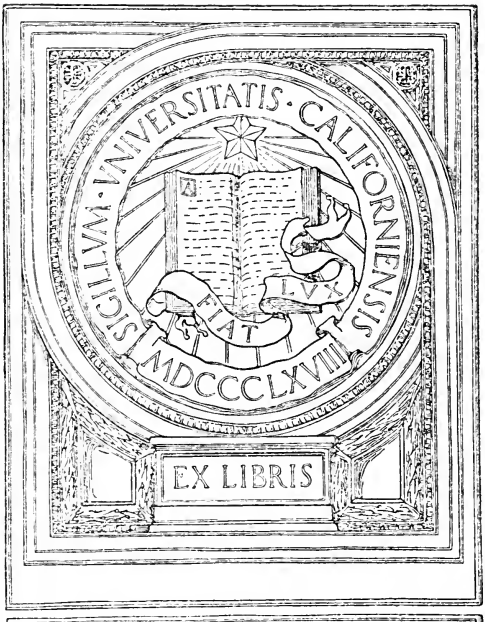
TEXAS FEVER

Its History, Cause & Treatment

Dr. R. A. Archibald


SIGILLVM · VNIVERSITATIS · CALIFORNIENSIS
FIAT LVX
MDCCCLXVIII
EX LIBRIS

TEXAS FEVER.

Its History, Cause and Treatment.

A Paper Read Before a Meeting of the California State Veterinary Medical Association, Dec. 13th, 1898, by Dr. R. A. Archibald, Oakland, Cal., Veterinarian to the State Board of Health; Member and Secretary of the State Veterinary Medical Board; Member and President of the California State Veterinary Medical Association; Member of the American Veterinary Medical Association; Bacterologist to the Oakland Board of Health, Etc.

A great variety of names have been given to this disease, such as Southern cattle fever, splenetic fever, Spanish cattle fever, Texas cattle fever, Carolina cattle distemper, bloody murrain, Mexican or Indian cattle disease, distemper, red water, haematuria, splenic fever, haemaglobinura, tick fever, acclimatization fever, etc. I am, however, presenting this disease under the name of Texas fever, not because Texas has anything more to do with the malady than some of the other Southern States, but because it is the name the disease is popularly known by.

History.—In the 16th, 17th and 18th century this country was colonized by two classes of people who brought their cattle with them. Those of you who are familiar with history will remember that the Spanish colonized the West Indies, Florida, Mexico, Texas, New Mexico and California, and the North European nations the thirteen colonies. The Spanish endeavored to push northward along the Atlantic Coast, or at least to hold the southern advance of the northern pioneers. Until the cattle of the Spanish began to mingle with those of the English, those of the latter prospered and multiplied, but after that northern cattle died from Texas fever and have continued to die in numbers proportional to the movement and number of cattle involved.

This occurred about the beginning of the eighteenth century. Carolina cattle were infected from Florida or Cuban cattle, Virginia cattle were infected by Carolina cattle and by cattle introduced by coastwise traders who traded between Cuba and other West Indian Islands and the Main.

As the Spanish cattle spread over Texas, and when the great markets of the north began to require meat, the Texas cattle were driven over trails northward and spread the disease along their route. The disease from these centers gradually spread unhindered by law or man, until it was checked by the laws of nature, which restricted the distribution of the disease.

The Spanish invader on the continent was responsible for many things, but could he have planned, as diligently as he did inquisition methods, to have left behind him a cattle plague, which would harass his foemen, he could scarcely have found a better means than by distributing this disease which time has proved to have been the greatest known curse to the stock industry of our southern States.

NATURE OF THE DISEASE.—Texas fever is directly due to the presence of a plasmodium, or more correctly speaking a haematozoa, an organism that lives within the red blood corpuscles and breaks them up and destroys them. It was discovered by Dr. Theobald Smith in 1889 who named it the "Pyrosoma Bigemium" on account of its pyroform outline and the fact that it often occurs in pairs within the corpuscle.

It may be well to state at this time that the germ of Texas fever is very distinct in its origin, mode of development and attack from the anthrax germ and has absolutely no connection with it, in spite of the misnomer of "splenic fever" occasionally given to Texas fever by those ignorant of its cause and dissemination. The germ of Texas fever is peculiar to the Southern States and cannot live outside of an animal in the Northern States, whereas the anthrax germ can be transplanted anywhere and can thrive on mountain peaks and marshy bottoms. The germ of Texas fever does not belong to the class of bacteria, but to the "protozoa." It is not a microscopic plant, as is the germ of anthrax, but belongs to the lowest forms of the animal kingdom. It kills by the direct destruction of the red blood corpuscles and not by the secretion of a poison. A correct appreciation of the difference between the two diseases is very important in regulating measures necessary for their prevention, especially as it has been claimed in the past by those ignorant of its true nature, that Texas fever was "anthracoid" in character.

The pyrosoma bigemium in Texas fever is represented by peculiar bodies in the red corpusles.

In fresh blood they are visible as round or oval bodies, nearly colorless from ½ to 2 microms (1-50,000 to 1-12,000 inch) in diameter on the disk of the red blood corpuscles, and are usually somewhat eccentrically placed. Careful focusing under the microscope leaves no doubt as to their being bodies within the corpuscles. They may occur singly or in pairs or very rarely three or four in the same corpuscle. When cover-glass preparations are dried, fixed and stained with the ordinary analine dyes, the intra-globular bodies stain as readily as nuclei and bacteria, and hold the stain with similar tenacity. The smallest forms then appear like deeply stained cocci about ½ to 1 micron (1-50,000 to 25,000 inch) in diameter, situated within the circle of the corpuscle. Occasionally the bodies are nearly two microns (1-12,000) inch in diameter and in these the staining may be less intense. Besides the spherical forms ovide forms are frequently observed. These usually occur in pairs within the red blood corpuscle. Still another, the pear shaped form, is encountered in stained preparations of the blood. These are rounded at one pole and pointed at the other and are described by some as being drawn out as a short filament. These forms invariably occur in pairs, a corpuscle being occupied by a single pair. Some investigators claim that the pair is the result of a division of the single body within the corpuscle. One other abnormal form has been described as being found in the blood and may well be mentioned. When dried cover-glass is stained with the usual analine dyes a few red blood corpuscles appear as if their surface had been dusted over with minute specks of coloring matter. Whether they are due to anaemia, improper staining, or whether they are connected with the life history of the parasite, remains to be determined experimently.

As to the relative number of parasites in the different parts of the body of the same animal, it may be stated that about 20 per cent of the red blood cor-

puscles in the blood of the superficial circulation containing the parasite in acute cases, while about 80 per cent of the corpuscles in the kidneys, spleen, liver and heart (right Ventricle) contains the intra-globular bodies.

This organism does not belong to the class of diseases producing organism known as bacteria but to the class known as micro-parasites or protozoa. So many people have got into the habit of classing this disease in the same category with anthrax, when the fact is that if we omit the ante mortem symptoms of the affected animal, no similarity whatever exists. This is a point that should receive careful notice as it is of the greatest importance when we come to the consideration of methods toward the eradication and control of these two diseases.

This organism multiplies with great rapidity in the blood causing an enormous destruction of red blood corpuscles in a few days. For instance, during health, there are about 5,500,000 red blood corpuscles in a cubic millimeter of blood, but in Texas fever actual count shows that the ravages of this organism reduces the number as low as 1,500,000 at which point the animal usually dies. Or to put it in another form, according to experimental determination by the U. S. Bureau of Animal Industry which consists in counting the number of corpuscles in a given quantity of blood from day to day in an animal affected with this disease in the acute form, shows that the corpuscles contained in from five to ten pounds of blood may be destroyed within 24 hours. The importance of this is apparent when we realize that in a steer weighing 1,000 pounds the blood in his body will probably amount to about 50 pounds. Reasoning from the above facts it is easy to understand the manner in which the symptoms and post-mortem lesions are produced and we can realize what a task is imposed on the excretory organs in disposing of the waste products due to the wholesale destruction of red blood corpuscles, the remains, as it were of the destroyed corpuscles and their coloring matter must either be converted into bile or execreted unchanged. The natural result of the effort to excrete this material by the liver is extensive disease of that organ.

The bile secreted by the liver contains so much solid debris that it occludes the bile capillaries, this in time interferes with the nutrition of the liver and fatty degeneration is the result, consequently, the physiological functions of the liver are suspended. The kidneys are the organs where the greatest number of corpuscles contain the parasite; as a consequence great destruction of corpuscles take place in these organs, hence the reason of the blood colored urine in these cases due to the hemoglobin of the destroyed blood corpuscles, this condition is so constant in cases of Texas fever that it may almost be considered as pathognomonic.

That the cause of Texas fever is the above mentioned red blood corpuscle estroying micro-organism, there can be no possible doubt as its presence in the blood of affected animals can be always demonstrated. The evidence in support of this statement may be briefly summarized as follows:

1st.—That microscopicol examinations show the constant presence of the micro-parasite in the red blood corpuscles of infectuous southern cattle.

2nd.—That microscopical examinations show the constant presence of the same micro parasite, but in greatly increased numbers in the blood corpuscles of northern cattle suffering from Texas fever.

3rd.—That microscopical examinations show the absence of the micro-parasite in the blood of healthy northern cattle.

4th.—That microscopical examination shows the absence notwithstanding the result of Billings investigations, in the blood of an animal affected with Texas fever, of other organisms when the examinations was made previous to death or very soon after.

5th.—It has been demonstrated that the intravenous injection of blood from infectious southern cattle into northern cattle resulted in the contraction of Texas fever by the latter. In these cases the presence of the micro-parasite was demonstrated by microscopic examination.

Maneer of Transmission. — In the year 1889–90 Dr. F. L. Kilborne demonstrated that the transmission of the pyrosoma bigemium from southern cattle to native northern cattle in natural outbreaks is effected by the Texas fever cattle tick (Boophilus Bovis) "Ox loving") and by this means only, and this claim is substantiated by the following experiments:

1st.—Northern cattle were exposed for several weeks to southern cattle, the latter being infested with ticks. Results:—The native northern cattle contracted Texas fever. Young ticks were found upon them. The pyrosoma, bigemium, upon microscopical examination was found in their blood.

2nd.—Northern cattle were exposed to southern cattle from which ticks had been removed, the ticks having been picked off by hand. Result:—Northern cattle showed no signs of fever.

3rd.—A pasture was infested with ticks taken from southern cattle, no southern cattle were admitted to the pastures Northern cattle were turned into the pasture. Result: Texas fever and death.

4th,—Young ticks hatched artificially from eggs laid by adult ticks picked from southern cattle were placed upon northern cattle. Result:—Texas fever and death. Pyrosoma bigemium demonstrated in the blood by microscopical examination.

5th.—Experiments were made showing the disease is not transmissible by means of the excretions of southern cattle.

The above experiments have on numerous occasions, been repeated and corroborated, by the Bureau of Animal Industry, Experimental stations of Texas, Arkansas, Missouri, Kansas and other southern states situated on and below the Federal quarantine line, seperating the infected from the non-infected district. Consequently, notwithstanding the skepticism of stockmen throughout the south we are absolutely bound to acknowledge the fact that the tick is the sole transmitter of the pyrosoma bigemium in natural outbreaks of Texas fever.

The Tick.—There are some people who still believe that the tick in itself is the cause of all the trouble and that the death of affected animals is due to the abstraction of blood by them. The falfacy of this idea appears when we realize that the ticks ordinarily found upon cattle dead or dying are still quite small and have scarcely begun to draw blood on a large scale. Moreover if such an idea had any foundation how can the fact be explained that there is such an extensive destruction of red blood corpuscles within the animal body, which is demonstrated by the presence of coloring matter in the urine, the thick bile and the presence of pigment in the kidneys and liver?

The cattle tick, Ixodes Bovis (Riley) or Boophilus Bovis as its name indicates is a parasite peculiar to cattle in the southern part of the United States, Mexico and the West Indian Islands. It belongs to the group of Artropode and to the genus Ixodes (Boophilus) which is included in the order of Acarina. Its life history is quite simple and easily traced from one generation to another. It is essentially a parasite, attaching itself to the skin and drawing the blood

of its host. It is unable to come to maturity and reproduce its kind unless it becomes attached to the skin of cattle or horses whence it may obtain nourishment.

The eggs laid on the ground after the female has dropped from the host begin to develop at once. When the embryo is fully formed within the shell it ruptures this and gains its freedom. The time required from the laying of the egg to the hatching varies considerably according to the temperature. In my laboratory where the eggs were placed with some moist earth and grass in a fruit jar on the top and outside of the incubator, at a temperature ranging from 70 to 80 degrees Fah., this was accomplished in 22 days. This was in the summer time. In the late fall under the same conditions it would undoubtedly take a much longer period. The larva after emerging from the egg is very minute, is six legged, and just visible to the naked eye. If the larvae be kept on moist earth in a covered jar they may remain alive for months, but there is no appreciable increase in size. As soon, however, as they are placed on cattle growth begins.

On pastures the parasite soon finds its way upon bovine animals. They attach themselves by preference to the tender skin of the escutcheon, the inside of the thighs and the base of the udder. Yet they may be found on different parts of the body, such as the neck, chest, ears, etc.

In about a week after the tick in its larval stage becomes attached to the skin of cattle, it goes through the process known as molting, and the second or nymphal stage of the parasite life commences. After this stage you will notice it has four pair of legs. In about another week molting takes place again, when the tick passes from the nymphal stage to the sexual or adult stage. Impregnation now takes place, and with the development of the ova in the body the parasite takes in an increased quantity of blood, so that it becomes very much larger in a few days, this applies more especially to the female tick. The rapid growth of the tick at this time is mainly due to the large quantity of blood it takes into its body. When the female has reached a certain stage of maturity it drops to the ground and deposits her eggs which in due time are hatched out and the above life history is repeated, provided conditions, climate, etc., are favorable.

Southern cattle sent North during the spring and early summer carry on their bodies large numbers of ticks. These, when matured drop off and lay eggs on northern pastures. These hatch and the young ticks soon get upon northern cattle which happen to be in the pasture, and attach themselves to the skin when they inoculate the cattle with the pyrosoma bigemium and fever breaks out in from one to three weeks thereafter. When the weather is cool as in the autumn this period may be a little longer.

When northern cattle graze upon pastures over which southern cattle have passed, the time when the disease appears depends upon circumstances. When northern cattle are put upon pastures immediately after southern cattle have infected them with ticks, it may be from thirty to sixty days or even longer, before the disease appears. This will be readily understood when we recall the life history of the tick. The southern cattle leave only matured ticks which have dropped from them. These must lay their eggs and the latter be hatched out before any ticks can get upon the northern cattle.

If on the other hand northern cattle are placed upon pastures which have been infected some time before with ticks, the disease will appear much

sooner, for the reason that young ticks may be already hatched and attack the cattle at once, in such an event the disease may appear in 10 or 12 days. It will be easily seen therefore that the length of time elapsing between the exposure of northern cattle on infected fields and the appearance of the disease will depend entirely upon the date of original infection and on climatic conditions.

The fever always appears before the ticks have matured. In fact they are still small enough to be overlooked by a casual observer. After the acute stage of the disease has passed the ticks begin to swell up and show very plainly.

SYMPTOMS, ANTE-MORTEM AND POST-MORTEM.—The ears of the animal droop, its movements become sluggish, and secretions retarded, especially in milch cows, appetite at first continues as well as rumination, disposition to lie down soon makes itself apparent, and wherever pools exist the sick animal seeks them out to lie in.

A slight cough is sometimes noticed, depression of the head, drooping ears, arched back hollow flanks, with a tendency to draw the hind leg under the body, and knuckling over in the hind fetlocks, are early and very marked Phenomena. The skin seems dry and attached, the foeces are not materially affected but in some cases clots of blood are attached to them. The urine is at first clear but later becomes deeply stained with the cololring matter of the blood. The visible mucous membranes are semewhat anaemic, but a hyperaemic condition may sometimes be observed, accompanied by a viscid discharge. The mucous membrane of the rectum is frequently injected. The pulse is frequent, in the early stages hard and thin, it gradually becomes more feeble, and in the later stages, as death approaches, it is impossible to feel it. It varies from sixty to one hundred and twenty beats in frequency.

The thermometer is a valuable aid in the diagnosis. The temperature is the highest at the commencement, but becomes reduced with the approach of death. The temperature of the external parts varies, frequently the poll, ears and extremities are very hot in the active stage of the disease at other time, they are cold, particularly the posterior extremities.

The respirations frequently rise as high as 100 per minute, but in the comatosed condition they are slow, deep and labored.

The nervous phenomena are very marked, trembling of the muscles of the posterior parts is very frequent, as well as of the neck. Weakness of the limbs, particularly the posterior is very common, so that many animals are unable to rise, or if they get up, walk with a feeble and tottering gait. Listlessness indicates the approach of the end.

The state of the secretions is usually indicative of the course of the diseases perspiration is much restricted, oedema of the cutis is quite frequently met with. The urine contains albumen in large quantities when haematuria is present. In the case of milch cows the milk secretion is almost if not entirely suspended.

In most cases the depression increases, the pulse becomes more feeble and accelerated, respiration is labored and the temperature falls to 100 or 98 Fah., and the patient becomes outstretched upon the ground and dies without a struggle.

The course of the disease is very variable in duration. Death may ensue in from three days to several weeks after the beginning of the fever. Those that recover ultimately, do so very slowly, owing to the great poverty of the blood in red blood corpuscles, The flesh is regained very gradually, and the animal may be subjected to a second, though

light attack later on in the autumn, which pushes the full recovery onward to the beginning of winter.

In the mild type of the disease which occurs in October and November, symptoms of the disease are well nigh absent. There is little if any fever, and if it were not for the loss of flesh and more or less dullness, the disease might pass unnoticed, as it undoubtedly does in the majority of cases. If, however, the blood corpuscles are counted from time to tin e a gradual diminishing number will be found and after several weeks only about one-fifth or one-sixth of the normal number are present.

Post-Mortem Lesions. — The first thing noticed when the skin is cut through, is the absence of blood in the superficial blood vessels. When the abdominal cavity is laid open, the first thing to attract attention is the uniformly enlarged spleen which weighs from 2 o 10 pounds, its pulp is soft and degenerated, when it is incised its contents are found to be pulpy and blackish, and may even ooze out as a disintegrated mass. The markings of the healthy spleen are all effaced by an enormous number of blood corpusclas which have collected in that organ and to which the enlargement is due.

The liver is larger than in the healthy state, and has on its surface a pale yellowish hue, when it is incised the yellowish tinge is still more prominent. This is due to the large amount of bile in the bile ducts, which produces in most cases degeneration of the liver cells, which makes the organ lighter in color.

The gall bladder is usually found distended and filled with a viscid fluid.

The urinary bladder, invariably, in acute cases contains urine which varies in colors from a deep port wine to a light claret. The kidneys are always found congested in the acute attack.

The lung, stomach and intestines are as a rule not diseased. The heart usually shows patches of blood extravasation on the inside, usually in the left ventricle, and sometimes, but less marked on the outside suface.

Treatment.—With regard to the curative treatment of Texas fever very little need be said, as so far no successful remedies has been discovered, but should any one desire to apply treatment I should recommend large doses of qunine and stimulants.

Preventitive treatment, however, is of the utmost importance and is easily considered. When we recall what has been said with regard to the cause of the disease, viz.: That the boophilus bovi or cattle tick is the only medium through which the pyrosoma bigemium can be transmitted, the methods towards the prevention of this disease are easily determined. Kill the tick and no further trouble will be experienced.

In the first place cattle infested with ticks should be dipped in an oily solution, as the oil is much more effective than chemicals, and in the second place disinfect the pastures. This is much more difficult than destroying the ticks on cattle. The following suggestions, however, may be tried with a reasonable hope of success, but of course only applies to localities that are permanently affected with the tick. That is to say localities in which it does not get cold enough in the winter time to destroy the tick.

Place no cattle on infested pastures. Let the grass grow until of sufficient length, when it may be mowed and when dead and dry enough may be burned. Let the burning take place when the ground is thoroughly dry, so that everything, including the old manure and decayed vegetable matter may be consumed. This, if properly done

should destroy all the ticks, but if not, the ground being rendered bare and every portion exposed, the freeze during the succeeding winter should complete the work. However, as an additional precaution against future loss we would suggest the cultivation of the land for a year or two. It might be sowed to oats or in some small grain that would leave a stubble that could be burned in the fall, thus leaving the ground bare each winter after cultivation.

When the pasture is an enclosure of woodland, or ground unsuitable for cultivation, or cannot be clipped with the mower, all that can be done is to encourage a vigorous growth and burn the first opportunity after it is killed by frosts. The leaves from the timber and the grass that will grow on the spots where the timber is thin will generally be sufficient to give the desired heat if a suitable time is selected for the work. On spots so bare they will not afford rubbish sufficient for burning, the hard freeze that may be expected through the winter will in all probability accomplish the desire end.

Lots and corrals that do not produce sufficient growth for burning may be sprayed with a mixture of kerosene and five per cent naphtha, or ten per cent of gasoline. The spraying should be sufficient to moisten all rubbish and care should be taken to get it well distributed over all the ground. Immediately after spraying apply the match, taking care to be so situated that you can readily step out of the way of the flames, as this solution will burn very rapidly. Buildings and fences should be looked after and such action taken before applying the solution as will protect them from the conflagration, as you will have but little opportunity to make such arrangements atter the fire is once started.

Opened or enclosed grazing lands may be disinfected by the free use of fire. If the farmers and stockmen in an infected vicinity would unite in the work and prepare for the protection of their buildings and fences, large areas could be burned over with a fair prospect of success by the heat occasioned by the burning, or by the action of the frost on the exposed surface.

The importance of disinfecting these areas cannot be estimated. If no steps are taken to eradicate these parasites when they are found, some of our territory not already infected will become so, carrying with it not only severe loss by death of animals, but a material reduction in prices when placed on the market.

In conclusion, permit me to say that citizens should, in the interests of the cattle industry in the State of California, promptly report all cases of suspected Texas fever and then unite with the State Board of Health in prompt and energetic measures for its control and eradication.

As mentioned elsewhere in this paper, a host is necessary for the propagation of the tick, and as ticks do not travel far, the quarantining of infested grounds would probably disinfect the ground after a winter, but the burning measure recommended should not be neglected when it is practicable.

If horses and cattle are kept off the infested pastures the tick will finally die, as one of these hosts is necessary to the propagation of these parasites. The mating of the male and female must take place on the host.