1-1905

Texas Fever Cattle Tick: Pasture Methods of Eradication

University of Tennessee Agricultural Experiment Station

H.A. Morgan

BULLETIN

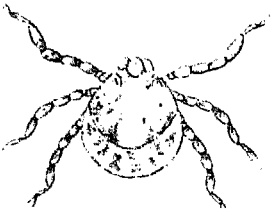
OF THE

Agricultural Experiment Station

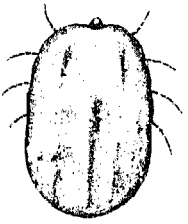
OF THE

UNIVERSITY OF TENNESSEE

Egg



Seed tick



Engorged female

VOL. XVIII JANUARY 1905 No. 1

TEXAS FEVER CATTLE TICK: PASTURE METHODS OF ERADICATION

BY

H. A. MORGAN

KNOXVILLE, TENNESSEE

THE AGRICULTURAL EXPERIMENT STATION

OF THE UNIVERSITY OF TENNESSEE

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TEXAS FEVER CATTLE TICK: PASTURE METHODS OF ERADICATION

INTRODUCTION

While the writer was entomologist of the Experiment Stations of Louisiana he began a series of investigations on the life history and development of the North American Texas fever cattle tick, with the view of procuring data on the incubation and development of this species during each month in the year. Laboratory and field tests were made in connection with incubation; the parasitic periods of development were tested on herds and individual animals. During the course of the experiments the remedies given in this bulletin were suggested, and afterwards these remedies were put into practical operation.

The results of this work have been condensed for bulletin publication for the Experiment Stations of Louisiana. Through the courtesy of Prof. W. R. Dodson, Director of the Louisiana Stations, we have been given permission to publish this bulletin contemporaneously with its issue from the Louisiana Stations. The results are applicable not only to Louisiana, but to Tennessee and every state or part of a state lying south of the quarantine line. We therefore wish to express to the Louisiana agricultural authorities our appreciation of the privilege extended.

THE NORTH AMERICAN TEXAS FEVER CATTLE TICK SITUATION

In general

Outside of the immediate Gulf Coast region, which is menaced by the prevalence of charbon (anthrax), horse flies, and mosquitoes, there is no serious obstacle to profitable beef and dairy production in the South other than the North American Texas fever cattle tick (*Boophilus annulatus*). This fever-conveying parasite of cattle has effectually discouraged and suppressed attempts to develop generally the beef and dairy industries of the tick-infested areas. It has been a millstone about the necks of those who have engaged in the cattle business, and is in a great measure responsible for the reluctance with which many farmers accept the gospel of diversification. This tick inflicts a double tax upon cattle. Aside from being the conveyer of the death-producing and life-sapping germ of Texas fever, its habits and development are such that upon permanent pasture areas ticks become so enormously abundant as to check the growth, maturity, and beef and dairy possibilities of the animals which they infest. These combined effects make the cattle business hazardous, and have forced many farmers to abandon cattle raising in the face of the fact that the Bermuda, *Paspalum*, and *Lespedeza* pastures of the area involved are not excelled for grazing purposes even by the blue-grass and other famous pasture regions above the quarantine line.

Immunity and blood inoculation

Great relief was felt a few years ago when some of the experiment stations of this country worked out, to a practical degree, at least, a way of successfully immunizing by blood inoculation cattle susceptible to Texas fever. This achievement brought fresh courage to the farmers of the tick-infested area, especially to those who have realized what it would mean for the agricultural interests of the South to have some form of cattle raising an integral part of every well organized farm. With inoculation, the pendulum of confidence swung too far the other way; not because of any lack of merit in the plan of immunization, but because persons unfamiliar with the complications of the whole tick situation made investments confident that the fever phase of the question was the main one and that blood inoculation solved it. Recent experiences prove that the fever germ becomes more virulent if perpetuated in ticks bred upon recently immunized or partially susceptible animals, and that the so-called native animals, usually accepted as naturally immunized, when reduced in flesh, from intense infestation of ticks of the virulent type, or from other causes, show more or less distinct symptoms of Texas fever. These facts, coupled with the one that an immunized mother transmits little if any immunity to her offspring, multiply the complexity of the problems. Blood inoculation has given very satisfactory insurance against the death of imported non-immune animals, but it does not insure the feeder against the failure of his animals to make profitable gains when he attempts to utilize the pasturage resources of his holdings alone or in connection with supplemental concentrates, the by-products of some of the South's staple crops.

National quarantine

Through the efficient efforts of the United States Department of Agriculture, Bureau of Animal Industry, and the States bordering the northern tick boundary, working in cooperation with the Bureau of Animal Industry, the spread of the tick has been limited and the area infested considerably reduced. A vigorous quarantine has been inaugurated and maintained, and during the major part of the year no animals are allowed to pass from below the quarantine line except for the purpose of immediate slaughter. The necessity for quarantine restrictions no one questions; and the annual saving to the country by the protection they maintain is difficult to estimate, but the embargo peculiarly emphasizes the magnitude of the tick problems and the demand for a practical remedy. The Southern breeder naturally asks the question if the time will not come when animals other than those for immediate slaughter will be in demand north of the quarantine line, and if the prize ring of the national beef and dairy shows is always to remain closed to the products of his breeding and feeding skill. If this be so, the problem warrants an earnest effort on the part of every farmer living in the infested area to eradicate the fever tick from this country. Extermination is not impossible, but it can not be accomplished without careful study and intelligent cooperation.

Summary—I Experiments conducted in this and other states suggest the following conclusions upon the fever side of the cattle tick situation:

1 The cattle tick (*Boophilus annulatus*) is the *only* species in the United States capable of conveying the Texas fever germ from one animal to another (cattle).

2 The degree of virulence of the fever germ transmitted by individual ticks depends to a very great extent upon the susceptibility of the animals upon which the immediate progenitors of these ticks were developed. Hence an animal recently immunized by blood inoculation will suffer less from tick fever if pastured with a number of native cattle than if permitted to collect seed ticks, the immediate offspring of those developed upon this inoculated animal. The offspring of cattle ticks developed a few generations on horses and mules, in the blood of which the germ becomes innocuous, are non-transmitters of fever. These conditions, together with incorrect identifications, account for the belief of some stock owners that ticks do not transmit Texas fever.

3 It is possible to give a marked degree of immunity by hypodermic injections of fresh or defibrinated blood (1-5 c. c.) from a non-susceptible tick-infested animal, or by gradual and limited artificial application of young ticks (seed ticks), the product of old ticks developed on animals which have had Texas fever either from inoculation or from tick infestation.

4 Young animals suffer less during immunization than older ones, unless changes in dentition disqualify them for the range, in which case judicious feeding must be resorted to. In fact, during the fever period (60 days) animals should be placed upon a nutritious, well balanced ration.

5 With higher-priced animals it is better to inoculate the calves at from six to nine months old than to permit promiscuous tick infestation, and consequent serious check in development when a week or more old, as is the case with calves dropped upon infested pastures.

THE ERADICATION OF THE TICK BY A PASTURE ROTATION SYSTEM

There are five species of ticks found upon cattle in the South which the stock raiser might experience some difficulty in differentiating: the North American Texas fever tick (*Boophilus annulatus*), the lone star tick, (*Amblyomma americanum*), the dog tick (*Dermacentor electus*), the net tick (*Dermacentor reticulatus*), and the castor bean tick (*Ixodes ricinus*). The first is the only one which should give the breeder any concern, but persons not familiar with the specific differences have confused the habits and development of the fever tick with those of the lone star, dog, and net ticks. While the habits (except in selection of hosts) and development of all these species are very similar up to the period of attachment to host animals in the seed tick condition of each, there is a very marked difference in habits and development of the fever tick and the three other species from the period just before the first molt to that of the fully mature

and engorged female. The fever tick remains upon its host throughout the molting periods up to engorgement, while the other species drop from their hosts just prior to each molt. The latter habit greatly prolongs the life cycles of the lone star, dog, and net ticks, even to as much as ten months or a year, and in consequence reduces the numbers to such an extent that they are not in any sense serious pests.

Life cycle of fever tick

As the pasture rotation remedy for the Texas fever tick is based upon a life history and habit study, a general statement of the development of this species is given in order that the plan proposed for its extermination may be more clearly understood.

The fully engorged female (that stage most commonly observed upon animals) detaches itself from its host, drops to the ground, and deposits as many as 3,000 eggs. The number of eggs laid by individual ticks and the time required to deposit them vary with the food and temperature conditions. In summer, with food conditions normal, even more than 3,000 eggs may be deposited in a few days; in late fall and winter as long as a month or more may be consumed in laying half, and less than half, of the eggs a tick of the same size would deposit in summer. Eggs laid in summer hatch in from 20 to 30 days, while those deposited in late fall and winter months may not hatch until the following March or April. On hatching, the ticks are called "seed" ticks in distinguishing them from the "yearling" ticks (stage after first and second molts) of the lone star and dog tick species, which may collect upon a person in walking through a pasture or woodland, or from the same stages of the fever tick found upon cattle. The seed ticks bunch in an exceedingly local manner upon grass and twigs of weeds and shrubs, and there await the passing of some animal to which they attach. These seed ticks possess remarkable vitality in that they may remain in a pasture as long as two months in summer and over six in winter before perishing, in case no host animal should pass and collect them. On being collected by a host animal the young ticks soon attach themselves and begin their parasitic life. The time required to develop (molts twice) upon cattle is important in connection with the remedy suggested. During the midsummer, full engorgement of the mature tick ranges from 19 to 30 days after attaching, while in late fall and winter the cycle of development upon cattle is usually a few days longer, ranging from 28 to 40 days.

From the foregoing it will be seen that the female ticks during the egg laying period, the eggs, and the young ticks (seed ticks) prior to attaching to animals, are to be found on the ground of pasture fields and not on animals; while the remaining stages—seed ticks after attachment, stage after first molt, and stage after second molt to engorgement of females—are consecutively developed upon the animals, and at no time upon the ground, grass, weeds, or shrubs of the pasture.

In the study of the development of the Texas fever cattle tick during the summer months it was found that the time required for seed ticks after infesting animals to mature into engorged females and drop to the

ground for egg deposition was a little less than the time required for a female after dropping to lay eggs and these eggs to hatch. Therefore infested animals might be cleaned of ticks by being placed in a tick-free field, upon which to drop all their ticks, before eggs from females dropped the day the animals were placed in the pasture would hatch. The time between the dropping of the ticks and possible reinfestation was of too short duration for this plan to be practicable in the face of slight developmental variations due to changes in temperature or other conditions. Experiments were conducted in order to determine if a wider range of time between these important suggestive remedial periods did not exist and thus develop a remedy easily within the range of the average farm operations of the South. Continuing the breeding experiments through every month in the year, it was found that eggs deposited the latter part of November and in December, January, and February did not hatch until late March, April, or early May, and that the longest period of development of the tick (from seed tick to full engorgement and period of dropping) upon cattle during these months was 40 days, 35 being in most cases ample for the development and dropping of every tick. *It thus became easily possible to place infested animals upon tick-free areas during late November, December, and January, have them drop every tick, and run no risk of reinfestation, as eggs did not hatch under the prevailing temperature of these months.*

Data and pasture rotation Remedy I—(a)

The next phase in the development of a practical remedy was the determining of the length of time necessary to starve ticks out of a pasture when all hosts (cattle, horses and mules) were excluded. Experiments during the summers from 1897 to 1904, inclusive, showed that about one month was necessary for the laying and hatching of eggs and that seed ticks could endure as long as two months in summer without food. For example, if all hosts of the cattle tick were removed from a pasture on June 1 this pasture would be tick-free by early October.

Data and pasture rotation Remedy I—(b)

The fall and winter months, though a decidedly opportune period for ridding animals of ticks, were found least effective as a period for cleaning pastures by excluding cattle tick hosts. Eggs deposited in late fall may not hatch until the next March or April, and seed ticks may live without food from late September until the middle of the following April. It will thus be seen that more time is required during the late fall and winter months to deposit and hatch tick eggs or to starve out seed ticks than is necessary during midsummer to effect both operations.

With this information a remedial application may be perfected to meet the conditions upon the farms or plantations of the South. Pastures may be divided so that from a portion of them all animals (cattle, horses and mules) upon which the Texas fever cattle tick develops, may be excluded from June 1 until late fall in order that the animals when cleaned of ticks may have a tick-free field in which to be placed. To be cleaned the animals

may be placed, not earlier than the middle of November, in a corn or cotton field from which the crop has been removed, and there kept until the ticks have dropped (35 or 40 days). In no case should they have access to the pasture from which they have just been taken, as animals may become infested during a warm spell of the winter months with seed ticks which hatched in September or early October. (Seed ticks hatched September 29, 1903, remained alive without food until April 10, 1904). As soon as all ticks are dropped the animals may be removed to the tick-free field, or they may remain longer without danger of reinfestation if the corn or cotton field provides sufficient pasturage. Not later than February they should be placed in the tick-free field to be fed the hay crop gotten from this area the previous season. Upon this tick-free area they may be kept until sufficient time has elapsed to destroy the ticks by starvation in the pasture from which they were removed into the corn or cotton field the fall previous.

"Feed-lot" method of ridding cattle and of cleaning pastures during summer Remedy II

It should be remembered that not all farms nor all fields of individual farms lying below the national quarantine line are infested with the fever tick. Parishes of Louisiana devoted to sugar cane and rice culture are practically free from ticks. Many cotton plantations are also exempt, and those parts of all farms throughout the South upon which no cattle have been from June 1 until October 1, or later, are also tick-free. These areas may be advantageously used in eradicating the fever tick from contiguous ones.

The "feed-lot" method of cleaning cattle is based upon the fact that the parasitic period (from attachment as seed tick to dropping to ground as a fully engorged female) of the fever tick is not more than 40 days; less in summer. In this method a portion of ground is set apart, half of which is of sufficient size to accommodate the number of cattle on hand. The area selected should be convenient to plenty of feed and water. Surround and divide the lot with a double fence (8 to 10-foot space). Feed the cattle for 20 days on one side, then remove them to the other for 15 or 20 days longer. Every tick will have dropped, and the cattle may then be placed upon such field or pasture as may be tick-free and available. By this method entire farms may be cleaned during a summer period of not exceeding four months. In the early spring select a field with water and shade available to be devoted to broadcast sorghum, corn or millet, or all three. On June 1 fence off the feed-lot (within the forage field), in which place all the cattle of the farm, and feed and rotate as described above for 40 days. At the end of this period the cattle may be turned into the field of sorghum, millet or corn, and there pastured until October 15 or November 1, by which time all fever ticks upon the entire property outside of the feed-lots will have perished.

After the animals are removed the feed-lots should be immediately plowed and thoroughly cultivated, and their edges completely sprayed with crude petroleum, zenoleum solutions, or other substances destructive to tick life.

Summary—II

1 The North American cattle tick has been bred upon cattle, horses and mules. Horses and mules are not continuously infested when upon ticky pastures as are cattle.

2 Sheep and goats run upon pastures, scatter bunches of seed ticks and reduce possible infestation of cattle upon the same pastures.

3 The excessive tax of gross infestation of ticks is not only shown by the great loss of flesh of animals attacked, but in the slower development of ticks on animals intensely infested.

4 In connection with the two pasture methods suggested for the eradication of the fever tick, the periods of greatest importance in the life of this tick are, (1) the combined egg laying and incubation, which takes place *upon the ground of the pasture*, and (2) the development of the tick *upon cattle* (from the time the seed ticks are collected from the pasture and attach, through the two molting periods, to the engorgement and dropping of the females). Eggs hatch readily in from 20 to 30 days from May until early October. Those deposited in the latter half of November, in December, January, February, and early March, hatch in April and May; earlier in exceptionally open winters. Ticks develop upon cattle in from about 19 to 30 days in summer, and the longest winter development upon cattle was found to be 40 days.

5 More eggs as a rule are deposited in summer than in winter. Many females succumb to the cold before depositing half as many eggs as females of the same size would deposit in summer.

6 Seed ticks possess remarkable vitality, having been found to be able to exist without food as long as two months in summer and over six in late fall, winter, and early spring.

7 From a study of the life and habits of the fever tick, two plans have been developed for its eradication: (1) a pasture rotation system, utilizing June, July, August, September, and October to starve out the tick from pastures by excluding cattle, horses, and mules; (2) the adoption of the feed-lot method within a sorghum, corn, millet or other forage field conveniently located for water and shade.

8 Animals south of the quarantine line may, any time during the year, be absolutely cleaned of ticks in 40 days or less by the feed-lot method.

9 Seed ticks hatched in late September and October, living as they can as long as six months, may infest cattle during any warm spell from late September until April.

10 While a number of substances are of great value in reducing tick infestation of animals, they are attended with some loss, considerable expense, and much worry, and can not be relied upon for complete eradication except when associated with the pasture rotation remedy. Many substances used to lessen tick infestation irritate the skins of animals and lengthen the period of development of ticks which survive the effect of the application.

During the summer of 1904 the writer had the opportunity of testing on a large scale the plans of eradicating ticks as set forth in this bulletin upon the property of Mr. August Mayer, Shreveport, La. In corresponding with Mr. Mayer relative to the results, we have received the following letter, which Mr. Mayer has kindly permitted us to publish:

LETTER FROM MR. AUGUST MAYER

SHREVEPORT, LA., April 20, 1905.

PROF. H. A. MORGAN,
Director Tennessee Experiment Station,
Knoxville, Tenn.

My Dear Sir:—With the advent of the boll weevil the problem of the total eradication of the fever-transmitting cattle tick from the pastures of the South, especially from those of the farm, has become of the greatest importance. Next to the problem of maintaining American supremacy in the production of cotton in spite of the boll weevil, there is no problem facing the Southern people today of greater consequence than the one dealing with the eradication of the cattle tick (*Boophilus annulatus*) from the United States. Indeed, it may be said that the damage done annually by the cattle tick at present exceeds that wrought by the boll weevil, and this enormous loss, amounting perhaps to more than one hundred million dollars, has been suffered for many years.

To explain by a concrete example how formidable a barrier the fever tick is to a profitable cattle industry on the farms of the South, I may cite my own struggles in the building up of a herd of full-blooded cattle. After expending over ten thousand dollars in the importation of registered non-immune stock, and battling with the fever tick for several years, to have the cattle survive and become reproductive, experiencing losses by deaths in the herd from tick fever representing in the aggregate over two thousand dollars, and further outlays of several thousand dollars for extra feed, care, etc., all chargeable to the cattle tick, I saw almost no hope for success in my enterprise. Grave thoughts of surrender to the tick crowded my mind. And had it not been for the knowledge gained from your experiments, in the nick of time, and your kind assistance in my last stand against the tick, my attempt to raise fine cattle profitably on the richest soil in the world would have proved a failure. How well we succeeded by your "feed-lot" method in freeing my herd of cattle completely from the ticks and restoring new life and vigor to them, I am only too happy to testify. Your experiments have proved to my entire satisfaction that the cattle tick need have no terrors for him who informs himself thoroughly of its habits and life history and follows out your plans for its control and eradication.

At the same time I wish to sound a note of warning to my fellow-farmers below the quarantine line, especially to those owning rich pasture lands capable of carrying a comparatively large number of animals per acre, to take it at once for granted that the fever tick and a profitable cattle industry are antagonistic propositions. However, until the tick has been completely eradicated from the United States—a thing quite possible—it is only the course of wisdom to see to the thorough immunization of all cattle destined to live below the fever line, even if some of our pastures, or all of those belonging to the more progressive individuals in communities here and there, are tick-free. But after thorough immunization the cattle should be kept free from ticks in order that good results be obtained. Pursuing such a course, one will succeed in adding to his calling a branch of agriculture at once profitable, enjoyable, and ennobling to the highest degree.

Sincerely yours,
AUGUST MAYER.