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NECROBACILLOSIS

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NECROBACILLOSIS

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Few realize the rapid progress that is being made in reducing the loss of livestock from disease. The year-book of the Department of Agriculture for 1922 states that the annual loss of horses from disease has been reduced from 22.3 per thousand in 1895 to 16 in a thousand in 1922. This means that 150,000 fewer horses and mules die from disease in the United States in a year now than thirty years ago. The loss of hogs from disease and parasites makes even a better showing. In 1895 there was a loss of 92.3 hogs out of every thousand from disease, while in 1922 this loss was 54.4 a thousand. This means a saving of two and one-fourth million hogs a year and is attributed in a large measure to the use of anti-hog-cholera serum.

Not all of this saving is due directly to the ministrations of the veterinarian for stockmen generally have acquired much knowledge of the proper care of animals in the prevention of disease. This knowledge has been disseminated in a large measure through the medium of the public press.

There is possibly no other disease about which there has been so much inquiry by farmers and stockmen of Colorado as *necrobacillosis*. The aggregate loss has possibly been greater than that from any other one disease, not excepting hog cholera.

In many sections of our State, no veterinarians upon whom stockmen can depend for advice are as yet available, and it is hoped that this bulletin may in a measure serve as an aid to those interested. The purpose of the bulletin is to give a practical summary of knowledge extant on the subject at this time, and to this end discussion of purely scientific phases of the subject will not be attempted.

DEFINITION AND HISTORY

Necrobacillosis is a generic term that applies to a group of diseased conditions caused by the specific germ, *Actinomyces necrophorus*, (*Bacillus necrophorus*). It affects practically all species of domesticated animals, but is more common to hogs and sheep. When affecting the mouth it is called *necrotic stomatitis*; in the intestinal tract, *necrotic enteritis*; in the throats of calves, *calf diphtheria*; in the nasal chamber of hogs, *snuffles or bull-nose*. When affecting the feet it is known as *contagious foot-rot*, and in the skin, *necrotic dermatitis*. One

form common to sheep is *lip and leg ulceration*. It may affect any tissue of the body and is named according to the organ especially involved. The disease is well distributed over Colorado and has been known for many years. The heaviest loss seems to have occurred in the San Luis Valley. The aggregate losses are heavy because it affects so many species of animals and at all seasons of the year.

ETIOLOGY

The cause of the disease in all of its different manifestations is the specific germ, *Bacillus necrophorus*, of Bang. It is usually spoken of as the necrosis germ. To grow a crop of oats it is necessary to plant oat seed in a fertile soil; so here the one special germ must be implanted in the tissues under favorable conditions or there will be no disease. The micro-organism appears in different forms, (pleomorphic) under varied conditions, but it usually occurs in long threads both in laboratory cultures and in the invaded tissues. The threads contain granules particularly in old cultures. The bacillus is non-motile and does not form spores. When grown on laboratory media, air must be absolutely excluded. A pungent characteristic odor is emitted from the cultures and may be recognized in the lesions.

Unlike the specific germs of most diseases, the *B. necrophorus* is universally distributed and it appears that the intestinal tract of swine may be its natural habitat. In the intestinal tract it ordinarily causes no recognizable disturbance of health of the host, but thru either increased virulency of the organism or lowered resistance of the tissues it may become pathogenic. In such cases the pens, floors, yards, all surroundings, may become contaminated. In this way infection is usually indirect, but may be transmitted by contact as for example, a nursing pig infecting the udder of its mother. Indirectly infection may take place thru the medium of contaminated food or drink, thru inhaled particles of dust, thru abrasions of the skin, or even by copulation.

While the *B. necrophorus* causes disease in practically all animals, yet in most cases it is secondary, the resistance of the tissues having been lowered by previous disease such as an injury. The necrosis germ does not seem able to attack normal, healthy membranes. There is great weakness, followed by general emaciation, and this is noticeable even with primary mild infections. A few of the most common forms of *necrobacillosis* will be mentioned briefly, followed by a general outline of measures that might be adopted in the prevention and treatment in each instance.

NECROTIC STOMATITIS

The disease in this form is also mentioned as "canker", "sore mouth," and "ulcerative stomatitis." *Necrotic stomatitis* is the most serious form of inflammation of the mouth and is confined largely to pigs and calves. Pigs from a few days up to four months old are most affected. It occurs particularly in pigs that are farrowed in the fall, where the yards are muddy, and where they come in contact with harsh foods of any kind. The inflammation is most liable to start at the margin of the gums and may spread to the cheeks, tongue, and upper respiratory passages, or as a result of swallowing, the intestinal tract may become involved. Two or three days after the inflammation has started yellowish white or brown croupous-diphtheretic membranes form with deep seated ulcers beneath. It is attended by a general toxemia which causes extreme weakness from the beginning and leads to death within a few days. With calves, the first symptoms noticed are languor, disinclination to suck, drooling from the mouth and swelling of the cheeks. Little pigs show extreme emaciation and weakness and examination of the mouth will reveal the presence of one or more angry-looking deep-seated ulcers. Occasionally in a diseased herd a sick pig will be found without mouth lesions but on post mortem the characteristic ulcers will be found in the stomach, intestines, or elsewhere in the body. The disease frequently involves the nasal cavities and in the lungs may cause necrotic pneumonia.

Animals affected with *necrotic stomatitis*, unless treated early, will surely die. This disease must be treated on the same general principles as any other contagious or infectious disease. All of the calves or pigs should be examined and those that reveal no mouth lesions should be removed to clean quarters and kept under close observations thereafter. When ulcers or eroded areas are found they should be scraped with a dull instrument and treated with a one or two percent solution of silver nitrate, or a three to five percent solution of zinc chloride. The mouth should be irrigated frequently with a strong disinfectant solution. For this purpose probably nothing will be more satisfactory than a solution of potassium permanganate, one ounce to the gallon of water. A three or four percent boracic acid solution is an old, reliable remedy. In some cases caustics may be used to advantage. For this purpose lunar caustic is preferable. Hold the stick of caustic with pincers, or rolled in paper, dip the end of the stick in water and thoroughly rub over the surface of the ulcer.

Pigs that are badly diseased should be destroyed at once since there is no hope of recovery. After the sick pigs have been destroyed, and the mild cases treated, the others should be dipped and placed immediately in new, clean pens. For dipping, a half

barrel or tub will suffice. Potassium permanganate solution (.5 to 1 oz. to one gallon of water), or a four percent solution of one of the coal-tar disinfectants will be satisfactory and reasonably cheap. The pigs should be completely submerged with the head down.

CALF DIPHTHERIA

Calf diphtheria is differentiated from *necrotic stomatitis* on the grounds that it is essentially a calf disease and further that the lesions are confined more to the throat. It must not be confused with human diphtheria, between which there is no reciprocal relation and no similarity save in the formation of diphtheretic membranes. The symptoms, lesions, and treatment when possible, are practically the same as with *necrotic stomatitis*.

The importance of this disease should be stressed among farmers and stockmen. It attacks mostly young calves and very few survive. It commences on about the fifth day after infection, with marked weakness, diminished appetite, and a slight fever. A day or two later the calf refuses to eat, drools from the mouth, and the cheeks are swollen. An examination of the mouth and throat will reveal the presence of yellowish deposits and a ragged surface. Occasionally the lesions are confined largely to the larynx, and there will be difficult respiration, without mouth complications. Sometimes the nostrils are filled with a yellowish exudate and the respiration appears snuffling. It is a matter of common observation that where there is not a maximum of effort in curing the sick calves there is sure to be a minimum of effort in suppressing the infection. In other words, nothing is ordinarily done but treat the individual cases as fast as they appear. This is futile, for they nearly all die in from three to ten days, after showing the first symptoms.

The appearance of calf diphtheria must be managed on the same general principles as human diphtheria or any other highly contagious or infectious disease. Healthy calves should be immediately removed to clean quarters. Pregnant cows should be taken to clean quarters and kept there until their calves are at least three weeks old. The infected quarters should be thoroughly cleaned and disinfected.

From the standpoint of health a three-year rotation of animal quarters is of supreme importance. Where animals occupy the same quarters for a number of years they invariably become unhealthy. Unless the pens and yards are kept scrupulously clean they, after a time, become infested with parasites and germs of many diseases, making it practically impossible to keep them healthy.

LIP-AND-LEG ULCERATION OF SHEEP

Lip-and-leg ulceration of sheep is a form of *neurobacillosis* in which, as the name indicates, the lips and legs are most conspicuously involved.*

It has on occasion assumed a malignant form in Montana and Wyoming, causing considerable loss through deaths, abortion in ewes, and lost service of bucks. This disease is carried to Colorado with the importation of lambs every fall but fortunately under the conditions which exist the losses have never been very heavy. It is presumed that the specific germ, *B. necrophorus*, enters the skin lesions caused by cacti and other mechanically injurious plants.



Showing necrotic ulcers on the legs.

The first thing noticed in acute inflammation of the lips and quite commonly the skin on the legs about the coronet and fetlock joint. Pustules form, which soon erupt and, drying, form dark, gray-colored scabs. Ulcers form beneath the scabs that continually grow larger, manifesting little tendency to heal.

Each fall when lambs are shipped in for winter feeding a few flocks develop a scabby-lip condition soon after being placed in the feed lots. Most of these cases recover after a week or two but occasionally a few of them will develop deep-seated ulcers characteristic of the disease in question. The primary infection is no doubt induced by the change to harsh feed, and the scabby-lip condition which results is favorable to development of the secondary infection in a proportionate

*This should not be confused with Foot and Mouth Disease, which is foreign to the disease under consideration.

number of instances. Since the necrosis germ does not thrive in the presence of air it would seem best to soften and remove the scabs in so far as this can be accomplished without serious injury to the underlying tissue. The ulcers should then be cleaned with a dull instrument, being careful to remove all dead tissue. Next, lunar caustic should be used to disinfect the ulcer as outlined under the discussion of *Necrotic stomatitis*. The ulcers should be dressed daily thereafter. Healthy sheep should not be permitted to pasture on infected ranges for at least one year. Obviously under range conditions this precaution cannot always be observed, but when feasible it is a wise precaution against spread of the disease.



Showing *Necrobacillosis* of the Head

NECROTIC DERMATITIS

This is a form of *necrobacillosis* where the skin is essentially involved. It is more often seen in young pigs, the bacillus probably gaining entrance into the skin through abrasions caused by fighting. There are usually rather large necrotic areas, (see illustration herewith) which slough, causing irregular surfaces denuded of skin. Where the lesions become extensive there are grave systemic disturbances occasioned by absorption of poisonous products. These cases are hopeless, unless when the lesions are small the necrotic area can be entirely cut away, and appropriate treatment applied immediately and persistently. The treat-

ment as outlined above is appropriate in these cases. Pigs that are badly affected should be destroyed and the carcasses burned to insure safety against spreading the infection. The disease may appear in the form of large, hard tumors about the head, on the udder, or elsewhere on the body. These tumors develop very slowly, showing no tendency to suppurate, but finally degenerate in the center, and if the pig survives long enough, will form into large, open, necrotic areas.

Necrobacillosis attacking the skin of horses and mules sometimes takes on an extremely malignant form that is hard to combat. During the war great losses occurred at the various army camps throughout the country. At one camp alone it is reported that 80 percent of deaths during the two months of July and August were due to *Bacillus necrophorus*. In horses and mules, more especially, the disease is sometimes spoken of as *gangrenous dermatitis*. It follows more often as a complication of "scratches," which is an eczematous inflammation in the region of the heel and fetlock. The exudate, combined, with dirt, dries into scabs which make the conditions ideal for the necrosis germ.

Nolecheck, of the U. S. Army, gives an outline of treatment for these cases which appears to have been highly satisfactory, and is as follows:

"*B. necrophorus*. being an anaerobe, each form must be treated with one object in view:—Expose the organism to the air. This is easily accomplished with the knife. In *gangrenous dermatitis* remove all necrotic tissue and a part of the healthy structure, cutting away ragged edges of skin around the necrosed area. After the necrotic tissue is removed, apply bichloride pack, 1-500, leave pack 24 hours, remove and apply the following: Camphora pulv., liquor cresolis compositus, and phenol,—of each, 3 ounces; tincture of iodine, q. s., 1 quart. Apply with swab twice daily. If part becomes filthy, wash before applying. Bandaging at this time is contra-indicated."**

NECROTIC ENTERITIS

It appears that inflammation of the intestinal tract attended with destruction of mucosa may be caused by a variety of microorganisms. Among these, in addition to the *B. necrophorus*, are various representatives of the para-typhoid group,—*B. suispestifer*, and the Gartner colon group.* *Necrotic enteritis* is of common occurrence, among pigs in Colorado. The indications are that there has been relatively a greater loss in Colorado from this disease than in any other state. It has existed in the San Luis Valley for many years and has constituted the most serious menace to the hog-raising industry.

**For open skin lesions powdered sodium perborate is highly recommended. The powder is applied in the form of a pack, being kept in place by means of a bandage.

Of course it is apparent that the services of a veterinarian are indispensable in treating these cases.

*The significance of certain animal parasites (protozoa) found with great frequency in the ulcers has yet to be determined. These organisms, namely,—"*Trichomonas suis*" and "*Balantidium coli*", appear with great constancy and the diarrhea is characteristic of an amebic infection.

There is a dearth of accurate data respecting the specific nature of *necrotic enteritis* in hogs. The fact that it is so frequently associated with *necrotic stomatitis*, "bull-nose," and necrosis of the skin makes it appear likely that it is in many instances at least, true *necrobacillosis*. However, the disease has a tendency to adhere strictly to the form in which it first made its appearance in the herd. If it starts in the form of contagious foot-rot in sheep it continues to appear in that form and there will be no cases of *necrotic stomatitis*, "bull-nose" or *enteritis*. The exception to this rule is the frequent occurrence of *necrotic enteritis* and *necrotic gastritis* following infection in the mouth or throat.

The first indications are diarrhea and unthriftiness. If the mouths are examined at this time there will frequently be found one or more ulcers, or by passing the hand downwards over the sheath with a firm pressure an exude may be squeezed out of the preputial opening. The disease may assume a chronic form or complications may arise at any time, such as "thumps," or pneumonia, causing death. The infection usually spreads rather slowly, attacking first pigs from a few days old up to six weeks, until finally the whole herd appears unthrifty and many die.

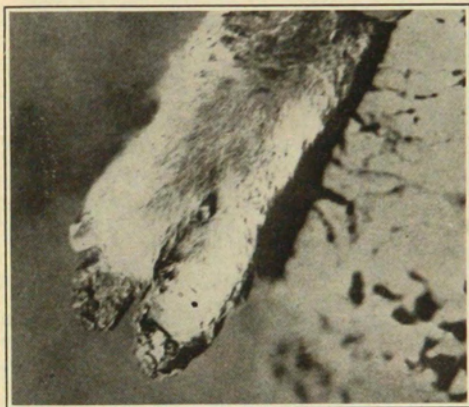
Treatment would consist in separating the well animals from the sick ones. Badly diseased animals should be destroyed and their carcasses burned. Give strict attention to improving sanitary conditions. Unaffected pigs should be removed to clean pasture and the more range they have the better. Solid foods, such as corn, and other concentrates should be withheld for at least three weeks. Semi-solid buttermilk when available is considered the most appropriate food, since the lactic acid which it contains has an inhibiting effect upon the specific germs of infection. Among intestinal disinfectants copper sulphate has preference. Dissolve one pound of copper sulphate in a gallon of water and give this solution in the slop at the rate of one ounce to every 300 pounds live weight of animal, twice daily. Air-slacked lime has been recommended. To this end a bucket of quick lime may be dissolved in a tub of water and a quart of the solution mixed with the slop at each feeding. Fowler's solution of arsenic is to be considered because of its alterative, tonic, and antiseptic properties. A half teaspoonful for each little pig mixed with slop once a day will be appropriate. A veterinarian should be consulted respecting the use of bacterins.*

*Recent laboratory experiments seem to indicate that tincture of iodine as a disinfectant in drinking water ranks very high, and considering the fact that it is quite inexpensive, it might be considered in this connection. Fifteen drops to one quart of water will be strong enough.

CONTAGIOUS FOOT-ROT

All farm animals are subject to foot-rot, possibly sheep more than the others. It is usually associated with dirt and barn-yard filth. Mud sometimes dries between the claws to the consistency of a brick, which causes an abrasion, and this paves the way for necrophorus infection. Most outbreaks are infectious. After the lameness has become severe there is a slight discharge, with very offensive odor, and the hoof becomes rotten, usually in one spot which soon spreads to the deeper

structures. After a fortnight the claws begin to separate, the animal is unthrifty and in great pain; the claws may slough, and the animal be unable to stand if more than one foot is affected. Cases of lameness in the feed-lots should not be neglected,—employ a veterinarian if possible. Clean the foot and pare away all dead tissue. Apply a two percent solution of silver



Showing characteristics of foot-rot.

nitrate or a five percent solution of zinc chlorid. Pine tar might then be applied, and bandages placed in such a way as to not only protect the foot from dirt but to keep the claws from spreading. Keep the animal on clean, dry ground.

Sometimes it becomes necessary to treat a whole flock and special attention to individuals can not be accomplished. In such cases the sheep may be made to stand for five minutes in a pan containing an antiseptic solution. The solution should be deep enough to cover the feet. A solution made by dissolving one pound of copper sulphate in a gallon of water may be used, or dissolve one pound of fresh chlorid of lime in three gallons of water. This treatment should be repeated and continued as long as necessary. Separate the diseased animals from the herd and place them in a clean pasture.

An easier treatment, but probably not so effective, is to drive the flock over a large platform, (cleats may be placed around the edges) on which has been placed air-slacked lime several inches deep. Foot-rot in cattle and other farm animals should be treated on the same general principles, as outlined above for sheep.

NODULAR NECROSIS OF THE LIVER

Nodular necrosis is of common occurrence in cattle and is characterized by dry nodules in the liver substances which gradually undergoes a process of softening. Cases in sheep are rare and in other animals quite exceptional. It is presumed that in most cases the *bacillus necrophorus* reaches the liver through the portal blood stream from the intestine. Detection of the disease in life is practically impossible, and internal treatment is useless.

OTHER FORMS OF NECROBACILLOSIS

Ano-vulvitis is a form of the disease in question which affects the external genital organs of females. Starting, as it usually does, on the lips of the vulva, it may extend to the *anal mucosa* or the vagina. Several outbreaks of the disease in male animals have been reported where it assumed enzootic proportions. In one instance 125 steers in a feedlot were all affected. In male pigs it occurs as often in Colorado as in any other form of *necrobacillosis*. Both wethers and bucks are subject to it and usually with fatal termination. The first thing usually noticed is a scabby condition of the prepuce at the junction of the skin and mucous membrane. The infection may extend upward inside the sheath, in which case the penis is sure to become involved. Exudative material and urine may become imprisoned in the sheath because of the partial occlusion of the preputial opening. In an outbreak of the disease in cattle, in northwestern Missouri, Dr. A. T. Kinsley reported the use of the following treatment, which though simple was quite effective:—

“The lesions and surrounding structures were thoroughly cleansed with a three percent solution of liquor *cresolis compositus*, then the scab was detached and the necrotic tissue removed by means of a brush, curved scissors or curette. After the cleansing and the removal of the scab a small swab was used in cleansing the sheath of steers. The lesions on some of the animals were painted with an oleoginous mixture, composed of linseed oil three parts, turpentine one part, and on others, tincture of iodine was used. The treatment was repeated on the second day and again on the fifth day”.