during the year 1916-17 :—

| PROVINCE | Number of outbreaks in which inoculation was undertaken | NUMBER OF ANIMALS WHICH DIED UNINOCULATED IN COURSE OF DISEASE | | | NUMBER OF ANIMALS INOCULATED | | | NUMBER OF ANIMALS WHICH DIED AFTER INOCULATION | | | Percentage of deaths in inoculated bovines | REMARKS |
|---|---|--|---------|--------|------------------------------|---------|--------|--|---------|--------|--|---------|
| | | Equines | Bovines | Others | Equines | Bovines | Others | Equines | Bovines | Others | | |
| Punjab | 869 | .. | 7,485 | .. .. | 82,831 | .. .. | .. .. | 124 | .. .. | .. .. |  |  |
| North-West Frontier Province and North Punjab | 17 | .. | 106 | .. .. | 3,797 | .. .. | .. .. | .. .. | .. .. | .. .. |  |  |
| United Provinces | 892 | .. | 5,191 | 67 .. | 43,453 | 502 | .. .. | 82 | .. .. | .. .. |  |  |
| Bengal | 161 | .. | 2,057 | .. .. | 20,498 | .. .. | .. .. | 186 | .. .. | .. .. |  |  |
| Assam | 346 | .. | 9,613 | 20 .. | 29,678 | 308 | .. .. | 558 | 10 | .. .. |  |  |
| Bihar and Orissa | 637 | .. | 6,689 | .. .. | 67,513 | .. .. | .. .. | 288 | .. .. | .. .. |  |  |
| Central Provinces | 703 | .. | 6,238 | .. .. | 79,835 | .. .. | .. .. | 378 | .. .. | .. .. |  |  |
| Bombay | 283 | .. | 4,516 | .. .. | 59,116 | .. .. | .. .. | 219 | .. .. | .. .. |  |  |
| Madras | 560 | .. | 15,162 | .. .. | 100,473 | .. .. | .. .. | 668 | .. .. | .. .. |  |  |
| Sind, Baluchistan and Rajputana | 38 | .. | 304 | .. .. | 5,643 | .. .. | .. .. | 48 | .. .. | .. .. |  |  |
| Burma | 36 | .. | 229 | .. .. | 4,803 | .. .. | .. .. | 82 | .. .. | .. .. |  |  |
| Mysore State | 34 | .. | 34 | .. .. | 29,867 | .. .. | .. .. | .. .. | .. .. | .. .. |  |  |
| Bengal Veterinary College | 57 | .. | 73 | .. .. | 2,993 | .. .. | .. .. | 28 | .. .. | .. .. |  |  |
| Baroda State | 5 | .. | 181 | .. .. | 778 | .. .. | .. .. | .. .. | .. .. | .. .. |  |  |
| TOTAL | 3,645 | .. | 57,878 | 87 .. | 522,273 | 810 | .. .. | 2,611 | 10 | 0.49 | | |

The figures given in the above table of the animals inoculated with serum include animals which were infected at the time of inoculation and which serum cannot be expected to save, those which became infected after the protective action of the serum had passed off, as well as the more susceptible animals which the serum failed to protect. As the mortality was only 0.49 per cent. of the whole number, we are justified in concluding that this serum is of the utmost practical value.

The Superintendent, Civil Veterinary Department, Assam, in referring to the number of deaths after inoculation in Assam in the return for the quarter ending 30th September, 1916, which amounted to 116 out of 4,931 animals inoculated, states that—

“ 102 deaths occurred on one tea garden. An Inspector visited the garden 20 days after inoculation and found that 405 animals had been inoculated, that 201 of these were attacked and 85 died. Of these 85, about 43 contracted the disease within 9 days after inoculation. The animals were inoculated on the 8th to 10th July, 1916. Many of the coolies objected to inoculation and a large number (675) were not inoculated. Rinderpest persisted in the garden, and on the 8th to 12th August, 483 animals were inoculated or re-inoculated, out of which 131 were attacked and 17 died. The dose of serum was 25 c. c. (a few large animals got 30 c. c.) A certain number (43) of cattle died, as they were evidently inoculated in the incubative stage of the disease. The disease was of a very virulent type and I think the dose was not quite sufficient. The disease subsided after the second inoculation. The explanation of the figures in column 6 of the chart, *viz.*, number not inoculated, is that the animals were either suffering from the disease or hidden in the jungle by the coolies.”

Similarly the Superintendent, Civil Veterinary Department, Bengal, states that—

“ Due to rains these villages were almost under water for the season. The animals were constantly shut in their respective sheds for the time being. The heavy mortality took place in three herds of over 50 cattle in each, kept thickly in small sheds, and left open to inclement weather in absence of proper nursing and feeding. It is not improbable, therefore, that they gradually lost condition and most of them died of starvation. Percentage of deaths was high

at Hariharpur village, where the owner kept his herd far away from his home having no sensible men to look after it."

As regards the efficacy of this serum, the Superintendent, Civil Veterinary Department, United Provinces, in his Annual Report, paragraph 22, page 3, for the year ending 31st March, 1916, states :—

"During the year under report there has been considerable abatement in the ravages of this disease and very few districts were seriously affected. Wherever it appeared, inoculation campaigns were originated with the gratifying result that only 3,767 deaths have been recorded against 19,839 of last year, those districts which suffered most severely being Banda, Benares, Gorakhpur, Basti and Mirzapur."

The following statement comparing the figures of the year under report with those of the previous five years, shows that during the year 1916-17 the manufacture and issue of the anti-rinderpest serum exceeded the average by 212,874 and 423,904 doses respectively :—

| YEAR | Manufacture doses | Issue doses |
|--|----------------------|----------------|
| 1911-12 | 1,052,500 | 698,100 |
| 1912-13 | 805,500 | 1,128,500 |
| 1913-14 | 720,870 | 748,470 |
| 1914-15 | 1,388,560 | 1,382,050 |
| 1915-16 | 1,186,550 | 969,460 |
| Average of the previous five years | 1,030,796 | 985,316 |
| 1916-17 | 1,243,670 | 1,409,220 |

Anthrax serum. Eleven thousand and twenty-nine doses of this serum were prepared and 29,069 issued during the year 1916-17, as compared with 71,870 doses prepared and 48,337 issued during the previous year. The manufacture of this serum was regulated according to the demand.

The following table shows the results obtained in the field from inoculations with anthrax serum :—

| PROVINCE | Number of outbreaks in which inoculation was undertaken | | NUMBER OF ANIMALS WHICH DIED UNINOCULATED IN COURSE OF DISEASE | | | NUMBER OF ANIMALS INOCULATED | | | NUMBER OF ANIMALS WHICH DIED AFTER INOCULATION | | | Percentage of deaths in inoculated bovines | REMARKS |
|---|---|----|--|---------|--------|------------------------------|---------|--------|--|---------|--------|--|---------|
| | | | Equines | Bovines | Others | Equines | Bovines | Others | Equines | Bovines | Others | | |
| Bengal | 6 | .. | 30 | .. | 5 | 160 | .. | .. | .. | .. | .. | .. | |
| Assam | 46 | 23 | 442 | 6 | 359 | 3,258 | 197 | .. | 6 | .. | .. | .. | |
| Bihar and Orissa | 13 | .. | 42 | .. | .. | 1,759 | .. | .. | 2 | .. | .. | .. | |
| Central Provinces | 2 | .. | 20 | .. | .. | 302 | .. | .. | 3 | .. | .. | .. | |
| Sind, Baluchistan and Rajputana | 5 | .. | .. | 368 | .. | .. | 453 | .. | .. | 32 | .. | .. | |
| Bombay | 1 | .. | 13 | .. | .. | 460 | .. | .. | .. | .. | .. | .. | |
| Mysore State | 8 | .. | .. | .. | .. | 168 | .. | .. | .. | .. | .. | .. | |
| TOTAL | 81 | 23 | 547 | 374 | 364 | 6,107 | 650 | .. | 11 | 32 | 0.18 | | |

In the following table figures for the year under report are compared with those of the previous five years, and with the average for that period :—

| YEAR | Manufacture doses | Issue doses |
|--|-------------------|-------------|
| 1911-12 | 28,722 | 6,070 |
| 1912-13 | 2,658 | 6,718 |
| 1913-14 | 3,920 | 20,097 |
| 1914-15 | 18,640 | 20,883 |
| 1915-16 | 71,870 | 48,337 |
| Average of the previous five years | 25,162 | 20,421 |
| 1916-17 | 11,029* | 29,069 |

* Manufacture of this serum suspended pending issue of the last year's balance of 23,533 doses.

Hæmorrhagic Septicæmia serum and vaccine. One hundred and twenty-two thousand nine hundred and fifteen doses of hæmorrhagic septicæmia serum were manufac-

tured and 157,065 doses issued during the year under report, as against 127,365 doses prepared and 79,965 issued in the year 1915-16.

The number of doses of hæmorrhagic septicæmia vaccine prepared and issued during the year 1916-17 was 146,540 against 124,150 prepared and issued in the preceding year.

The demand for both hæmorrhagic septicæmia serum and vaccine is increasing and steps are now being taken to augment the supply of these products.

As regards the efficacy of the serum, the Superintendent, Civil Veterinary Department, Bombay Presidency, in his Annual Report for the year 1915-16 (paragraph 18) states:—

“Serum inoculation in 14 outbreaks of hæmorrhagic septicæmia was adopted with very satisfactory results, only one death occurring in an inoculated animal, while 141 un-inoculated died of this disease. The supply of this serum was limited or more inoculations would have been carried out.”

The Superintendent, Civil Veterinary Department, United Provinces, in paragraph 23 of the Annual Report for 1915-16, states:—

“Two hundred and fifty-four cattle were immunized by the vaccine method and 3,844 were inoculated, and both with generally satisfactory results.”

The following table shows the results of inoculations in the field with hæmorrhagic septicæmia serum:—

| PROVINCE | Number of outbreaks in which inoculation was undertaken | NUMBER OF ANIMALS WHICH DIED UNINOCULATED IN COURSE OF DISEASE | | | NUMBER OF ANIMALS INOCULATED | | | NUMBER OF ANIMALS WHICH DIED AFTER INOCULATION | | | Percentage of deaths in inoculated bovines | REMARKS |
|---|---|--|---------|--------|------------------------------|---------|--------|--|---------|--------|--|---------|
| | | Equines | Bovines | Others | Equines | Bovines | Others | Equines | Bovines | Others | | |
| Punjab | 100 | .. | 1,141 | .. | .. | 18,907 | .. | .. | 3 | .. | .. | |
| North-West Frontier Province and North Punjab | 14 | .. | 174 | .. | .. | 4,089 | .. | .. | .. | .. | .. | |
| United Provinces | 139 | .. | 577 | 8 | .. | 10,646 | 283 | .. | .. | .. | .. | |

| PROVINCE | Number of outbreaks in which inoculation was undertaken | NUMBER OF ANIMALS WHICH DIED UNINOCULATED IN COURSE OF DISEASE | | | NUMBER OF ANIMALS INOCULATED | | | NUMBER OF ANIMALS WHICH DIED AFTER INOCULATION | | | Percentage of deaths in inoculated bovines | REMARKS | |
|---|---|--|---------|--------|------------------------------|---------|--------|--|---------|--------|--|---------|----|
| | | Equines | Bovines | Others | Equines | Bovines | Others | Equines | Bovines | Others | | | |
| Benga | 59 | .. | 601 | .. | .. | 9,070 | .. | .. | 22 | .. | .. | .. | .. |
| Assam | 13 | .. | 80 | .. | .. | 2,216 | .. | .. | 1 | .. | .. | .. | .. |
| Bihar and Orissa | 141 | .. | 823 | .. | .. | 16,521 | .. | .. | 51 | .. | .. | .. | .. |
| Central Provinces | 18 | .. | 175 | .. | .. | 2,296 | 9 | .. | .. | .. | .. | .. | .. |
| Bombay | 46 | .. | 514 | .. | .. | 10,584 | .. | .. | 2 | .. | .. | .. | .. |
| Madras | 19 | .. | 322 | .. | .. | 6,182 | .. | .. | 9 | .. | .. | .. | .. |
| Sind, Baluchistan and Rajputana | 12 | .. | 83 | .. | .. | 1,300 | .. | .. | 1 | .. | .. | .. | .. |
| Hissar Cattle Farm | 1 | .. | 14 | .. | .. | 228 | .. | .. | 4 | .. | .. | .. | .. |
| TOTAL | 562 | .. | 4,504 | 8 | .. | 82,019 | 292 | .. | 93 | .. | .. | 0.11 | .. |

Hæmorrhagic septicæmia serum is used to check actual outbreaks of the disease.

The results obtained from inoculations with hæmorrhagic septicæmia vaccine are detailed in the following statement :—

| PROVINCE | Number of outbreaks in which inoculation was undertaken | NUMBER OF ANIMALS WHICH DIED UNINOCULATED IN COURSE OF DISEASE | | | NUMBER OF ANIMALS INOCULATED | | | NUMBER OF ANIMALS WHICH DIED AFTER INOCULATION | | | Percentage of deaths in inoculated bovines | REMARKS | |
|---|---|--|---------|--------|------------------------------|---------|--------|--|---------|--------|--|---------|----|
| | | Equines | Bovines | Others | Equines | Bovines | Others | Equines | Bovines | Others | | | |
| Punjab | 105 | .. | .. | .. | .. | 40,696 | .. | .. | 2 | .. | .. | .. | .. |
| North-West Frontier Province and North Punjab | 24 | .. | .. | .. | .. | 11,089 | .. | .. | .. | .. | .. | .. | .. |
| United Provinces | 3 | .. | 19 | .. | .. | 247 | .. | .. | .. | .. | .. | .. | .. |
| Bihar and Orissa | 38 | .. | 149 | .. | .. | 4,205 | .. | .. | 13 | .. | .. | .. | .. |
| Bombay | 5 | .. | 2 | .. | .. | 803 | .. | .. | .. | .. | .. | .. | .. |
| TOTAL | 265 | .. | 170 | .. | .. | 56,990 | .. | .. | 15 | .. | .. | 0.02 | .. |

Hæmorrhagic septicæmia vaccine is used in areas where the disease is endemic at the beginning of the seasons when it is most prevalent.

The following table gives the quantities prepared and issued during the past five years and compares the figures of the past year with these and with the average :—

| YEAR | | Manufacture doses | Issue doses |
|---------------------------------------|---------------------|----------------------|----------------|
| 1911-12 . . . | { Serum | 30,845 | 28,970 |
| | { Vaccine | 33,700 | 33,700 |
| 1912-13 . . . | { Serum | 40,901 | 43,218 |
| | { Vaccine | 25,750 | 25,750 |
| 1913-14 . . . | { Serum | 57,829 | 63,980 |
| | { Vaccine | 242,320 | 242,320 |
| 1914-15 . . . | { Serum | 77,428 | 77,328 |
| | { Vaccine | 100,690 | 100,690 |
| 1915-16 . . . | { Serum | 127,365 | 79,965 |
| | { Vaccine | 124,150 | 124,150 |
| Average of the five previous years | { Serum | 66,873 | 58,692 |
| | { Vaccine | 105,322 | 105,322 |
| 1916-17 . . . | { Serum | 122,915 | 157,065 |
| | { Vaccine | 146,540 | 146,540 |

Black Quarter vaccine. Twenty-three thousand three hundred and fifty doses were issued from the outstanding balance of the last year, as against 20,257 doses during the preceding year.

The following table shows the results of inoculations in the field with black quarter vaccine :—

| PROVINCE | Number of outbreaks in which inoculation was undertaken | NUMBER OF ANIMALS WHICH DIED UNINOCULATED IN COURSE OF DISEASE | | | NUMBER OF ANIMALS INOCULATED | | | NUMBER OF ANIMALS WHICH DIED AFTER INOCULATION | | | Percentage of deaths in inoculated bovines | REMARKS | |
|---|---|--|---------|--------|------------------------------|---------|--------|--|---------|--------|--|---------|----|
| | | Equines | Bovines | Others | Equines | Bovines | Others | Equines | Bovines | Others | | | |
| Punjab | 48 | .. | .. | .. | .. | 2,652 | .. | .. | .. | .. | .. | .. | .. |
| North-West Frontier Province and North Punjab | 13 | .. | .. | .. | .. | 1,000 | .. | .. | 12 | .. | .. | .. | .. |
| United Provinces | 9 | .. | 1 | .. | .. | 542 | .. | .. | 17 | .. | .. | .. | .. |
| Bihar and Orissa | 2 | .. | 1 | .. | .. | 210 | .. | .. | .. | .. | .. | .. | .. |
| Mysore State | 17 | .. | .. | .. | .. | 5,890 | .. | .. | .. | .. | .. | .. | .. |
| Hissar Cattle Farm | .. | .. | .. | .. | .. | 555 | .. | .. | 5 | .. | .. | .. | .. |
| Madras | 4 | .. | 20 | .. | .. | 193 | .. | .. | 4 | .. | .. | .. | .. |
| TOTAL | 93 | .. | 22 | .. | .. | 11,042 | .. | .. | 38 | .. | .. | 0.03 | .. |

The Superintendent, Civil Veterinary Department, United Provinces, in paragraph 24 of his Annual Report for 1915-16, states :—

“ There has been a satisfactory decline in the prevalence of this disease. It appeared in 15 districts and 262 deaths only have been reported. In those places where the disease appears to recur periodically, vaccination was resorted to as a preventive measure and 183 animals were treated by this method. Protective vaccination is probably responsible to some extent for the steady decrease in the death-rate.”

The Chief Superintendent, Civil Veterinary Department, Punjab, in paragraph 16 of his Annual Report for 1915-16, states :—

“ One thousand four hundred and fifteen deaths were reported during the year against 2,007 during the previous year. Rohtak and Hissar chiefly suffered from the disease. Again, the deaths during the year are considerably less, which fact the Superintendent, South Punjab, partly attributes to a healthier year, and partly to a larger number of vaccinations. 2,715 vaccinations were performed against 981 last year. The larger number of vaccinations performed is

creditable, and shows that the people appreciate the help of the department. This statement also applies to Hæmorrhagic Septicæmia vaccinations and Rinderpest inoculations."

Strangles serum and vaccine. During the year under report, 4,195 doses of this serum were prepared and 9,063 issued as against 11,242 doses manufactured and 17,132 issued in 1915-16.

Besides this, 260 doses of anti-streptococcic and 500 doses of mixed anti-streptococcic and staphylococcic vaccines were prepared and issued.

The demand for the above serum and vaccines was mainly from the Army Remount Depôts for the treatment and experimental immunization of horses against strangles.

Mallein. The demand for mallein was maintained fully throughout the year. Thirty-five thousand nine hundred and seventy-two doses were issued as against 30,332 doses in the preceding year, which was much more than the average issue of the five previous years as will be seen from the following table:—

Thirty thousand doses were prepared as against 28,009 doses in 1915-16.

| YEAR | Prepared doses | Issued doses |
|--|----------------|--------------|
| 1911-12 | 20,664 | 16,480 |
| 1912-13 | 15,181 | 17,933 |
| 1913-14 | 17,406 | 16,275 |
| 1914-15 | 37,766 | 31,104 |
| 1915-16 | 28,009 | 30,332 |
| Average of the previous five years | 23,806 | 22,425 |
| 1916-17 | 30,000 | 35,972 |

Tuberculin. Eighty-two doses were prepared during the year under report. The whole number of doses issued was 377 as against 430 in 1915-16.

A new brew consisting of a large number of doses is now ready for issue.

Miscellaneous vaccines. As in the previous year material from various infective conditions chiefly from horses was received at this Laboratory for the preparation of autogenous vaccines.

In all 690 doses of a special vaccine and 50 of pleurisy vaccine were prepared and issued.

Specimens examined. During the year under report 230 specimens were received for examination and report at this Laboratory as against 125 specimens during the preceding year.

The subjoined table indicates the nature of these :—

| | NUMBER OF SPECIMENS | | |
|--|---------------------|------------|-----------|
| | Positive | Negative | Doubtful |
| Fistula | 7 | .. | .. |
| Epizootic Lymphangitis | 1 | 8 | 2 |
| Piroplasmosis | 11 | 6 | 0 |
| Glanders | 9 | 2 | 1 |
| Black Quarter | 2 | .. | 1 |
| Tuberculosis | 9 | 1 | .. |
| Kumri | 3 | .. | .. |
| Anthrax | 1 | 2 | 1 |
| Anæmia | 2 | .. | .. |
| Spirochaetes | 1 | .. | .. |
| Dourine | 10 | 64 | 10 |
| Abortion | .. | 6 | 7 |
| Surra | 5 | 7 | .. |
| Anaplasmosis | 1 | .. | .. |
| Pleuro-Pneumonia | 3 | .. | .. |
| Necrosis | .. | 5 | .. |
| Ticks | 1 | .. | .. |
| Miscellaneous Pathological specimens | 41 | .. | .. |
| TOTAL | 107 | 101 | 22 |

Serum test for the diagnosis of Dourine. The study of the complement fixation test and its application to the diagnosis of dourine in India, was taken up by Mr. Shilston early in the year. The discovery that this disease was widely established in the Punjab and Baluchistan and threatening seriously to interfere with horse-breeding operations, made the working out of a reliable diagnostic method a matter of great importance.

The progress of the investigation was much interfered with by pressure of routine work and the necessity of making various tours, but a considerable number of tests were carried out before the close of the year.

Reports were furnished on 131 specimens of serum, received from the Civil and Army Remount Veterinary Officers as follows:—

| Positive | Negative | Doubtful |
|----------|----------|----------|
| 10 | 64 | 10 |

Forty-seven samples of serum were received in such condition as to be unsuitable for testing.

Training. During the year under report, Mr. G. H. Frost, Superintendent, Military Dairy Farms, underwent a course of training at Muktesar from 29th July to 13th October, 1916, in the study of contagious diseases among animals.

At the request of the Director of Agriculture and Industries, Punjab, Mr. Barkatali, Bacteriological Assistant to the Agricultural Chemist of that province, visited the Laboratory to make himself acquainted with the modern researches carried out at the Institution. He stayed here for a week only in October, 1916.

Military Dairy inoculations. Mr. V. R. Phadke, Veterinary Deputy Superintendent, visited Jubbulpore in August to investigate the cause of deaths amongst the cattle at the Military Dairy Farm there, and inoculated 1,800 animals collected at Lucknow and Cawnpore for transport duty in Mesopotamia.

In October Mr. Phadke was deputed to Bareilly to continue and supervise experiments initiated by the Assistant Bacteriologist.

During November, 1916, the Assistant Bacteriologist and Mr. Phadke carried on inoculations by the simultaneous method in the Government Military Dairies at Sitapur and Cawnpore.

During December and January the animals at Allahabad, Agra and Karnal dairies, were inoculated and frequent visits were paid by the Deputy Superintendent to all these five dairies to supervise the reactions of inoculated cattle.

In February, 1917, the Assistant Bacteriologist initiated inoculations in the dairy cattle in South India and Mr. Phadke carried them on in the Dairies at Bangalore, Wellington and Belgaum.

A detailed report on the inoculations carried out in November and December, 1916, at the Sitapur, Cawnpore, Allahabad and Agra Dairy Farms was duly submitted by Mr. Shilston to the Assistant Director of Dairy Farms, Northern Circle, in January, 1917.

During winter of the year under report, 446 animals were treated by the serum simultaneous method at the Military Dairy Farms in India. Of these, 306 including 60 buffaloes, 94 country bred, 119 half bred and 3 Ayrshire bulls, were treated in Northern Circle Dairies at Sitapur, Cawnpore, Allahabad, Agra and Karnal, and 142 animals including 80 country bred, 53 half bred, 1 pure bred, 2 Australian short horn and 4 Ayrshire bulls in the Southern Circle at Bangalore and Wellington.

The majority of these animals treated by the above method at the various farms showed moderate reactions, and it is anticipated that an active and lasting immunity against rinderpest has been established.

There were no mortalities amongst these animals from rinderpest as a result of serum simultaneous inoculation, but some 8 animals (7 half bred and 1 country bred) while

reacting to the simultaneous inoculation developed piroplasmosis, diagnosis being confirmed by the detection of piroplasmata in blood by microscopic examination. Of these, 6 were successfully treated by the subcutaneous administration of Trypan Blue, but in the case of two half bred's death was so sudden that treatment could not be carried out.

Besides these inoculations, natural outbreaks of rinderpest at Belgaum and Mhow were attended to and suppressed by inoculating all the animals on the farm (some 1,300) with serum alone.

At Bangalore a natural outbreak occurred amongst the untreated milking stock: this was suppressed by means of serum inoculations. None of the animals previously treated by the simultaneous method became infected during this outbreak.

III. RESEARCH WORK.

Several factors have combined to limit the amount of research work that could be carried out during the past year. The routine work of the Laboratory and the difficulties of administration were greatly increased. The departure of Dr. Macalister, shortly after my arrival, again reduced the number of officers on the staff to two. During the first half of the year Mr. Shilston's time was very fully occupied with duties of administration and the maintenance of the increasing output of sera and vaccines. Later he was touring in the Madras Presidency, supervising inoculations at the Military Dairies and initiating tests for the diagnosis of dourine, outbreaks of which disease have assumed serious proportions in the Punjab and Baluchistan.

In these circumstances the amount of time that I was able to devote to research work was very small.

Rinderpest. A large number of observations have been made regarding the vitality of the virus of rinderpest under various artificial conditions. A report of the results obtained will be submitted for publication shortly.

The method of obtaining serum by the oxalate process is being practised on a larger scale in order to cope with the enormous increase in the demands, and will shortly be applied to the whole of the serum production at Muktesar.

In the course of the inoculations carried out at the Military Dairies several valuable observations were made regarding methods of immunization.

Anthrax and Hæmorrhagic Septicæmia. Efforts are being made to accelerate the production of the anti-sera for these diseases. It is anticipated that labour and materials will be economized.

Kumri. A report on *Kumri* was submitted for publication by Dr. Macalister before he left Muktesar for military duty. It embodies an account of the disease and his work regarding the nature of the pathological changes produced.

Further research on the disease has had to be postponed for the present.

Strangles. Anti-strangles serum and vaccine have been supplied in fairly large quantities for the treatment of the disease and have given satisfactory results.

Contagious abortion. Contagious abortion in cattle has been reported from some of the military dairies. Efforts are being made to isolate the causal organism of this disease.

Pleuro-pneumonia of goats. During the last month or two of the year under report some experiments were carried out in connection with this disease. Failure to obtain susceptible animals for experimental purposes interrupted the work, but the subject will be taken up again when suitable animals become available.

Surra. Some experiments in connection with the treatment of surra have been carried out but so far without success.

Tuberculosis. Modification of the culture medium used for the preparation of tuberculin has accelerated its

production very considerably, and a large stock is now available. The study of strains of the tubercle bacillus isolated from cattle in this country is being continued.

Dourine. During the past year a trypanosome infection of horses transmitted by coitus made its appearance in the Punjab and Baluchistan and evidently has a wide distribution in the horse-breeding areas. Its existence is seriously interfering with the progress of horse-breeding, especially in the Army Remount Department Circles. The diagnosis of the disease in its early stages presents great difficulties. A laboratory method of examining the serum of suspected cases known as the complement fixation test has been successfully applied in America, for the detection of infected animals and the study of its applicability to the disease in this country has been taken up by Mr. Shilston.

A large number of tests have been carried out with promising results, and it is hoped that by this means the officers of the Civil Veterinary Department and Army Remount Department may be assisted in stamping out the disease.

Miscellaneous. The occurrence of a chronic form of enteritis has been reported from one of the military dairies. Examination of specimens from two cases appears to indicate that the condition is that known in Europe under the name Johne's Disease. Two animals suspected of being infected are under observation.

Publications. During the year under report the following papers were submitted for publication:—

- (a) "Vitality of the rinderpest virus outside the animal body under natural conditions" by A. W. Shilston, M.R.C.V.S., Assistant Bacteriologist. *Memoirs of the Department of Agriculture in India, Veterinary Series*, Vol. III, No. 1.
- (b) "Rinderpest—Preparation of Anti-serum," by A. W. Shilston, M.R.C.V.S., Assistant Bacteriologist. *Pusa Agri. Res. Inst. Bull.* No. 64.
- (c) "Kumri—Combined diffuse Sclerosis and Central Poliomyelitis of Horses," by G. H. K. Macalister, M.A.,

M.D., D.P.H., Pathologist. *Memoirs of the Department of Agriculture in India, Veterinary Series, Vol. II, No. 8.*

General Remarks. The appearance of Foot and Mouth disease in our outkraals early in November, 1916, caused great difficulty in providing accommodation for segregated as well as healthy animals. Temporary sheds were erected by our own labour for isolation, etc.

Relapsing fever broke out amongst the coolies and *gwalas** in the last week in December, 1916. Up to the 3rd week of March, 1917, 46 cases with 14 deaths were recorded. The disease was prevented from assuming more serious proportions by the prompt introduction of sanitary measures. Only two or three cases occurred during the last month of the outbreak.

The maintenance of the increased output of sera and vaccines during the last year, difficulties experienced in obtaining material on account of war, and paucity of water supply and labour imposed a heavy strain on the members of the staff.

I am greatly indebted to Mr. Shilston for the assistance that he has rendered me at all times and for placing his experience and knowledge of local conditions freely at my disposal.

The prompt and energetic measures taken by Mr. Andrews on the occasions when the water pump broke down prevented a very serious interruption of the work of the Laboratory. His services in connection with the whole of the plant under his charge are fully appreciated.

The three European Laboratory Assistants have carried out their responsible duties with care and thoroughness and their zeal and energy is to be commended.

Mr. Goffi acted as Farm Manager till July 14th, when he was relieved by Mr. A. J. Hearsey. The improvements effected by Mr. Goffi in the work of the Farm staff and the condition of the estate have been maintained, and every

* *Gwalas* = Cattlemen.

effort is being made to render the estate still more productive.

The services of Rai Sahib Pandit Krishna Nand, Office Superintendent, have been of the utmost value to me in dealing with many administrative and other difficulties that have arisen during the year. His long experience and knowledge of local conditions have been placed freely at my disposal.

The great increase in the office work and changes rendered necessary by the retirement of the Accountant, Rai Sahib Pandit Nitya Nand, have entailed a considerable strain on the office staff. The manner in which the work has been carried on deserves special commendation.

Table showing the doses of different products issued from the

| Products | QUANTITY ISSUED | | | | | | | |
|--|-----------------|------------------------------------|--------------|------------------|--------|---------|------------------|-------------------|
| | Punjab | North-West Frontier Province | South Punjab | United Provinces | Bengal | Assam | Bihar and Orissa | Central Provinces |
| Rinderpest serum . . | 30,300 | 20,000 | 120,012 | 129,350 | 52,000 | 98,000 | 214,500 | 155,000 |
| Anthrax serum . . | 66 | .. | .. | .. | 3,000 | 8,000 | 4,500 | 2,000 |
| Hæmorrhagic Septi- cæmia serum | 12,750 | 13,000 | 13,000 | 15,550 | 13,000 | 5,500 | 26,000 | 7,250 |
| Hæmorrhagic Septi- cæmia vaccine | 1,000 | 13,500 | 69,000 | 2,040 | .. | .. | 59,000 | .. |
| Charbon Symptoma- tique vaccine | 750 | 1,000 | 4,500 | 500 | .. | .. | 6,500 | .. |
| Mallein . . . | 55 | 50 | 100 | 150 | .. | .. | 55 | 12 |
| Ophthalmic Mallein . | .. | .. | .. | 15 | .. | .. | .. | .. |
| Tuberculin . . | 6 | .. | 10 | .. | 90 | .. | .. | 4 |
| Anti-Streptococcic se- rum | 67 | .. | .. | .. | .. | .. | .. | .. |
| Anti-Streptococcic vac- cine | 200 | .. | .. | .. | .. | .. | .. | .. |
| Special vaccine . . | .. | .. | .. | .. | .. | .. | .. | .. |
| Streptococcic and Sta- phylococcic vaccine (mixed) | .. | .. | .. | .. | .. | .. | .. | .. |
| Pleurisy vaccine . | .. | .. | .. | .. | .. | .. | .. | .. |
| TOTAL . | 45,194 | 47,550 | 206,622 | 147,605 | 68,090 | 111,500 | 310,555 | 164,266 |

Imperial Bacteriological Laboratory during the year 1916-17.

IN DOSES

| Bombay | Madras | Sind, Baluchistan and Rajputana | Burma | Coorg | Military Department | Native States | Foreign Countries | Imperial Bacteriological Laboratory | Total |
|---------|---------|--|--------|--------|---------------------|---------------|-------------------|-------------------------------------|-----------|
| 103,210 | 195,000 | 18,000 | 15,000 | 12,000 | 154,750 | 62,330 | 17,510 | 12,258 | 1,409,220 |
| 2,000 | .. | 1,900 | .. | 1,000 | 2,266 | 3,023 | 1,000 | 314 | 29,069 |
| 18,500 | 20,000 | 2,000 | .. | .. | 2,267 | 1,250 | 2,333 | 4,665 | 157,065 |
| 2,000 | .. | .. | .. | .. | .. | .. | .. | .. | 146,540 |
| 1,100 | .. | .. | .. | .. | .. | 9,000 | .. | .. | 23,350 |
| 270 | .. | 90 | 2,000 | .. | 32,768 | 390 | .. | 32 | 35,972 |
| 25 | .. | 10 | .. | .. | 1,000 | 25 | .. | 5 | 1,080 |
| .. | 200 | 2 | .. | .. | 14 | .. | .. | 51 | 377 |
| .. | .. | .. | .. | .. | 5,996 | 199 | .. | 2,801 | 9,063 |
| .. | .. | .. | .. | .. | 60 | .. | .. | .. | 260 |
| .. | .. | .. | .. | .. | 690 | .. | .. | .. | 690 |
| .. | .. | .. | .. | .. | 500 | .. | .. | .. | 500 |
| .. | .. | .. | .. | .. | 50 | .. | .. | .. | 50 |
| 127,105 | 215,200 | 22,002 | 17,000 | 13,000 | 200,361 | 76,217 | 20,843 | 20,126 | 1,813,236 |

Table showing main results of the working of the Imperial

| QUANTITY IN DOSES OF SERA OR ANTI-TOXIN PREPARED AND ISSUED | | | | | | | | INSTRUCTION IMPARTED | | | | | |
|---|--|-----------|-----------|-----------|-----------|-----------|---------|-----------------------------|----|----|----|----|-----------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | |
| | | | | | | | | | | | | | Opening balance | Prepared during the year | Returned serum | TOTAL | Issued during the year | Stock in hand | Department or Province | European Officers attending class | Number passed | Indian Veterinary Graduates | Number passed |
| Imperial Laboratory | Rinderpest serum (dose=5 c.c.) | 287,250 | 1,243,670 | 1,500 | 1,532,420 | 1,400,220 | 123,200 | Military Dairy Farm Manager | | | | | |
| | Anthrax serum (dose=15 c.c.) | 23,600 | 11,029 | .. | 34,719 | 20,069 | 5,050 | | | | | | |
| | Hæmorrhagic Septicæmia serum (dose=15 c.c.) | 47,500 | 122,915 | 3,250 | 173,665 | 157,065 | 16,000 | | | | | | |
| | Hæmorrhagic Septicæmia vaccine (dose=5 c.c.) | .. | 146,540 | .. | 146,540 | 146,540 | .. | | | | | | |
| | Charbon Symptomatique vaccine (dose=1 pill) | 40,400 | .. | 5,000 | 54,400 | 23,350 | 31,050 | | | | | | |
| | Mallein (dose=1 c.c.) | 7,592 | 30,000 | 2,000 | 39,592 | 35,972 | 3,620 | | | | | | |
| | Ophthalmic Mallein (dose ½ c.c.) | 7,015 | .. | .. | 7,015 | 1,080 | 5,935 | | | | | | |
| | Tuberculin (dose=2 c.c.) | 296 | 82 | .. | 378 | 377 | 1 | | | 1 | 1 | .. | .. |
| | Anti-Streptococcus serum (dose=15 c.c.) | 7,800 | 4,195 | .. | 11,995 | 9,063 | 2,932 | | | | | | |
| | Anti-Streptococcus vaccine (dose=5 c.c.) | .. | 260 | .. | 260 | 260 | .. | | | | | | |
| | Special vaccine (dose=1 c.c.) | .. | 690 | .. | 690 | 690 | .. | | | | | | |
| | Streptococcus and Staphylococcus (mixed) vaccine (dose=1 c.c.) | .. | 500 | .. | 500 | 500 | .. | | | | | | |
| | Pleurisy vaccine (dose=1 c.c.) | .. | 50 | .. | 50 | 50 | .. | | | | | | |
| TOTAL | 430,543 | 1,550,931 | 11,750 | 2,002,224 | 1,813,236 | 188,988 | | 1 | 1 | .. | .. | | |

* Inclusive of Rs. 4,921-5-6 for

Bacteriological Laboratory, Muktesar, during the year 1916-17.

FINANCIAL RESULTS

| RECEIPTS | | | | | EXPENDITURE | | | | | |
|-------------------------------|-----------------|--|------------------------------|---------------|--|--------------------------|---------------------------------|---------------------------------|---------------------|-------------|
| Sale of anti-rinderpest serum | Sale of animals | Sale of garden products and Reserved Forests | Other miscellaneous receipts | TOTAL | Salaries and travelling allowances of officers and staff | Feed and keep of animals | Cost of chemicals and apparatus | Other miscellaneous expenditure | Purchase of animals | TOTAL |
| 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. | Rs. A. P. |
| 1,60,021 10 1 | 85 2 6 | 1,176 8 6 | 1,087 7 5 | 1,62,320 12 6 | 90,485 7 10 | 93,360 15 11 | 14,831 2 11 | 46,331 8 5* | 22,110 7 0 | 267,128 5 1 |
| 1,60,021 10 1 | 85 2 6 | 1,176 8 6 | 1,087 7 5 | 1,62,320 12 6 | 90,485 7 10 | 93,360 15 11 | 14,831 2 11 | 46,331 3 5 | 22,110 7 0 | 267,128 5 1 |

* Military Dairy Inoculation charges.

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