

PART I.

INVESTIGATIONS INTO SOUTH AFRICAN DISEASES.

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A.—THE IMMUNITY OF CATTLE INOCULATED WITH PIROPLASMA MUTANS.

In Nelspruit, on the very place where our experiments in 1903 were conducted with East Coast fever, the proprietor introduced some ten calves from the high veld early in 1908; the majority of them died, and microscopical examination of smears showed the presence of small piroplasms to such an extent that for a short time the diagnosis was doubtful, and for safety's sake East Coast fever had to be declared.

An investigation was immediately made, and it was then clearly proved that the calves were susceptible to a *Piroplasma mutans* infection, and *Piroplasma parvum* had to be excluded. The fact that a strong infection of *Piroplasma mutans* was present suggested the idea of seeing to what extent cattle introduced on this particular farm would contract the infection. Arrangements were made with the proprietor, and the cattle to be exposed were selected from our stock and divided into five lots, namely: (1) Animals immune against redwater; (2) animals immune against redwater and *Piroplasma mutans*; (3) knowing that the farm was also infected with heartwater, animals immune against redwater and heartwater; (4) animals immune against redwater, heartwater, and *Piroplasma mutans*; and (5) with animals not immunised in any way, to serve as controls.

EXPERIMENT NO. 1.

With animals immune against redwater.

1. *Bull* 309.—Born in the Transvaal, and running on infected veld for two years.

NOTE.—This animal is immune against redwater.

Exposed at Nelspruit on the 13th March, 1908.

Slight reaction from the 15th day, lasting four days, during which time *Piroplasma mutans* in rare numbers were noted—1st April, 1908. A secondary reaction noted from the 25th day, touching 105·4, six days later and subsiding on the 28th day.

Discontinued on the 14th June, 1908.

2. *Ox* 342.—Born on the station in November, 1905, and had been running on redwater veld for two years.

NOTE.—Immune against redwater.

Exposed at Nelspruit on the 13th March, 1908.

Reaction from the 13th day, *Piroplasma mutans* in rare numbers and the lesions of a slight poikilocytosis being present five days later.

Secondary reaction from the 7th April, 1908, lasting for thirteen days, blood examinations on the 9th April, 1908, being negative. With the exception of a sharp rise from a morning record of 98 on the 16th May, 1908, to an evening reading of 105 three days later, no further symptoms were noted.

Discontinued on the 14th June, 1908.

Results.—Two animals immune against redwater alone, and exposed to natural infection, both showed slight reactions, accompanied with *Piroplasma mutans*.

EXPERIMENT No. 2.

With animals immune against redwater and Piroplasma mutans.

1. *Ox* 380.—Imported from Cape Colony.

Injected on the 6th June, 1908, subcutaneously with 5 c.c. blood of calf 378 (immune against redwater and *Piroplasma mutans*), developed a *Piroplasma mutans* reaction, accompanied with parasites.

Injected on the 4th November, 1906, with 5 c.c. heifer No. 316 (an animal infected with *Piroplasma mutans* and ordinary redwater); *Piroplasma mutans* again noted, together with a reaction, but this was probably caused as a result of vaccination with lymph. (See Annual Report, 1906-07, page 57).

NOTE.—Immune against redwater and *Piroplasma mutans*.

Exposed at Nelspruit on the 13th March, 1908.

Typical temperature reaction from the 12th day, reaching a maximum of 105·6 eleven days later, and regaining normal on the 16th April, 1908.

Piroplasma mutans and a slight poikilocytosis were noted on the 1st and 4th April, 1908; the latter lesion also being present on the 31st March, 1908, and 9th April, 1908.

Discontinued on the 14th June, 1908.

2. *Heifer* 400.—Imported from Aliwal North.

Injected on the 16th October, 1906, subcutaneously with 5 c.c. calf 397 (an animal immune against ordinary redwater), a reaction followed, accompanied with poikilocytosis.

On the 18th December, 1906, used in experiment with English redwater (see Annual Report, 1906-07, page 65); negative results.

Injected on the 30th January, 1908, with 10 c.c. blood of calf 425 (this animal had been inoculated with blood obtained from a calf in Zeerust which showed *Piroplasma mutans* in its blood).

Reaction from the 13th day, accompanied with *Piroplasma mutans*.

NOTE.—This animal is immune against redwater and *Piroplasma mutans*.

Exposed at Nelspruit on the 13th March, 1908.

Slight reaction from the 15th day, but with no high evening temperature record, the morning reading being below 101 during the following seventeen days; microscopical examinations negative.

Discontinued on the 14th June, 1908.

3. *Heifer 418*.—Imported from Cape Colony.

Injected on the 13th February, 1906, with English redwater (see Annual Report, 1906-07, page 66); negative results.

Injected on the 26th March, 1907, with 10 c.c. blood of heifer 425 (an animal containing *Piroplasma bigeminum* and *mutans* in its blood—see Annual Report, 1906-07, page 60). Irregular reaction accompanied with *Piroplasma mutans*.

NOTE.—This animal is immune against redwater and *Piroplasma mutans*. Exposed at Nelspruit on the 13th March, 1908.

Reaction from the 11th day, temperature rising daily. On the 18th day the morning temperature recorded 104, and microscopical examination showed *Piroplasma mutans* in rare numbers. The following day the temperature dropped to a morning record of 102·2, rising to 105·6 in the evening; on microscopical examination slight poikilocytosis and *Piroplasma mutans* were noted; the same lesions were present the next day, and the animal died during the ensuing evening (2nd April, 1908) from heartwater.

4. *Heifer 419*.—Imported from Cape Colony.

Injected on the 13th December, 1906, with blood of heifer 425 (an animal containing *Piroplasma bigeminum* and *mutans* in its blood—see previous animal, heifer 418); reaction accompanied with *Piroplasma mutans*.

NOTE.—This animal is immune against redwater and *Piroplasma mutans*. Exposed at Nelspruit on the 13th March, 1908.

Reaction from the 14th day, the temperature slowly rising for four days; slight poikilocytosis and *Piroplasma mutans* in rare numbers being noted on the 18th day; a sharp rise now followed, with an evening record of 106 on the 22nd day, remaining high for the three subsequent days; death from heartwater occurring on the morning of the 26th day—8th March, 1908—smears taken just previous to death showed slight poikilocytosis and *Piroplasma mutans*.

5. *Heifer 421*.—Imported from Cape Colony.

Injected on the 13th December, 1906, with English redwater (see Annual Report, 1906-07); negative results.

Injected on the 30th January, 1907, with 10 c.c. of blood of ox 426 (an animal immune against ordinary redwater); reaction with *Piroplasma bigeminum*.

Injected on the 8th March, 1907, with 10 c.c. heifer 409 (an animal containing *Piroplasma bigeminum* and *Piroplasma mutans* in its blood—see Annual Report, 1906-07, page 55); reaction with *Piroplasma bigeminum* and *Piroplasma mutans*.

NOTE.—This animal is immune against redwater and *Piroplasma mutans*.

Exposed at Nelspruit on the 13th March, 1908.

Reaction from the 15th day, a slight poikilocytosis and *Piroplasma mutans* being noted three days later; the temperature remained high for several days, and the same lesions were present on the 13th April, 1908—31st day. Normal record obtained from the 24th April, 1908, until the 15th May, 1908, when a sudden rise to 107 was noted in the evening, followed ten days later by another sharp rise to 106.

Discontinued on the 14th June, 1908.

6. *Heifer 473*.—Imported from Cape Colony.

Injected on the 7th November, 1907, with blood of ox No. 441, and showed *Piroplasma bigeminum* and *mutans*.

NOTE.—This animal is immune against redwater and *Piroplasma mutans*.

Exposed at Nelspruit on the 13th March, 1908.

Typical fever reaction from the 15th day, lasting for twenty-four days, during which time *Piroplasma mutans* was present on the 19th, 23rd, 26th, and 27th days, together with the lesions of a slight poikilocytosis; the latter being also apparent on the 29th and 31st day.

Discontinued on the 14th June, 1908.

7. Ox 479.—Imported from Cape Colony.

Injected on the 7th November, 1907, with 5 c.c. blood of ox 441 (see above); reaction followed, accompanied with *Piroplasma mutans* and poikilocytosis.

NOTE.—This animal is immune against redwater and *Piroplasma mutans*.

Exposed at Nelspruit on the 13th March, 1908.

Reaction from the 8th day, reaching 106 five days later, and 106·6 eight days later again, returning to normal on the 24th April, 1908—42nd day. Microscopical examination showed *Piroplasma mutans* and slight poikilocytosis on the 22nd, 23rd, 26th, 30th, and 31st days, the latter lesion being also present on the 27th and 29th days.

Discontinued on the 14th June, 1908.

8. Ox 480.—Imported from the Cape Colony.

Injected on the 11th November, 1907, with 5 c.c. ox 469, an animal infected with *Piroplasma mutans* and *bigeminum*.

Reaction followed, accompanied with a slight poikilocytosis.

NOTE.—This animal is immune against redwater and *mutans*.

Exposed at Nelspruit on the 13th March, 1908.

Reaction from the 15th day, rising slowly to a maximum evening temperature of 106 on the 30th day; microscopical examination showed slight poikilocytosis and *Piroplasma mutans* on the 26th, 27th, and 31st days; *Piroplasma bigeminum* appeared on the 29th day, and a slight poikilocytosis the following day. Temperature remained very irregular from the 17th April, 1908, occasionally reaching 105 and 106 in the evening.

Discontinued on the 14th June, 1908.

Results.—Eight animals immune against redwater and *Piroplasma mutans* showed reactions when exposed to natural infection, in seven of them accompanied with *Piroplasma mutans*.

EXPERIMENT NO. 3.

With animals immune against redwater and heartwater.

1. Ox 262.—Imported from Cape Colony in September, 1904.

On the 7th November, 1904, infested with larval blue ticks from ox 347, suffering from redwater and spirillosis, and reinfested on the next four days. No reaction.

Injected on the 25th June, 1906, with 20 c.c. blood of goat 119, an animal affected with heartwater.

No reaction.

NOTE.—This animal is immune to redwater and heartwater.

Exposed at Nelspruit on the 13th March, 1908. Indications of a very slight reaction from the 3rd to 21st days.

Blood examinations negative. Rise of temperature from the 33rd day, with an evening record of 104 to 105 for two weeks.

Discontinued on the 14th June, 1908.

2. *Bull* 302.—Born and bred in the Transvaal.

Injected on the 6th June, 1906, subcutaneously with 20 c.c. blood of sheep 484, an animal infected with heartwater. No distinct reaction; the morning temperature remained about 98·4, rising to an evening record of 103 to 104. Exposed in a redwater infected area for three months.

NOTE.—This animal is immune against redwater and heartwater.

Exposed at Nelspruit on the 13th March, 1908.

Reaction from the 9th day, lasting eleven days, during which time slight poikilocytosis and *Piroplasma mutans* appeared. Morning and evening temperature remained normal.

Discontinued on the 14th June, 1908.

3. *Bull* 305.—Born and bred in the Transvaal.

Injected on the 6th June, 1906, intrajugularly with 20 c.c. blood of sheep 484, an animal infected with heartwater. Slight reaction from the 17th day; exposed to a redwater infected area during 1907.

NOTE.—This animal is immune against redwater and heartwater.

Exposed at Nelspruit on the 13th March, 1908.

Short rise noted from the 13th day, touching 105 three days later, and regaining normal on the 24th day. Typical fever reaction followed, touching 108 on the 10th of April (twenty-eight days after exposure); slight poikilocytosis and *Piroplasma mutans* in rare numbers noted two days previously and again on the 28th day. Temperature slowly fell, returning to normal on the 26th April, 1908, or forty-six days after exposure.

Discontinued on the 14th June, 1908.

Results.—Three animals immune against redwater and heartwater showed slight reactions when exposed to natural infection, accompanied in two instances with *Piroplasma mutans*.

EXPERIMENT NO. 4.

With animals immune against redwater, heartwater, and Piroplasma mutans.

1. *Ox* 229.—Imported from Cape Colony early in 1903.

Injected on 3rd December, 1903, with blood containing *Piroplasma bigeminum* and *mutans*; slight primary and distinct secondary reaction followed; examination of blood on 25th February, 1904, showed the presence of small piroplasms.

Injected on 1st February, 1904, with blood of sheep 102 (suffering from heartwater); negative results.

During August, 1904, and the following months hyperimmunised with heartwater blood to the extent of 4 litres.

On the 24th May, 1906, infused with 1,000 c.c. blood of calf 323, suffering from heartwater and *Piroplasma mutans*.

Reaction from 15th day, lasting six days.

NOTE.—This animal is immune against *Piroplasma bigeminum*, *mutans*, and heartwater.

Exposed at Nelspruit on the 12th March, 1908; sharp rise on the 12th day, reaching 106 twenty-four hours later, and returning to normal on the 15th day. Blood examinations negative. Morning temperature remained at 101 for the next fourteen days, and from then recorded 98 to 99, with an evening record of 103. From the 15th May, the difference in the morning and evening temperature varied between 5° and 7°.

Discontinued on the 14th June, 1908.

2. *Ox 244*.—Imported from Cape Colony in July, 1904.

On the 30th July, 1904, infested with heartwater infected ticks. Reaction from the 24th day. On the 25th October, 1904, hyperimmunised with heartwater blood.

Injected on the 24th May, 1906, with 1,000 c.c. blood of calf 323 (heartwater), an animal which also contained *Piroplasma bigeminum* and *mutans* in its blood. Slight reaction from the 15th day.

NOTE.—This animal is immune against *Piroplasma bigeminum*, *mutans*, and heartwater.

Exposed at Nelspruit on the 12th March, 1908.

Slight rise on the 13th day, reaching 104·4 twenty-four hours later and returning to normal on the 24th day. Blood examinations on the 18th and 19th days negative. Temperature remained normal, with a morning record of 98 to 99, and 102 or 103 F., in the evening.

Sharp rise lasting from the 31st May to the 6th of June, and reaching the maximum of 105 on the evening of 3rd June, 1908.

Discontinued on the 14th June, 1908.

3. *Ox 269*.—A Transvaal animal, purchased in August, 1904.

Injected on the 15th November, 1905, with 10 c.c. blood of ox 347, an animal infected with *Piroplasma bigeminum* and *mutans*.

No reaction, and no piroplasms noted.

On the 21st March, 1906, infused with blood of ox 361, an animal affected with heartwater. Reaction from the 7th day, lasting three weeks. On the 28th December, 1906, hyperimmunised with blood of ox 390, an animal infected with heartwater. No result.

NOTE.—This animal is immune against *Piroplasma bigeminum*, *mutans*, and heartwater.

Exposed at Nelspruit on the 13th March, 1908.

Reaction from the 14th day, reaching 106·2, three days later; microscopical examinations negative. Temperature fell on 4th April, 1908, and another reaction commenced three days later, lasting for a week.

Discontinued on the 14th June, 1908.

4. *Bull 320*.—Born in the Transvaal; had been running on redwater infected area for one year, and was in the low veld for two months.

Injected on the 24th July, 1906, with 10 c.c. blood of sheep Nos. 347, 349, and 381, these animals being infected with heartwater. Slight reaction from the 8th to 16th days.

Injected on the 24th July, 1906, with 20 c.c. goat 136 (goat 136 had been injected with blood of cow 364, an animal suffering from heartwater).

Reaction from the 16th day, lasting for nine days.

NOTE.—This animal is immune against redwater, heartwater, and also possibly against *Piroplasma mutans* (by reason of exposure in the low veld).

Exposed at Nelspruit on the 13th March, 1908.

Reaction noted from the 13th day, lasting nine days, but microscopical examinations gave negative results. Secondary reaction from the 7th April, 1908, lasting until the 21st April, 1908.

Discontinued on the 14th June, 1908.

5. *Ox 337*.—Born in Potchefstroom; had been running in redwater veld, and was also in the low country for two months.

Injected on the 24th July, 1906, intrajugularly with 20 c.c. goat 136 (this animal had been injected with blood of cow 364, infected with heartwater). Fever reaction from the 14th day, lasting for seven days.

NOTE.—This animal is immune against redwater, heartwater, and possibly also against *Piroplasma mutans* (by reason of exposure in low veld).

Exposed at Nelspruit on the 13th March, 1908.

Slight reaction from the 15th day, lasting until the 24th day, during which time *Piroplasma mutans* in rare numbers were noted on the 19th day. Secondary reaction from the 7th April, 1908, the temperature rising to 105 two days later—microscopical examinations being negative—slowly falling until the 20th April, 1908, when a sharp rise was noted, recording 106 in the evening three days later.

Discontinued on the 14th June, 1908.

Results.—Two animals immune against redwater, heartwater, and *Piroplasma mutans* all showed slight reactions, and in one case accompanied with *Piroplasma mutans*, but it is doubtful whether this animal was immune against the disease.

EXPERIMENT No. 5.

With susceptible animals.

1. Ox 547.—Imported from the Cape Colony.

Had not been previously injected, and served as one of the controls in the experiment.

Exposed at Nelspruit on the 13th March, 1908.

Reaction from the 8th day, rising to 107 on the 21st day, and followed by death from heartwater thirty-six hours later (4th April, 1908).

Microscopical examinations showed slight poikilocytosis and *Piroplasma mutans* on the 18th, 20th, and 22nd days, the former lesion being also noted on the 17th and 18th days. Blood taken at time of post-mortem examinations showed *Piroplasma mutans*.

2. Ox 548.—Imported from the Cape Colony.

This animal had not been injected previously, and served as the second control in the experiment.

Exposed at Nelspruit on the 13th March, 1908.

Typical reaction from the 3rd day, the temperature touching 107 on the 12th, 17th, and 18th days, falling for the next five days, followed by another rise to 106·8 on the 26th day; death from heartwater, complicated with redwater, occurred on the following morning. Slight poikilocytosis and *Piroplasma mutans* in rare numbers were noted on the 20th, 22nd, 23rd, and 26th days; *Piroplasma bigeminum* appeared on the 27th day.

Results.—The two control animals both died showing lesions of heartwater. In both cases *Piroplasma mutans* was present in the blood, and one animal's death was complicated with redwater.

EXPERIMENT No. 6.

With blood taken from animals exposed at Nelspruit and injected into susceptible sheep and goats.

Animals Nos. 479, 419, 480, 380, 337, 473, 305, 302, 342, and 400 were tapped during the reaction on 8th April, and, with the exception of Nos. 479 and 419, were again tapped on the 11th of April, 1908. The blood was immediately forwarded to Pretoria and injected into the following animals:—

(A) Injections on the 10th April, 1908, with blood collected on the 8th April, 1908.

“A.” Goat 1363.—Injected with 5 c.c. blood of ox 479, not immune against heartwater.

Result.—Reaction followed, temperature recording 105·8 on the 19th day. Death from heartwater occurred on the 30th April, 1908, twenty days after injection.

“ B.” *Sheep* 426.—Injected with 5 c.c. blood of ox 419, not immune against heartwater.

Result.—Reaction from the 7th day, lasting seven days, followed by a doubtful heartwater reaction from the 28th to 36th day.

(B) The following animals received two injections, the first on the 10th April, 1908, with blood taken on the 8th April, 1908, and the second on the 13th April, 1908, with blood collected at Nelspruit on the 12th April, 1908 :—

“ C.” *Sheep* 611.—Injected with 5 c.c. blood of ox 480, not immune against heartwater, followed by a second injection of 5 c.c. of the same ox.

Result.—Reaction from the date of the second injection lasting fifteen days, followed immediately by a doubtful heartwater reaction lasting ten days.

“ D.” *Sheep* 660.—Injected with 5 c.c. blood of ox 380, not immune against heartwater; injection repeated three days later.

Result.—Reaction nine days after first injection, lasting nine days, and followed immediately afterwards by a doubtful heartwater reaction lasting eleven days.

“ E.” *Sheep* 671.—Injected with 5 c.c. blood of ox 337, immune against heartwater, redwater, and *Piroplasma mutans* (?); injection repeated three days later.

Result.—Irregular atypical reaction for six days after first injection, followed by a slight reaction lasting twelve days; not typical for heartwater.

“ F.” *Sheep* 678.—Injected with 5 c.c. blood of heifer 473, not immune to heartwater; injection repeated three days later.

Result.—Very slight indication of a temperature reaction; not typical for heartwater.

“ G.” *Sheep* 825.—Injected with 5 c.c. blood of bull 305, immune against heartwater; injection repeated three days later.

Result.—Reaction from date of second reaction, lasting fourteen days, followed immediately by a doubtful heartwater reaction which continued for nine days.

“ H.” *Sheep* 934.—Injected with 5 c.c. blood of bull 302, immune against heartwater; injection repeated three days later.

Result.—Irregular temperature for eight days after first injection, followed by a slight atypical reaction prolonged for about three weeks.

“ I.” *Sheep* 1146.—Injected with 5 c.c. blood of ox 342, not immune against heartwater; injection repeated three days later.

Result.—Reaction from date of second injection, lasting fourteen days, followed immediately by a reaction not typical for heartwater, lasting about two weeks.

“ J.” *Sheep* 1149.—Injected with 5 c.c. blood of ox 479, not immune against heartwater; injection repeated three days later.

Result.—No distinct fever reaction.

“ K.” *Sheep* 1234.—Injected with 5 c.c. blood of heifer 400, not immune against heartwater; injection repeated three days later.

Result.—Slight reaction from fourth day after first injection, lasting eight days, followed by a doubtful heartwater reaction, continuing for about two weeks.

RESULTS.—Of ten sheep and one goat injected with blood collected from the exposed cattle, all showed reactions, and the goat died of heartwater.

TABULATED ANALYSIS OF RESULTS.

No. of Animal.	Immune against.	Result when exposed to infection at Nelspruit.	Results given by blood taken from these cattle when injected into sheep or goats.
309	Redwater	Slight reaction with <i>P. mutans</i>	Not tested.
342	"	" " "	Tested on sheep; reaction followed not typical for heartwater.
380	Redwater and <i>P. mutans</i>	Reaction with <i>P. mutans</i> ..	" " "
400	" "	Reaction	" " "
418	" "	Reaction with <i>P. mutans</i> , and died of heartwater	Not tested.
419	" "	" " "	Tested on sheep; reaction followed not typical for heartwater.
421	" "	Reaction with <i>P. mutans</i> ..	Not tested.
473	" "	" " "	Tested on sheep; reaction followed not typical for heartwater.
479	" "	" " "	Caused a goat to contract a heartwater reaction, and died from this disease; did not cause a reaction in sheep.
480	" "	" " "	Tested on sheep; reaction followed not typical for heartwater.
262	Redwater and heartwater	Slight reaction	Not tested.
302	" "	Slight reaction and <i>P. mutans</i>	Tested on sheep; reaction followed not typical for heartwater.
305	" "	" " "	" " "
229	Redwater, heartwater, and <i>P. mutans</i>	Slight reaction	Not tested.
244	" "	" " "	"
269	" "	" " "	"
320	Redwater, heartwater, and <i>P. mutans</i> (?)	" " "	"
337	" "	Slight reaction and <i>P. mutans</i>	Tested on sheep; reaction followed not typical for heartwater.
547	Susceptible; control animal	Reaction with <i>P. mutans</i> , and died of heartwater	Not tested.
548	" "	Reaction with <i>P. mutans</i> and <i>P. bigeminum</i> ; died of heartwater complicated with redwater.	"

RÉSUMÉ.

1. The two animals immune against redwater alone showed reactions when exposed, during which *Piroplasma mutans* was observed. This *Piroplasma mutans* infection must be considered to be a natural infection, but the reaction may not be due to *Piroplasma mutans* alone, but also to the undetermined disease alluded to later.

2. Two of the eight animals immune against redwater and *Piroplasma mutans* died; the post-mortem lesions corresponded to that of heartwater. The remaining six animals all showed reactions, accompanied with *Piroplasma mutans* in five cases.

3. The three animals immune against redwater and heartwater showed slight fever reactions when exposed, accompanied in two instances with *Piroplasma mutans*.

4. The five animals immune against redwater, *Piroplasma mutans*, and heartwater all showed slight reactions when exposed, and only one animal (337), of which there exists a doubt as to whether it was immune to *Piroplasma mutans*, showed this parasite. In the other animals the reaction did not cause the reappearance of *Piroplasma mutans*; in 337 it is probable that the reaction was either due to a relapse of heartwater or to some other agency.

5. Both control animals died, showing lesions of heartwater; both showed *Piroplasma mutans* in the blood, and one also showed an infection of *Piroplasma bigeminum* at post-mortem.

6. All the exposed animals showed reactions a certain time after exposure; these reactions cannot be determined with absolute certainty, although inoculation of blood collected during the reactions were made into various sheep. Only one goat contracted a typical heartwater reaction and died; the remainder—all sheep—showed reactions, but since none died, and heartwater is usually fatal for sheep, we must conclude that not all the reactions given by the exposed cattle were due to heartwater, but that there was some other agency responsible, of which we have no knowledge at the present time.

7. With regard to the reaction, which cannot be definitely determined, it must be remembered that the animals had been for a considerable length of time away from tick infection, or at least were exposed to a minimum tick infection, and running on veld in which the blue and red ticks were present, and the brown was hardly ever noticed. In the bushveld the bont and the brown tick preponderate, and it is possible that these are responsible for this fever.

CONCLUSIONS.

1. The exposure of animals immune against redwater in the low veld proved that this immunity protected against the redwater of that veld.

2. Animals immune against heartwater were protected against that disease in the low veld.

3. Animals which were only immune against redwater contracted a *Piroplasma mutans* infection when exposed in the low veld.

4. All the animals which were not immune against *Piroplasma mutans* contracted this infection when exposed in the low veld, but none died.

5. Of the two control animals which were not immune against any of the diseases both died; *Piroplasma mutans* was present in both cases, but the deaths were due to heartwater, and in one case complicated with redwater.

6. All the exposed animals showed reactions, due either to heartwater or to some other agency, and this reaction, in the majority of cases, caused an increase in the number of *Piroplasma mutans* present in the blood.

7. The animals which were immune against heartwater, *Piroplasma mutans*, and *Piroplasma bigeminum* showed a slight *Piroplasma mutans* infection, and also a slight reaction.

B.—THE INFLUENCE OF COLD ON TICKS AND PIROPLASMA PARVUM.

Shortly after the introduction of East Coast fever into the low veld of the Elands River Valley in the Eastern Transvaal, and before legislation prohibited the movement of cattle, in several instances infected herds were brought up from that district to the high veld. One particular case came under my