GAUW ZIEKTE: A DISEASE OF SHEEP.

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INTRODUCTION AND HISTORY.

ON the 1st July, 1907, the owner of some sheep which were grazing on a farm situated on the Umpiluzi River, in the New Scotland portion of the Ermelo District, reported that deaths were occurring amongst them from an unknown disease. Being at the time Government Veterinary Surgeon for the district, I made investigations *in loco* and found that the first case had appeared on the 14th June amongst a lot of bastard ewes which had been grazing for the previous six weeks on a certain part of the farm, but which were removed shortly after to a reputed healthy portion. Since deaths were occurring daily, an opportunity was afforded of making a number of *post-mortems*, with the result that pronounced lesions, viz., acute oedema and hyperaemia of the lungs with serious effusion into the pleural cavities, were found in a number of cases; a discharge of foam from the nostrils was frequently present at death. Previous to this, the writer had made investigations in connection with a disease of an apparently similar nature and also affecting sheep, which made its appearance on an adjoining farm. As the result of inquiries made from owners who were old residents, it was ascertained that certain farms in the New Scotland area had been for a considerable number of years reported unhealthy for sheep, owing to the occurrence of a disease which, on account of its rapidly fatal character, is popularly known as "Gauw Ziekte". Although opinions differed as to its nature and cause, and it was found difficult to separate the ideas from the facts, all appeared unanimous on the following points, viz.: That the cause existed only on certain portions of unhealthy farms, cases occurred amongst the flock a few weeks after grazing thereon, only sheep in good condition contracted it, deaths occurred up till a few weeks after their removal to a known healthy portion of the farm, and that outbreaks are first noticed at the beginning of summer and end shortly after the appearance of the first frost. (The rainfall in the New Scotland area during the latter half of the season, July, 1906–June, 1907, was above the average, and hence the contention that a wet summer is a factor appeared correct, but the fact that the first severe frost in this area in 1907 occurred in the beginning of May, and that cases occurred up till twelve weeks later did not bear out the opinion that the disease disappeared shortly after the first frost.) The burning of the veld at certain times of the year is said to be a factor, and some owners contend that sheep grazed on a recent burn will not die as readily. Grazing the flock in well-stocked camps is said to be a preventive. As to the cause, I found this, generally speaking, attributed to the animals putting on condition too rapidly.

On furnishing headquarters with particulars, the Government Veterinary Bacteriologist and Principal Veterinary Surgeon visited the district, and as a result it was decided to carry out further investigations.

LITERATURE.

On searching the literature in connection with the diseases of ruminants in this country, I found that *Hutcheon** describes under the term "Gal-Ziekte", "A disease due to vegetable poisoning in which great nervous prostration is present. Death seems to occur soon after the noxious plant has been eaten, the affected animals usually dying in a state of collapse, e.g. the different species of Cape tulip, moraea and slangkop. If the animal lives for a day or two the cystic and hepatic ducts of the liver become involved. In *Chailletia cymosa* (gift blaar) poisoning, cases occur in which the animal drops dead without any premonitory symptoms; in less acute cases gastro-enteritis is present.

"*Dunphy*† experimented on sheep and goats with *slangkop* (*Urginea burkei*) and *Chailletia* (*Diehapetalum cymosum*), and found that in *slangkop* poisoning the symptoms are not very characteristic, the animal appears dull and weak, head hangs, heart palpitates, and there is excessive diarrhœa. These symptoms may continue for twenty-four hours or longer, and recovery takes place, or they become aggravated and death occurs. The *post-mortem* lesions indicating that the poisonous properties are due to its action on the nervous system. Congestion of the bowels and brain were noted. In *Chailletia* feeding experiments this observer found that the *symptoms* appear rapidly, the animal suddenly becoming depressed, hangs its head, the limbs tremble, the heart's action becomes weak and rapid, the animal falls on its side and dies a few minutes later. No diarrhœa was observed. *Post-mortem appearances* not pronounced; congestion of the bowels may be present, brain invariably congested."

Since cases of gauw ziekte might possibly be mistaken for the above, a knowledge of the seasons and distribution of the above-mentioned plants is of importance in making a differential diagnosis. A number of varieties of tulip are known to exist in South Africa. In the Cape,‡ losses amongst sheep have been reported by Veterinary Surgeon Dixon, due to their eating the ripe and partially withered *Moraea polystachya*. In the Transvaal, the yellow flowered species, viz., *Homerea pallida*, chiefly on account of its known poisonous properties and wide range of distribution, interests us more particularly. On the high veld it flourishes particularly on black soil, in damp vlei land, and on river banks, and in damp places is usually the first green vegetation to appear in the early spring. The writer has not observed *Homeria pallida* growing on that portion of the farm on which later the experimental sheep were grazed.

Slangkop is found north of the Magaliesberg, on some farms in the Bloemhof District, Klerksdorp District, Christiana, and in part of the bushveld, etc. It is found in sandy soils; a single flowering stem appearing above the ground in September or October. It has not been observed by the writer on the farm on which the experiments in connection with gauw ziekte were carried out.

Chailletia or *gift blaar* is found north of the Magaliesberg, and is common about Pretoria. This plant does not occur in the Ermelo District. *Fadogia*, to which it bears some resemblance, has frequently been mistaken for it.

Moraea, a blue flowered species of tulip, is known to exist in the Transvaal, but it does not appear to have a wide distribution. It is known to exist in the Potchefstroom District and in parts of the southern and western Transvaal.

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* "Diseases of Stock", pamphlet by D. Hutcheon.

† "Report of experiments carried out to observe the effect of certain poisonous plants on sheep and goats", *Transvaal Agricultural Journal*, January, 1906, page 315.

‡ "The Poisoning of Stock", by the Colonial Vet. Surgeon, D. Hutcheon.

Another disease of sheep, described by *Hutcheon*, and known as geil-ziekte, occurs, in which the characteristic is its sudden onset and rapid course; there is acute disturbance of the brain and nervous system, congestion of the venous circulation, and a tendency to a formation of gas in the rumen, the commonly accepted cause being due to the direct action of a chemical poison produced in certain succulent plants. The *post-mortem* appearance is distension of the abdominal organs with gas, and a dark congested appearance of the tissues of the body, followed by rapid decomposition. Prevention of the disease: removal of the flock to a change of pasture. Geil-ziekte also occurs in the Transvaal during the summer months. In connection with diseases of stock due to vegetation, it is interesting to note that in the Cape Colony, a disease affecting cattle and known as the " Molteno cattle disease ", has been described.* Horses are also affected. In New Zealand, Winton's disease, affecting both sheep and cattle, and in Newfoundland, Picton disease, have been known for some time. The cause appears to be similar in each country, viz., a plant of the species *senecio*. In each case a more or less cirrhotic condition of the liver is characteristic.

In the report of the Principal Veterinary Surgeon, Division of Veterinary Science, New Zealand, 1904, *Hepatic cirrhosis* is dealt with, and it has been observed that in cattle the extent of liver changes has little or no bearing on the symptoms produced.

The microscopical examination shows considerable congestion with blood extravasation and proliferation of the connective tissue throughout the organ, but only a comparatively small amount of new fibrous tissue between the lobules and among the liver cells.

In the case of sheep, they may also be affected for a considerable time before any symptoms are exhibited. It appears, however, that they resist the action of the *senecio* poison to an indefinitely greater period than horses and cattle.

The *post-mortem* lesions are said to be: Yellow liver and black urine.

Deaths were observed up till two months after removal to a healthy area.

Experimental Investigations.

Although the particular species referred to above was not observed on the farm on which gauw ziekte was noted, there no longer seemed reason to doubt the specific nature of this disease, and there appeared to be some specific association between it and vegetable poison. This was taken into consideration when the general outlines of the experiments were drawn up. The fact of including one lot of unmuzzled sheep would, in the events of deaths occurring only amongst these, give support to the view that a vegetable poison or toxin could not be excluded.

In November, 1907, I was transferred to the Government Veterinary Bacteriological Division, and made preparations for a further study of the disease. In March, 1908, I received instructions in connection with the general outline of the experiment from the Government Veterinary Bacteriologist and proceeded to the farm Billys-Vlei, which was kindly placed at the disposal of the Bacteriological Division by the owner, A. D. Mulligan, Esq.

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* *Cape Agricultural Journal*, May, 1906, page 663.

Exposure Experiment.

For the purpose of the experiment 105 sheep were brought from Pretoria, and 115, which were running on a healthy farm, were taken over from Messrs. Parry Bros., Grasdal, against an arrangement whereby the Division paid for those animals which died.

These sheep were divided into the following lots :—

Lot No. 1, Kraal No. 1 ..	40 Sheep, kraaled constantly, and fed on forage.
Lot No. 2, Kraal No. 2 ..	Running under natural conditions, kraaled at night.
Lot No. 3, Kraal No. 3 .. (Merinos and bastards)	Muzzled, and running with Lot. No 2 during the day ; fed on forage, and kraaled during feeding hours and at night.
Lot No. 4, Kraal No. 4 ..	Running under natural conditions (kraaled at night) on a portion of the farm, the grass on which was burnt off in March, 1908.
Lot No. 5, Kraal No. 5 ..	Muzzled, fed on forage, and running with Lot No. 4 during the day, kraaled during feeding hours and at night.
Lot No. 6	Reserve sheep, grazing on a reputed healthy portion of the farm.
Lot No. 7 .. .. .. (Merinos and bastards)	20 Sheep constantly kraaled on a reputed healthy portion of the farm, and fed on grass cut on the unhealthy area.

The water used by all the above animals was from the same source.

The experiment continued until the beginning of July. Unfortunately no cases occurred. During the latter half of the 1907–08 season, the rainfall was below the average ; frosts were frequent from the beginning of May. A very severe frost occurred on the 21st July. Throughout the district generally similar conditions prevailed. No cases of gauw ziekte were reported in the New Scotland area.

In December, 1908, the investigation was continued, the plan of the experiment being similar to the above, viz. :—

The sheep were drafted into the following lots. The same kraals were made use of, and the grazing lot were grazed over the same ground as in the previous experiment.

The following sheep were utilized, viz., the remainder of the lot of 105 which were brought from Pretoria for the previous experiment, total 87 ; and the following lots taken over from Messrs. Parry Bros., Grasdal ; A. P. Thorpe, Esq., Lake Chrissie ; Messrs. Booth & Bell, Spionkop, and J. D. Hamilton, Esq., Caledonia ; against an arrangement whereby payment was made for those animals which died.

The above were divided into the following lots :—

Lot No. 1, Kraal No. 1 .. (Bastard ewes and hamels and merino ewes and hamels)	30 Sheep kraaled constantly and fed on forage ; drinking water boiled ; drafted into the kraal on the following dates :— 10 on 22nd December. 10 on 23rd December. 10 on 30th December.

Lot No. 2, Kraal No. 2 ..	40 Sheep drafted in on dates as follows, and running under natural conditions, kraaled at night:—
Bastard ewes	1903, 1904, 1905, 1906, 1907, 1908, 1909, 1910, 1911, 1912, 1913, 1914, 1915, 1916, 1917, 1918, 1919, 1920, 1921, 1922; total, 20; 20th December, 1908.
Merino hamels	668, 1511, 1145, 1167, 1267; total, 5; 22nd December, 1908.
Bastard hamels	952, 59, 11, 12, 358; total, 5; 22nd December, 1908.
Bastard and merino sheep	1297, 1123, 68, 1260, 1279, 848, 1902, 1973, 1971, 1967; total, 10; 8th January, 1909.
Lot No. 3 .. .. .. (Bastard and merino sheep)	Muzzled; running with Lot No. 2; fed on forage; kraaled during feeding hours and at night time.
	10 sheep drafted in on the 22nd December, 1908.
	10 sheep drafted in on the 23rd December, 1908.
	10 sheep drafted in on the 30th December, 1908.
Lot No. 4. Kraal No. 4 ..	Total, 31 sheep, grazing under natural conditions, Separate from Lot No. 2.
Merino hamels	1953, 1951, 1952, 1944, 1948, 1947, 1956, 1409, 1945, 1949; Total, 10; 30th December, 1908.
Merino ewes	1047, 911, 1063, 1109, 1979, 1960, 1962, 1901, 1963, 1965; total, 10; 30th December, 1908.
Bastards	446, 1068, 1079, 1295, 1514, 1969, 1966, 1964, 1975; total 10; 8th January, 1909.
Sheep	648, 3rd February, 1909.
Lot No. 8 .. .. .. (Merinos and bastards)	20 Sheep, muzzled; running with Lot No. 4 during the day; kraaled at night and during feeding hours; 30th December, 1908.
Lots Nos. 6, 7, and 8 .. (Merinos and bastards)	Reserve sheep used for inoculation purposes chiefly.
Lot No. 9 .. .. .. (Merinos and bastards)	10 Sheep kraaled night and day in the vicinity of a spruit; fed on forage.
Lots Nos. 3, 5, and 9 ..	Were watered in their respective kraals; water taken from the same source and same supply used as in the case of Lots Nos. 2 and 4.
Lot No. 1	As stated above, received water which had been boiled.
	The remainder of the sheep were watered from or watered at the same spruit.

Of the total number of sheep, viz. 71, belonging to Lots Nos. 2 and 4, grazing under natural conditions, fifty deaths occurred, the cause of which was apparently specific. The following list shows the lots to which these belonged.

With the exception of a few deaths due to worm infection, accidents, or dipping, no cases similar to those observed in the case of the sheep in kraals Nos. 2 and 4 occurred amongst the remainder of the experimental animals.

PERIOD ANIMAL GRAZED OVER SUSPECTED AREA BEFORE THE APPEARANCE OF THE DISEASE AND DEATH.

Sheep No.	Breed and Sex.	Lot No.	Drafted into Kraal.	Noticed Sick.	Died	No. of Days Grazing.	Remarks.
1966	Bastard ewe ..	4	8/1/09	29/1/09	10/2/09	34	
1947	Merino hamel ..	4	30/12/08	No	20/2/09	53	Dropped dead while out grazing.
1975	Bastard ewe ..	4	8/1/09	No	21/2/09	45	Found dead in kraal.
1904	Bastard ewe ..	2	22/12/08	21/2/09	22/2/09	63	
1965	Bastard ewe ..	4	30/12/08	22/2/09	22/2/09	56	In lamb.
1905	Bastard ewe ..	2	22/12/08	23/2/09	24/2/09	65	
446	Bastard hamel ..	4	8/1/09	No	27/2/09	51	Dropped dead.
1960	Bastard ewe ..	4	30/12/08	22/2/09	27/2/09	60	In lamb.
1962	Bastard ewe ..	4	30/12/08	22/2/09	27/2/09	60	In lamb.
1916	Bastard ewe ..	2	22/12/08	27/2/09	28/2/09	69	
1409	Bastard hamel ..	4	30/12/08	No	28/2/09	61	Dropped dead.
1901	Bastard lamb ..	4	30/12/08	28/2/09	1/3/09	62	
59	Bastard hamel ..	2	22/12/08	No	1/3/09	70	Dropped on veld, and died shortly after.
848	Merino ewe ..	2	8/1/09	26/2/09	1/3/09	53	In lamb.
1918	Bastard ewe ..	2	22/12/08	2/3/09	4/3/09	73	
1963	Bastard ewe ..	4	30/12/08	3/3/09	4/3/09	65	In lamb ; destroyed for *post-mortem.*
1915	Bastard ewe ..	2	22/12/08	No	4/3/09	73	Found dead in kraal.
1944	Merino hamel ..	4	30/12/08	No	6/3/09	67	Dropped dead on veld.
1903	Bastard ewe ..	2	22/12/08	No	7/3/09	76	Found dead in kraal.
1970	Bastard ewe ..	4	8/1/09	27/2/09	7/3/09	59	In lamb.
1912	Bastard ewe ..	2	22/12/08	6/3/09	10/3/09	75	
1973	Bastard ewe ..	2	8/1/09	6/3/09	10/3/09	62	
1910	Bastard ewe ..	2	22/12/08	11/3/09	12/3/09	81	
911	Bastard ewe ..	4	30/12/08	No	13/3/09	74	In lamb ; dropped dead on being turned out of kraal.
668	Merino hamel ..	2	22/12/08	28/2/09	12/3/09	81	
358	Bastard hamel ..	2	22/12/08	28/2/09	13/3/09	82	
1951	Merino hamel ..	4	30/12/08	14/3/09	14/3/09	75	
1063	Bastard ewe ..	4	30/12/08	13/3/09	15/3/09	76	
1906	Bastard ewe ..	2	22/12/08	15/3/09	15/3/09	84	
1047	Bastard ewe ..	4	30/12/08	No	18/3/09	79	In lamb ; dropped dead on veld.
11	Merino hamel ..	2	22/12/08	13/3/09	20/3/09	89	
1964	Bastard ewe ..	4	8/1/09	16/3/09	21/3/09	73	
1920	Bastard ewe ..	2	22/12/08	20/3/09	24/3/09	93	
1068	Bastard hamel ..	4	8/1/09	22/3/09	24/3/09	76	Destroyed for *post-mortem.*
1969	Bastard ewe ..	4	8/1/09	20/3/09	25/3/09	77	In lamb ; destroyed for *post-mortem.*
1971	Bastard ewe ..	2	8/1/09	1/4/09	3/4/09	86	
1949	Merino hamel ..	4	30/12/08	No	9/4/09	101	Dropped dead on veld.
1902	Bastard ewe lamb	2	8/1/09	2/4/09	3/4/09	86	
1922	Bastard ewe ..	2	22/12/08	12/4/09	13/4/09	112	Destroyed for *post-mortem.*
1514	Merino hamel ..	4	8/1/09	6/4/09	14/4/09	97	,, ,,
1919	Bastard ewe ..	2	22/12/08	15/4/09	20/4/09	119	
1914	Bastard ewe ..	2	22/12/08	15/4/09	20/4/09	119	
1911	Bastard ewe ..	2	22/12/08	15/4/09	26/4/09	125	
1948	Merino hamel ..	4	30/12/08	9/4/09	26/4/09	118	
1945	Merino hamel ..	4	30/12/08	30/4/09	1/5/09	123	
1917	Bastard ewe ..	2	22/12/08	24/4/09	1/5/09	130	
1260	Bastard ewe ..	2	8/1/09	2/5/09	2/5/09	115	
1297	Bastard ewe ..	2	8/1/09	—	3/5/09	116	
1907	Bastard ewe ..	2	22/12/08	27/4/09	7/5/09	136	
1921	Bastard ewe ..	2	22/12/08	11/5/09	17/5/09	146	

Percentage of deaths in kraal No. 2, 67·5 per cent.
Percentage of deaths in kraal No. 4, 77·0 per cent.

The cause must have existed on the unhealthy portion of the farm before or at the date of the first death, viz., sheep 1966, 10th February, 1909, up till the time sheep 1921, which died on the 17th May, 1909, became affected. Some sheep, although grazing over the same ground during the period 10th February, 1909–17th May, 1909, did not contract the disease; others died as late as twenty-one weeks after date of being drafted into the kraal.

The shortest period in which death occurred after an animal was drafted into kraal was thirty-four days—sheep 1966.

The longest period in which death occurred after an animal was drafted into kraal was 146 days—sheep 1921.

On the 9th May the experimental sheep were disposed of as follows:—

New lot No. 1	Sheep grazing under natural conditions on infected areas; made up of some animals from each of the original lots Nos. 1, 3, 5, and 8.
New lot No. 2	Sheep kept in kraal and fed with grass of infected area, over which the sheep of new lot No. 1 graze, made up from sheep of each of original lots Nos. 1, 3, 5, and 8.
New lot No. 3	Sheep kept in a kraal and fed on forage, made up of some animals from each of original lots Nos. 1, 3, 5, and 8.

Remainder of original lots Nos. 2 and 4, total 14 sheep and 2 lambs (sheep grazing under natural conditions) were sent to Pretoria.

The experiment was continued as above until the 15th June, 1909, under the charge of Mr. Mitchell, Government Veterinary Surgeon, but no cases of a specific nature occurred. The climatic conditions were notable for the heavy rainfalls, which occurred not only in the Ermelo District generally, but throughout the Transvaal during the summer season 1908–09. The rainfall during the months of April and June was, however, about the average. The first frost occurred in the beginning of May.

Distribution.—So far gauw ziekte is definitely known to exist in the New Scotland area, but outbreaks have been reported on some farms in the Carolina District. Indeed, it may probably be found to enjoy a very wide distribution in the Transvaal, and to be identical with some of the, at present, obscure diseases of sheep.

Animals susceptible, breed, sex, and age.

Sheep.—Merinos, Persians, Africanders, and bastards of either sex. Pregnant animals do not appear to be more susceptible. Sheep from ten months upwards are known to become affected; so far as our present knowledge extends, young lambs do not contract the disease.

Cattle are said to die from gauw ziekte. In the year 1906 an outbreak was reported amongst oxen grazing on a farm adjoining Billys-Vlei, but unfortunately, I was unable to make an investigation. It is generally held that goats are susceptible. No cases have, however, come under my own personal observation.

Certain conditions are said to play an important *rôle* in the production of the disease, e.g. meteorological conditions. The commonly accepted view is that outbreaks appear during the summer months, particularly in wet seasons, and end shortly after the first frost. The following experience of the winter bears out to some extent this observation in regard to wet seasons.

During the summer of 1906–07 the rainfall was above the average. Gauw ziekte appeared as late as the 14th June and continued until the end of July. The summer of 1907–08 was a particularly dry one, and although the experimental sheep were grazed over the same ground from the beginning of April until the end of June, as that on which the outbreak on the 14th June of the previous year appeared, no cases occurred. The summer of 1908–09 was remarkable for the heavy rainfall and, as already pointed out, 70 per cent. (approximately) of the unmuzzled sheep grazed over the same ground as in 1907 and 1908 did.

Messrs. Parry Bros., Grasdal, New Scotland, kindly furnished me with the record of the rainfall registered on their farm during the seasons 1907–08 and 1908–09.

Season 1907–08.	ins.	*Season* 1908–09.	ins.
1907—July	0·3	1908—July	0·54
August	—	August	1·17
September	1·05	September	0·89
October	6·55	October	2·02
November	3·43	November	7·13
December	2·68	December	4·08
1908—January	6·07	1909—January	11·18
February	0·65	February	6·53
March	2·34	March	4·27
April	1·85	April	1·28
May	—	May	0·32
June	0·22	June	—
	24·87		39·41

The heaviest fall in twenty-four hours, season 1907–08, = 1·94, on 21st January, 1908.

Condition.—It is said that only sheep in good condition are subject, but sheep in fair and poor condition are now known to become affected.

Communicability.—Gauw ziekte seems to be neither infectious nor contagious in the ordinary sense. It is interesting to note the facts in connection with a previous outbreak on this farm. The owner had a flock of about 400 sheep (composed of about 240 bastards, the remainder merinos) grazing on a healthy portion of the farm, which may for convenience be described as portion A; on the 1st May, 1907, the bastards were removed to another part, which will be described as portion B. On the 15th June, 1907, two deaths occurred amongst the lot grazing on B. The remainder were removed back to their original grazing ground A, and although these were kept herded there with the merinos for some weeks, and deaths were occurring daily amongst them until the end of July, no cases were recorded amongst the merinos.

Experiments to Transmit the Disease.

Experiments made by injecting material from sheep which were sick or showed lesions on *post-mortem* were undertaken with the object of ascertaining whether the disease is transmittible or not.

14	Sheep	were injected	subcutaneously with blood, quantity varying from 2–10 c.c.
11	,,	,,	intrajugularly with blood, quantity varying from 4–20 c.c.
1	Sheep	was injected	intratracheally with blood, quantity varying from 4–20 c.c.
8	Sheep	were injected	intrajugularly with lung emulsion.
8	,,	,,	subcutaneously with lung emulsion.
5	,,	,,	intratracheally with lung emulsion.
4	,,	,,	intrajugularly with spinal fluid.
2	,,	,,	intrajugularly with brain and spinal cord emulsion.
2	,,	,,	subcutaneously with serous exudate in pleural cavity.
2	,,	,,	intrajugularly with serous exudate in pleural cavity.
2	,,	,,	intraperitoneally with serous exudate in pleural cavity.
2	,,	,,	intratracheally with serous exudate in pleural cavity.
2	,,	,,	intrajugularly with fluid in pericard.
1	Sheep	was injected	subcutaneously with fluid in pericard.
1	,,	,,	intrajugularly with serous exudate in peritoneal cavity.
1	,,	,,	subcutaneously with serous exudate in peritoneal cavity.
3	Sheep	were injected	subcutaneously with liver emulsion.
1	Sheep	was injected	intrajugularly with liver emulsion.
1	,,	,,	intrajugularly with lung oedema fluid.
1	,,	,,	subcutaneously with lung oedema fluid.
1	,,	,,	subcutaneously with spleen emulsion.
1	,,	,,	intramuscularly with brain and spinal cord emulsion.
1	,,	,,	subcutaneously with uterine fluid.
1	,,	,,	intramuscularly with portion of contents of jejunum.
3	Sheep	were injected	subcutaneously with portion of contents of jejunum.
31	Sheep	were drenched	with portion of contents of stomach and intestines.
5	Sheep	were drenched	with exudate pleural cavity.
115	Total.		

Excluding accidents due to embolism, and one death due to malignant oedema, and in a few cases, swellings at seat of inoculation, no other results were noted; this disease does not appear to be transmitted by injections and ingestion of material as shown above.

Symptoms.—Duration and Course.

Cases have been observed in which the disease runs a per-acute course, in some instances an acute, and in other a sub-acute course.

In the former there are no premonitory symptoms. The animal while at rest or grazing leisurely will not indicate by its presence that there is anything seriously amiss with it, but will suddenly describe one or two circles in its movements, or bleat, or leap into the air, and fall dead, or if just previously grazing or ruminating, the bolus of food may be found in the mouth at death. Tympany of the rumen and escape from the mouth and nostrils of a watery greenish fluid mixed with herbage has been noted. Deaths have been observed to occur suddenly when the flock was made to move hurriedly; particularly when attempts were being made to catch one of the sheep. Frequently when they are leaving the kraal in the morning one will fall, death occurring after a few minutes' struggling. In the other cases they have been kraaled for the night, all apparently healthy, and in the morning one or more may be found dead.

In acute cases the animal will leave the kraal, to all appearances healthy, on its return respirations will be found considerably accelerated, 80–100 (pulse 70–80–100), occasionally panting, tongue may be hanging from mouth, death usually occurring within a few hours with perhaps a discharge of foam from the nostrils (acute oedema of lung being present on *post-mortem*), paroxysms of coughing will occasionally be noticed; in one case frequent attempts at micturition were made.

In sub-acute cases the respirations are at the beginning also accelerated, but to a less degree (sheep on a warm day or when excited show hurried respirations).

Owing to this and to the fact that close attention is not usually paid to the character of the respiration in sheep, and the fact that the animal appears otherwise healthy, this symptom is, particularly in the early stages of the sub-acute cases, liable to escape notice. A careful observer will detect sick animals by noting the character of the respiratory movements, which will be found to be abdominal (ribs fixed), and frequently an interval will be detected in the expiratory act, or a distinct jerk will be noticed. Should the flock be in the kraal respirations of affected animals are audible to an attentive listener, and on placing one's ear to the animal's nostrils a grunt or moan is heard. It is in the sub-acute cases that a casual observer will usually first recognize that there is something amiss. The affected animal stands with head down, or lies for the greater part of the day, being unable to keep up with the flock, feeds very little, and rapidly loses condition, and if made to move falls exhausted. With the exception of a few cases in which oedema of the submaxillary tissues was noted some days after the animal showed symptoms (this condition lasted for a day or two), and the appearance of diarrhœa in two instances some days before, and in two cases after the appearance of symptoms (in the latter the faeces were mixed in one case with bile and in the other with blood), no further symptoms than those described above were observed.

There is nothing characteristic in the temperature reaction. In acute cases a rise may take place at the onset of symptoms. In one case which ran a sub-acute course (eighteen days), the temperature remained elevated throughout.

Duration.—Acute cases: death usually occurs in a few hours. In sub-acute cases the animal may survive for eighteen days (longest period noted); average seven days; no recoveries were noted.

CLINICAL SYMPTOMS.

Sheep No.	Condition.	Noticed Sick.	Date of Death.	No. of Days Sick.	Foam at Nostrils at Death.	Symptoms.	Remarks.
1966	Poor	29/1/09	10/2/09	13	No	Falling off in condition	
1947	Fair	Not noticed sick	20/2/09	—	No	None observed	Dropped dead. Tympany of rumen at death.
1975	Fair	Not noticed sick	21/2/09	—	Yes	None observed	Found dead in kraal.
1904	Poor	21/2/09	22/2/09	1	No	Lying	
1965	Good	22/2/09	23/2/09	1	Yes	Respiration accelerated	
1905	Fair	23/2/09	24/2/09	½	Yes	Respiration accelerated	
446	Good	Not noticed sick	22/2/09	—	No	None observed	Dropped dead.
1960	Good	22/2/09	27/2/09	6	No	Respiration accelerated	
1962	Good	22/2/09	28/2/09	7	No	Respiration accelerated	
1916	Good	27/2/09	27/2/09	½	No	Respiration accelerated	
1409	Good	Not noticed sick	28/2/09	—	No	None observed	Dropped dead.
1901	Fair	28/2/09	1/3/09	1	No	Respiration accelerated	
59	Good	Not noticed sick	1/3/09	—	No	None observed	Dropped dead.
848	Good	26/2/09	1/3/09	3	No	Respiration accelerated	
1918	Fair	2/3/09	4/3/09	2	No	Respiration accelerated	Noticed dull and off feed, 28th February, 1909.
1963	Good	3/3/09	4/3/09	1	Yes	Respiration accelerated	Noticed coughing paroxysms on day of death.
1915	Poor	Not noticed sick	5/3/09	—	Yes	None observed	Found dead in kraal.
1903	Poor	Not noticed sick	7/3/09	—	Yes	None observed	Found dead in kraal.
1944	Fair	Not noticed sick	6/3/09	—	No	None observed	Dropped dead on veld.
1970	Good	27/2/09	7/3/09	8	No	Respiration accelerated	
1912	Poor	6/3/09	10/3/09	5	No	Respiration accelerated	
1973	Fair	6/3/09	10/3/09	5	No	Respiration accelerated	
1910	Fair	11/3/09	12/3/09	1	No	Respiration accelerated	
911	Good	Not noticed sick	13/3/09	—	No	Respiration accelerated	Dropped dead on being turned out of kraal.

Clinical Symptoms—(*continued*).

Sheep No.	Condition.	Noticed Sick.	Date of Death.	No. of Days Sick.	Foam at Nostrils at Death.	Symptoms.	Remarks.
668	Fair	28/2/09	12/3/09	12	No	Respiration accelerated	
358	Fair	28/2/09	13/3/09	13	No	Respiration accelerated	Off feed and falling off in condition.
1951	Fair	14/3/09	14/3/09	Few hours	No	Respiration accelerated	Apparently healthy up to the morning of the 14th March, 1909; 8 a.m., blowing hard, panting, coughing paroxysms; on turning it out of kraal, moved a few yards, laid down, followed flock slowly. Inspiration 104, expiration 120, just before death.
1906	Good	15/3/09	15/3/09	Few hours	Yes	Respiration accelerated	Paroxysms of coughing prior to death.
1063	Good	13/3/09	15/3/09	2	No	Respiration accelerated	
1047	Good	No	18/3/09	—	No	—	Dropped dead on veld.
11	Good	13/3/09	20/3/09	8	No	Respiration accelerated	Destroyed for *post-mortem*.
1964	Fair	16/3/09	21/3/09	5	No	Respiration accelerated	Oedema of tissues submaxillary.
1920	Fair	20/3/09	24/3/09	5	No	Respiration accelerated	
1068	Good	22/3/09	24/3/09	2	No	Respiration accelerated	Coughing paroxysms. Destroyed for *post-mortem*.
1969	Fair	20/3/09	25/3/09	6	No	Respiration accelerated	Destroyed for *post-mortem*.
1971	Good	1/4/09	3/4/09	2	No	Respiration accelerated	Respirations on evening before death, 100; gasping. coughing paroxysms just before death.
1902	Good	2/4/09	3/4/09	Few hours	Yes	Respiration accelerated	Respirations greatly accelerated, coughing paroxysms, foaming at mouth, frequent attempts at micturition, mouth open. tongue hanging from mouth.

CLINICAL SYMPTOMS—(*continued*).

Sheep No.	Condition.	Noticed Sick.	Date of Death.	No. of Days Sick.	Foam at Nostrils at Death.	Symptoms.	Remarks.
1949	Good	Not noticed sick	9/4/09	—	No	—	Dropped dead. Tympany of rumen at death, green fluid from nostrils at death.
1922	Good	12/4/09	13/4/09	1	No	Respiration accelerated	Diarrhœa noted on 15th day before death. Destroyed for *post-mortem*.
1514	Fair	6/4/09	14/4/09	9	No	Respiration accelerated	On 9th day, before death, noticed blowing. On day before death, faeces mixed with yellow bile-like fluid and blood. Destroyed for *post-mortem*.
1919	Fair	15/4/09	20/4/09	5	No	Respiration hurried	Found dead in kraal.
1914	Fair	18/4/09	20/4/09	3	No	Lying down, off feed	
1911	Fair	15/4/09	26/4/09	11	Yes	Respiration hurried	Diarrhœa noted on 29th March, 1909.
1948	Fair	9/4/09	26/4/09	18	No	Respiration hurried	Oedema of tissues submaxillary on the 14th, disappeared on 16th. Faeces fluid, dark green colour, eleven days before death, and lasting one day.
1945	Good	30/4/09	1/5/09	1	Yes	Respiration hurried	
1917	Good	24/4/09	1/5/09	8	—	Respiration hurried	Pulse 116, respiration 52, when noticed sick.
1260	Good	2/5/09	2/5/09	—	—	Respiration hurried	Found dying in kraal.
1297	Fair	20/4/09	3/5/09	13	—	Respiration hurried	
1907	Fair	27/4/09	7/5/09	8	—	Respiration hurried	Pulse 140, respiration 70, when noticed sick.
1921	Fair	11/5/09	17/5/09	6	—	Respiration hurried	Forwarded to Pretoria, 3rd May, 1909; noticed sick in Pretoria, 11th May, 1909; died in Pretoria, 17th May, 1909; ruminating and feeding, 14th May, 1909.

Results.—

8	Dropped dead, no premonitory symptoms	16 per cent.
3	Found dead in kraal, no premonitory symptoms ..	6 ,,
36	Showed respirations accelerated	72 ,,
3	Dull	6 ,,
		100 per cent.

Average number of days appeared sick prior to death	7 days.
Shortest period sheep noticed sick prior to death ..	a few hours.
Longest period sheep noticed sick prior to death ..	18 days.

Pathology.

The prominent features are lung, liver, gastro-intestinal, and kidney lesions. In some cases there are no pronounced lesions.

As already stated, fifty sheep died. *Post-mortems* were kept of these. Lesions were pronounced in the following organs in the following percentage of cases, viz. :—

Intestinal, lung, liver, and kidney	36 per cent.
Lung, liver, and kidney	12 ,,
Intestines, lung, kidney	8 ,,
Intestines and lung	6 ,,
Liver	6 ,,
Lung and liver	6 ,,
Intestines and liver	4 ,,
Intestines, lung and liver	4 ,,
Intestines	4 ,,
Lung and kidney	4 ,,
Intestines, liver and kidney	2 ,,
No pronounced lesions	8 ,,
	100 per cent.

In 14 per cent. of cases foam was present at nostrils at death.

In 60 per cent. of cases there was a serous exudate in the pleural cavities.

In 36 per cent. of cases a varying quantity of serous exudate was present in the peritoneal cavity.

In 34 per cent. of cases there was an increase in quantity of pericardial fluid.

In 56 per cent. of cases a blood coagulum well-formed and large was present in the ventricles extending into the auricles and sometimes into the large vessels.

Lung lesions.—On opening into the pleural cavity a serous effusion, varying from 100–1000 c.c. and upwards, is invariably present. Mediastinum may be found infiltrated with a gelatinuous exudate, and bronchial and mediastinal glands swollen and hyperaemic. The pleura pulmonalis may present red stripes corresponding to intercostal spaces, and spots and patches of ecchymoses, varying in size, or corresponding to consolidation in the parenchyma.

Emphysema of portions of the lung tissues may be noted. The interlobular tissue is sometimes infiltrated with a straw coloured fluid, particularly noticeable at dependent portions of the lungs.

Lungs on section show hyperaemia and oedema more or less pronounced. There is sometimes a marked amount of frothy fluid in the bronchi and trachea (in some instances foam is found at the nostrils at death), and an abundance of pale red fluid flows from the cut surface. In some cases the lung lesions are not present, in others congestion may only be noticed.

In addition to respiratory disturbances, circulatory disturbances are induced. As a sequelae of these stasis in the portal system and in the small circulation takes place, the stasis in the portal system causes the lesions in the liver noted below, in the small circulation congestion and transudation of a serous fluid takes place from the vessels into the alveoli and causes the oedema found on *post-mortem.* It is usual to find dark red patches, varying in size, visible externally and extending into the lung parenchyma, which show on microscopical examination that diapedesis of red cells has taken place and frequently also hepatization.

On opening into the peritoneal cavity a quantity of serous fluid, varying from a few cubic centimetres to 1000 c.c. and upwards, may be found. This is not so constant a feature as in the case of effusion into the pleural cavity.

The liver is usually found swollen and the colour varies, sometimes being greyish white, sometimes yellow or brown; the weight was found in one instance to be 1·7 lb., in another 2 lb.

On section the organ presents in some instances a nutmeg appearance and is oedematous, in other cases the parenchyma is hyperaemic and has a finely granular appearance. The lobuli are distinct, they are surrounded by a hyperaemic zone, the parenchyma is of yellowish colour, friable, in other cases the cut surface may present a uniform yellowish appearance.

In several cases we find by microscopical examination of sections a more or less distinct peripheral deposit of fat in the liver cells; the deposit is often centrally situated. The cause of this phenomenon is not quite clear, but it may be pointed out that in phosphorous intoxication similar lesions occur. In a few probably sub-acute cases, naturally under the influence of the stasis in the liver vessels, we get alterations which, from the histological point of view, mark the beginning increase of fibrous tissue; this lesion gives the organ the appearance of a cirrhosis.

The liver is, in some cases, normal.

Gastro intestinal lesions.—The fourth stomach may contain dark brown bloody contents and mucus deposit. Mucosa frequently swollen, infiltrated, and hyperaemic; folds ditto.

Duodenum.—The mucosa is frequently hyperaemic, often distinctly haemorrhagic and swollen; in other instances the lesions are not so pronounced.

Jejunum, mucosa particularly at the proximal end, is in some cases hyperaemic, often distinctly haemorrhagic. It may also be swollen. Bile stained contents may frequently be noted.

Parasites are frequently found in the duodenum and jejunum.

The mucous membranes of the remainder of the small intestines, the caecum and colon are frequently hyperaemic and swollen. The contents of small intestines are frequently bile stained.

In some instances gastric and bowel lesions are not pronounced.

Heart.—Both ventricles and auricles contain, in a number of cases, a well-formed blood coagulum extending into the larger vessels.

The pericardium contains, in some instances, an increase of fluid, varying in quantity.

Spleen.—Usually normal; may be soft and swollen.

Kidneys.—Frequently enlarged; total weight recorded in one instance of both kidneys, 400 grammes.

Capsule is easily detached and of a dark red colour. On section there is diffuse hyperaemia. In other cases hyperaemia may be irregular in cortex and the intermediary zone.

Blood changes, lesions of anaemia were frequently observed. These take the form of anisocytosis poikilocytosis, of basophile and polychromatic cells. These changes are, however, observed in sheep with worm infection, which is frequent on this farm.

Epicrisis.—The cause of the pathological changes is in all probability due to an at present unknown toxine. Under its influence the functions of the heart undergo certain physiological changes, viz:—Insufficiency of the heart muscle, which induces the circulatory disturbances described. Alterations in the epithelium of the pulmonary and hepatic vessels may also be caused, which allow the transudation of fluid through the vessel walls.

Diffuse hyperaemia of the kidney and gastro enteritis may point to the fact that from these organs the elimination of the supposed toxine takes place. A similar condition is observed in horse-sickness.

Appendix.

Record of cases representing the various forms of gauw ziekte.

Per-acute case.

Post-mortem on merino hamel 1949, 9th April, 1909.

Died: 3 p.m. *Post-mortem:* 3.30 p.m.

Aged: Two tooth.

Condition: Fair. Dropped dead when out grazing on veld. Not noticed sick prior to death. Tympany of rumen present at death. Bolus of food in mouth. Greenish watery fluid mixed with herbage from nostrils and mouth.

Lungs: Normal.

Heart: Left heart contained a little fluid blood.

Right heart: Empty. Both endocard normal.

Liver: Normal.

Abomasus: Normal.

Rumen mucosa: Normal, full of ingesta, distended with gas.

Jejunum: Slight hyperaemia of proximal end; taenia present.

Ileum mucosa: Normal.

Caecum mucosa: Normal.

Colon mucosa: Normal.

Kidney: Left normal; right hypostasis.

Sheep 1949.

Date. 1909.	Temperature Record. Morning. °F.	Evening. °F.	Remarks.
March 3	102·0	102·4	
,, 4	103·0	100·4	
,, 5	102·0	103·6	
,, 6	101·6	103·8	
,, 7	102·0	100·0	
,, 8	101·4	103·6	
,, 9	101·6	103·6	

Sheep 1949—(continued).

Date. 1909.	Temperature Record. Morning. ° F.	Evening. ° F.	Remarks.
March 10	101·2	103·4	
,, 11	101·0	104·0	
,, 12	100·0	103·4	
,, 13	102·0	102·2	
,, 14	103·6	103·6	
,, 15	101·6	102·0	
,, 16	101·6	102·0	
,, 17	102·0	103·0	
,, 18	101·6	100·0	
,, 19	103·2	100·6	
,, 20	103·0	103·2	
,, 21	102·0	102·8	
,, 22	100·0	102·4	
,, 23	102·2	102·0	
,, 24	102·6	103·0	
,, 25	102·4	102·6	
,, 26	102·0	103·0	
,, 27	101·6	103·0	
,, 28	100·0	103·6	
,, 29	101·8	104·0	
,, 30	101·2	103·6	
,, 31	102·6	103·6	
April 1	100·6	103·8	
,, 2	100·0	103·2	
,, 3	102·0	106·0	
,, 4	101·0	103·2	
,, 5	102·6	103·2	
,, 6	101·0	103·2	
,, 7	101·4	104·0	
,, 8	101·4	102·8	
,, 9	100·0	—	Dropped dead on veld.

Acute case.

Post-mortem on merino hamel 1945, 1st May, 1909.

Age: Two tooth.
Noticed sick: 6 p.m., 30th April, 1909.
Died: 1.30 p.m., 1st May, 1909.
Condition: Good.
No ticks noted on body.
Frothy mucus from nose.
Pleural cavity: 1000 c.c. fluid.
Peritoneal cavity: Small quantity of fluid.
Pericard: 5 c.c. clear fluid.
Submaxillary lymphatic glands contain green pus.
Lungs: In expirium, anterior lobes atelactasis, main lobes of both lungs anteriorly, and towards the border show a patch the size of palm of hand, with petechiae and extravasation; on section strong oedema and hyperaemia of both lungs.
Mediastinum: Clear gelatinous infiltration.
Mediastinal glands swollen and soft.

Heart: Flabby, cavities dilated and empty.
Endocard: Normal.
Liver: Swollen, nutmeg appearance, soft on section.
Gall bladder distended with normal bile.
Spleen: Swollen; pulpa soft on section.
Abomasus mucosa: Slightly swollen.
Omasus: Normal.
Large intestines: Normal.
Small intestines: Mucosa swollen; slight patchy hyperaemia.
Nodules of oesophogostoma columbianum rare in intestines.
Kidneys: Capsule easily detached; parenchym normal.
Brain: Hyperaemic.

Sheep 1945.

Date. 1909.	Temperature Record. Morning. ° F.	Evening. ° F.	Remarks.
March 3	101·0	104·2	
,, 4	101·8	99·0	
,, 5	101·2	101·6	
,, 6	101·4	103·0	
,, 7	100·0	102·4	
,, 8	101·4	102·2	
,, 9	102·0	102·2	
,, 10	102·6	103·6	
,, 11	100·0	104·6	
,, 12	102·6	103·0	
,, 13	102·0	101·6	
,, 14	102·0	103·4	
,, 15	102·0	102·6	
,, 16	101·4	103·0	
,, 17	102·0	103·0	
,, 18	102·0	104·0	
,, 19	102·0	101·8	
,, 20	103·0	103·4	
,, 21	101·4	102·6	
,, 22	100·0	102·6	
,, 23	100·6	104·2	
,, 24	102·0	102·6	
,, 25	101·0	103·0	
,, 26	101·0	102·6	
,, 27	102·0	102·6	
,, 28	101·8	103·6	
,, 29	102·4	102·4	
,, 30	101·0	103·2	
,, 31	101·2	102·6	
April 1	102·6	102·8	
,, 2	101·6	103·8	
,, 3	101·8	102·6	
,, 4	101·0	103·0	
,, 5	101·0	102·0	
,, 6	101·0	104·4	
,, 7	101·6	103·4	
,, 8	101·2	103·6	

Sheep 1945—(continued).

Date. 1909.	Temperature Record. Morning. °F.	Evening. °F.	Remarks.
April 9	100·0	102·8	
,, 10	102·4	103·0	
,, 11	100·6	103·2	
,, 12	101·4	103·0	
,, 13	101·4	103·0	
,, 14	102·2	102·4	
,, 15	102·0	104·0	
,, 16	101·4	103·8	
,, 17	101·8	103·0	
,, 18	101·2	103·6	
,, 19	101·8	103·4	
,, 20	100·4	103·2	
,, 21	101·2	102·0	
,, 22	101·6	102·4	
,, 23	102·0	103·6	
,, 24	101·2	102·2	
,, 25	100·6	103·0	
,, 26	100·0	104·0	
,, 27	100·2	103·2	
,, 28	100·0	103·0	
,, 29	100·0	104·6	
,, 30	100·6	103·8	Noticed sick, 6 p.m.; blowing; respirations jerky.
May 1	102·4	—	

Sub-acute case.

Post-mortem on merino hamel 1948, 26th April, 1909.

Age: Six tooth.

Condition was good when first noticed sick, 9th April, 1909.

Emaciated condition before death. Died 26th April, 1909.

Post-mortem immediately after death.

Pleural cavity contains a considerable amount of straw coloured liquid.

Pericard contains an increase of fluid.

Lungs: Anterior lobe of right lung attached by three fibrous bands to chest wall. Posterior lobe of left lung attached to chest wall by fibrous band. A fibrous band passes from pericard to chest wall (left side).

Lungs: In expirum; slight hyperaemia. Anterior and middle lobe of right lung contain patches of red hepatization (sink in water). In middle lobe of left lung are patches of hepatization. Right lung, middle lobe, contains a cyst the size of a bean; contents, yellowish pus.

Mediastinal lymphatic gland present a yellowish nodule, hard on section and in concentric layers.

Heart: Right ventricle filled with a blood coagulum. Left ventricle contains a large-sized blood coagulum. Right and left endocards normal.

Liver: Enlarged, on section firm; nutmeg appearance; gall bladder contains a little normal bile.

Spleen : Pulpa rather pale.
Abomasus : Empty ; mucosa pale in colour.
Omasus : Almost empty.
Reticulum : Empty.
Rumen : Contains a lot of dark coloured ingesta consistency of pea soup.
Large intestines : Mucosa normal.
Ileum : Mucosa proximal end hyperaemia in transverse striae.
Jejunum : Contents chocolate colour. Proximal end swollen. Hyperaemic throughout length in transverse stripes. Petechiae size of a pin's head.
Duodenum : Mucosa swollen and hyperaemic.
Kidneys : Diffusely red in colour.

Sheep 1948.

Date. 1909.	Temperature Record. Morning. ° F.	Evening. ° F.	Remarks.
March 3	102·0	103·8	
,, 4	102·6	103·0	
,, 5	101·6	103·6	
,, 6	101·6	103·4	
,, 7	100·8	103·6	
,, 8	101·6	103·4	
,, 9	102·2	102·8	
,, 10	102·0	103·2	
,, 11	101·6	103·6	
,, 12	101·0	104·0	
,, 13	101·6	103·4	
,, 14	101·4	103·4	
,, 15	101·0	102·0	
,, 16	101·0	104·8	
,, 17	101·0	103·4	
,, 18	102·6	103·8	
,, 19	104·6	103·0	
,, 20	103·0	104·0	
,, 21	103·2	103·0	
,, 22	100·0	103·4	
,, 23	101·6	106·0	
,, 24	106·0	104·6	
,, 25	104·0	103·0	
,, 26	103·0	104·8	
,, 27	102·0	104·8	
,, 28	103·8	102·8	
,, 29	100·0	102·6	
,, 30	100·4	103·4	
,, 31	101·0	103·4	
April 1	102·0	103·0	
,, 2	102·0	103·8	
,, 3	101·2	103·8	
,, 4	101·6	104·0	
,, 5	102·2	103·2	
,, 6	103·0	102·0	
,, 7	100·6	103·6	

Sheep 1948—(continued).

Date. 1909.	Temperature Record. Morning. ° F.	Evening. ° F.	Remarks.
April 8	102·0	104·2	
,, 9	104·0	106·0	Respirations hurried.
,, 10	104·0	104·6	
,, 11	102·6	105·6	
,, 12	102·6	105·0	
,, 13	103·0	103·6	
,, 14	103·0	105·6	Oedematous condition of submaxillary tissues.
,, 15	103·8	106·4	Oedematous swelling disappearing.
,, 16	102·4	105·0	Faeces fluid dark green colour.
,, 17	104·0	104·0	Oedematous swelling almost disappeared, faeces not fluid, blood smears, basophile and polychromatic cells present.
,, 18	103·0	106·0	Poikilocytosis.
,, 19	104·0	103·2	Blood smear, basophile and polychromatic cells frequent. Poikilocytosis.
,, 20	100·4	105·0	Blood smear, basophile and polychromatic cells frequent.
,, 21	102·8	104·8	Blood smear, basophile and polychromatic cells frequent. Poikilocytosis.
,, 22	104·2	103·0	
,, 23	104·2	104·2	Blood smear, basophile and polychromatic cells frequent.
,, 24	103·4	104·4	Blood smear, basophile cells frequent, polychromatic cells not so frequent.
,, 25	103·4	104·2	Basophile cells frequent.
,, 26	101·6	—	Basophile cells frequent.

Sub-acute case.

Post-mortem on merino ewe 1919, 20th April, 1909.

Age: Eight tooth.

Noticed sick on 15th April, 1909; respirations accelerated.

Found dead in kraal on 20th April, 1909. Not in lamb.

Condition: Fair. No ticks found on body.

Pleural cavity contained 600 c.c. of a straw coloured fluid. Peritoneal cavity contained 750 c.c. of blood stained fluid.

Pericardium contained an increase of fluid.
Lungs : In inspirium. Right lung posterior lobe contains several patches of consolidation, size of a pigeon's egg. Left lung caseous nodules in anterior and middle lobes, size of a pigeon's egg, on incision contents greenish caseous material, encapsuled by a white fibrous tissue.
Lungs : On incision hyperaemic and oedematous.
Trachea contains a little foam.
Heart : Both ventricles contain a blood coagulum ; right and left endocards normal.
Liver : Enlarged, firm, on incision greyish white in colour.
Spleen : Pulpa soft.
Abomasum : A few strongyli present, mucosa slightly hyperaemic.
Omasum : Normal.
Duodenum : Hyperaemia of mucous membrane.
Jejunum : Hyperaemia of mucosa at proximal end, mucosa swollen, contents of jejunum chocolate colour. Taenia present.
Ileum : Arborization of vessels of mucous membrane.
Caecum : Arborization of vessels of mucous membrane.
Colon : Arborization of vessels of mucosa, parasitic nodules frequent in walls.
Kidneys : Dark red in colour, on section diffuse hyperaemia.

Sheep 1919.

Date. 1909.	Temperature Record. Morning. ° F.	Evening. ° F.	Remarks.
Feb. 23	100·0	101·4	
,, 24	100·0	101·0	
,, 25	100·6	101·0	
,, 26	100·0	103·0	
,, 27	101·6	104·6	
,, 28	100·0	100·4	
March 1	101·6	103·0	
,, 2	96·0	96·0	
,, 3	100·0	101·2	
,, 4	100·0	102·2	
,, 5	102·4	102·4	
,, 6	102·4	101·6	
,, 7	102·6	101·4	
,, 8	100·0	102·6	
,, 9	99·4	103·4	
,, 10	100·0	102·6	
,, 11	100·6	103·2	
,, 12	102·4	103·8	
,, 13	100·0	101·6	
,, 14	100·0	102·6	
,, 15	100·4	103·6	
,, 16	99·0	102·6	
,, 17	100·0	104·2	
,, 18	100·0	102·4	
,, 19	100·0	102·4	
,, 20	100·2	104·0	

Sheep 1919—(continued).

Date. 1909.	Temperature Record. Morning. °F.	Evening. °F.	Remarks.
March 21	100·0	103·0	
,, 22	100·0	103·6	
,, 23	100·0	103·0	
,, 24	101·6	103·6	
,, 25	100·0	103·6	
,, 26	101·0	101·4	
,, 27	101·0	102·6	
,, 28	100·0	100·0	
,, 29	100·0	100·0	
,, 30	98·0	103·0	
,, 31	99·6	102·8	
April 1	100·0	103·0	
,, 2	101·8	103·0	
,, 3	100·2	103·0	
,, 4	100·0	102·0	
,, 5	98·4	101·2	
,, 6	101·0	102·6	
,, 7	100·4	103·0	
,, 8	99·8	102·6	
,, 9	100·0	102·0	
,, 10	101·6	102·8	
,, 11	100·0	102·6	
,, 12	100·0	103·4	
,, 13	101·8	102·4	
,, 14	101·0	105·0	
,, 15	101·4	103·0	Blowing.
,, 16	99·0	102·2	
,, 17	100·0	102·0	
,, 18	99·2	99·6	Not feeding.
,, 19	101·2	103·4	Not feeding; respirations irregular; blood smear examined; result negative.

Sub-acute case.

Post-mortem on bastard ewe 1919.

Noticed sick: 11th May, 1909.

Died: 17th May, 1909.

Condition: Fair.

Mediastinum: Slightly gelatenous.

Peritoneal cavity: Contains a yellowish liquid.

Pericardium: Contains 10 c.c. clear yellowish liquid.

Lungs: In inspirium, pleura of right lobe is slightly folded, whole tissue is congested, strong hyperaemic and oedematous, anterior lobe and also right middle lobe emphysematous. Red prominent patch in right lobe. Trachea contains foam and hyperaemia of mucosa is present.

Bronchial lymphatic glands: Are hyperaemic.

Mediastinal glands: Are soft and present a slight anthracosis.

Heart : Left ventricle contains a blood coagulum, the right endocardium shows a few ecchymoses. Myocardium is slightly greyish and soft. The glands along the aorta are slightly swollen and prominent.
The right ventricle contains coagulated blood.
Liver : Weight, 1·7 lb. ; irregularly swollen, hyperaemic and of fine granular appearance. Lobuli distinct, surrounded by a hyperaemic zone. On section shows yellowish discolouration, friable, calcerous nodules. *Capsule glissoni* presents a few fibrous filaments.
Bile : Normal.
Spleen : 11 × 8 cm. Capsule, a few haemorrhages. Pulpa, slightly pale, follicles distinct.
Fourth stomach : Dark brown bloody contents and mucous deposit. Mucosa swollen, folds oedematous and diffuse hyperaemic. Contents very dry. An ulcus on pylora.
Reticulum and rumen : Normal.
Small intestines : Swollen, ramifications of blood vessels.
Caecum : Contents dark, mucosa swollen, rinkled and hyperaemic streaks, ramification of blood vessels.
Colon : Swollen, hyperaemic streaks.
Ileum : Mucous contents, mucosa slightly swollen, longitudinal streaks, nodules rare.
Jejunum : Slate colour in longitudinal streaks.
Mesenteric glands : Slightly swollen.
Kidneys : 400 grammes together, dark red colour, a few hyperaemic spots on section, cortex irregularly hyperaemic, also intermediary zone. Capsula easily detached.

Sub-acute case.

Post-mortem on bastard ewe 1962, 27th February, 1909.
In lamb.
Noticed sick on 22nd February, 1909.
Died : 27th February, 1909.
Condition : Good. No ticks found on body.
A considerable amount of fluid in pleural and peritoneal cavities.
Lungs : A few patches of consolidation in anterior and posterior lobes of both lungs. Red patches and spots on pleura pulmonalis of both lungs. Lungs on section hyperaemic and oedematous. Foam at bifurcation of trachea.
Right heart a blood coagulum, left heart ditto. The right endocardium is normal, also left.
Liver is pale yellowish in colour, enlarged. *Capsula glissoni* presents red patches extending into parenchyma.
Spleen : Normal.
Abomasus : Dark brown bloody contents.
Omasus : Normal
Rumen : Normal.
Duodenum : Hyperaemia of mucous membrane.
Jejunum : Hyperaemia of mucous membrane.
Ileum : Hyperaemia of mucous membrane.
Caecum : Hyperaemia of mucous membrane.
Colon : Hyperaemia of mucous membrane.
Kidneys : Dark red in colour, on section diffuse hyperaemic.

Sub-acute case.

Post-mortem on merino ewe 848, 1st March, 1909.
Noticed sick: 26th February, 1909.
Died: 1st March, 1909.
In lamb. Age: Six tooth. Condition: Good.
Pleural cavity contains a little clear straw coloured fluid.
Lungs: In inspirium; a few patches of consolidation, size of half-a crown. Lungs on section hyperaemia and oedema. Foam in trachea and bronchi.
Heart: Blood coagulum in both ventricles. Right and left endocard normal.
Liver: Pale yellowish in colour.
Spleen: Normal.
Abomasus: Erosions, size of a split pea on mucous membrane.
Omasus: Normal.
Rumen: Contains a small amount of ingesta.
Jejunum: At proximal end bloody fluid escapes on incision; mucosa hyperaemia, swollen, remainder of jejunum hyperaemic in transverse striae.
Duodenum: Hyperaemic, mucosa swollen.
Ileum: Mucosa hyperaemic.
Caecum: Bowel contracted, mucosa normal.
Colon: Bowel contracted, mucosa normal.
Kidney: Dark red in colour, on section hyperaemic.

Sub-acute case.

Post-mortem on bastard hamel 11, 20th March, 1909.
Noticed sick on 13th March, 1909.
Destroyed for *post-mortem* purposes, 20th March, 1909.
Age: Eight tooth. Condition good.
Pleural cavity about 150 c.c. of a straw coloured fluid.
Peritoneal cavity about 300 c.c. of a straw coloured fluid.
Pericard full of a straw coloured fluid.
Lungs: Normal.
Heart: Right heart contains a well-formed blood coagulum; left heart a small coagulum; right endocardium, normal; left endocardium, normal.
Liver: Swollen, on section firm, yellowish, stasis of bile. Stilesia hepatica present; gall bladder full of a golden coloured bile.
Spleen: Normal.
Abomasus: Mucosa normal.
Omasus: Mucosa normal.
Rumen: About one-third full of ingesta.
Caecum: Contracted, mucosa normal.
Colon: Contracted, mucosa normal, a few nemalodes (*Oesophogostoma columbianum*) present.
Ileum: Mucosa normal; contents mixed with bile.
Jejunum: Mucosa normal; contents mixed with bile. A few parasitic nodules in walls of bowels.
Kidneys: Normal.
Brain and meninges: Normal.

Sub-acute case.

Post-mortem on bastard ewe 1964, 21st March, 1909.
Noticed sick on 16th March, 1909.

Died on the afternoon of 21st March, 1909.
Age: Two tooth. Condition fair. Not in lamb.
Blood: Pale in colour; flows from jugular vein on section.
Pleural cavity contains a considerable amount of straw coloured fluid.
Pericardium contains an increase of fluid.
Peritoneal cavity contains a considerable amount of straw coloured fluid.
Lungs: In inspirium; middle lobe of right lung attached at dependent portion to chest wall, anterior lobe attached to chest wall at apex, on section slight hyperaemia and oedema of lungs. Two patches of consolidation posterior lobe of left lung.
Heart: Left ventricle contains a blood coagulum; left endocard, normal; right endocard, normal; right ventricle contains a blood coagulum.
Liver: Swollen. On section nutmeg appearance. Gall bladder contains dark green coloured bile.
Spleen: Normal.
Kidneys: Normal.
Abomasus: Ruptured; contains a little fluid ingesta mixed with mucus. A few strongyli present.
Omasus: Contents dry.
Reticulum: Empty.
Rumen: Contains a little ingesta.
Small intestines: MM normal; contents mixed with bile.
Caecum: MM normal; bowel contracted.
Colon: MM normal; contents mixed with bile.
Parasite nodules in walls of bowels.
Parasites fairly frequent in jejunum.