

No large number of ticks is necessary to convey the disease through the equine, but a solitary infectious tick detached from its equine host (before the completion of the fifth day of such attachment) may prove the means of involving a whole district many miles distant from the nearest point of disease in the inconvenience and grave loss which attends an outbreak of the disease (see charts, Schedule V).

This fact cannot but have a great significance in consideration of our present transport restrictions and also of the risk of spread by such an agency from farm to farm.

In the writer's mind there is no doubt that this cause has been the unsuspected factor in very many of those outbreaks which have baffled inquiry as to the means of spread.

A saddle horse or a team of mules outspanned, or even traversing infectious ground when on trek, may conceivably pick up infectious ticks and carry the same over a hundred miles into a clean area before the potentiality of the infectious tick becomes exhausted.

The risk of spread by means of the equine host seems emphasized when we remember the chances for detachment of brown ticks from their predilection sites (the ears and root of the tail), the putting on and off of headstalls and cruppers seeming to furnish ample opportunities of detachment of ticks from these regions.

It is felt that the recognition of the above fact as to the agency of the horse in spreading the disease East Coast fever must tend in the direction of rendering our precautionary measures even more stringent and exacting than at present.

The compulsory dipping of all equines before leaving infected areas is a serious measure to adopt, but the writer can, in view of the above findings, suggest no alternative other than a period of quarantine of at least five days on ground free from suspicion.

A modification of such precautionary measures would consist in the cleaning of the ears and tails of all equines when leaving infected areas with an arsenical fluid or preferably with the dressing suggested for this purpose in Part III of this report. This procedure would do much to reduce risk of conveyance of ticks by destroying the latter at their chief—though by no means sole—points of attachment.

While any increase of precautionary measures will only be adopted by the responsible authorities with great reluctance, and after maturest consideration, it should be borne in mind that the public inconvenience and economic losses attending a sudden outbreak of the disease—such as that recently occurring in a large provincial town—are very great, and such as to justify the adoption of precautions—however irksome—in order to rid both the locality and the country generally of a most devastating cattle scourge.

The ease with which equines tolerate the process of dipping was dealt with in the last report. The writer thinks, however, it may be of interest in the present context to bring forward such evidence on the point as extended observations since then have furnished. Schedule VII will be found to give particulars of a troop of horses continually dipped for over eighteen months at short intervals. In view of this result the dipping necessary on the borders of infected areas could be recommended for adoption without risk of equine life or health.

While other agencies in the distribution of the infectious tick exist (such as those, among others, shown in Report III on this

subject), there is no doubt that in excluding such agencies as those connected with the ox and horse we shall be dealing with the danger in its most direct form. The agency of dogs, birds, etc., though theoretically admissible, seems to the writer to be a negligible factor in considering the practical means of spread.

*Restraint of tick life* is the main principle which must underlie all our repressive policies, and such restraint can only be effectively exercised upon the larger animals which serve as appropriate hosts for the tick. We cannot—as in some other countries—look to recurring seasonal influences to rid any one of our South African Provinces of its tick life, nor dare we depend on altitude for immunity. The closing of an extensive tract of country in order to divest it of tick life by preventing access to a warm-blooded host is in the opinion of the writer economically impossible. Even were the end achieved so far as to clear such tract of country of its ticks, reinfestation would rapidly occur from adjoining areas directly such policy of isolation was abandoned, owing to the extraordinary fecundity of the tick.

The only means, therefore, of dealing with this grave problem of tick destruction consists in the general establishment and unsparing use of the dipping tank.

Recent observations and experience have conclusively proved the ease with which farms may be cleared from ticks by the frequent and methodical use of dipping, and this cleansing process has been the more efficient in proportion as the interval between dippings has been shortened, a result which has been shown to be due not merely—or even chiefly—to the increased destruction attending the more frequent immersion but rather to the arresting interference of such dipping upon the life cycle of the insect at certain stages of its development.

In the last report (III), on the subject of utility of dipping in the suppression of various disorders other than East Coast fever, mention was made of the use of the ordinary dipping tank for the treatment of scabies in the sheep.

Opportunity for more extended observation has been afforded since that time, and numerous fresh experiments have borne out the opinion previously expressed as to the value of the cattle tank in the routine treatment of scab in sheep, provided a suitable fluid is used. All observations have been conducted with the "Laboratory" and "Three-day" dipping fluids, but it is probable that the same results would attend the use of other of the proprietary dips, provided the alkalinity of the fluid was not so high as to affect the wool, or the arsenic content so reduced as to be below the level of efficient action.\*

On practical trial—dealing with flocks of sheep of at least fifty in number—it has been found that advanced outbreaks of scab in which every member of the flock has become infected, can become eradicated by passing the affected sheep three times at weekly intervals through the cattle tank filled with Laboratory Dip. No hand-dressing or holding back of the swimming sheep for a specified time has been found necessary to effect complete cure. Where the weaker or three-day dipping fluid is employed, the scabby flock has been driven

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\* A recently improved cattle dip by a well-known firm contains 20 per cent less arsenic, but 100 per cent. more alkali than the Laboratory Dip, 30 per cent. being in the form of caustic alkali. How long such a preparation could be used without detriment to the wool, the writer has had no opportunity of determining. This instance is one showing the limitations of the cattle tank as a sheep dip in cases where the composition and effect of the dip employed is unknown.

through the tank seven times at intervals of three clear days without the least discomfort or mishap, and with the complete eradication of the disease. Such a procedure shows the possibility attending the use of the ordinary dipping tank.

In the case of incipient scab a single immersion will, in the majority of cases, prove sufficient to check the development of the disease. It has been found practically impossible to produce the disease in a flock of clean sheep put through the tank once every few months, by closely herding infected animals amongst the clean ones. This, of course, is explicable upon the grounds that the deposition of the arsenic upon the skin and fleece of the animal renders it an unsuitable ground for the development of parasitic life. The writer is confident in asserting that scab in sheep should become rapidly extinct, or at any rate negligible, upon any farm where a cattle dip is used, provided a suitable dipping fluid is employed.

Objections have arisen with reference to the use of the cattle tank for sheep on account of the quantity of cattle hairs contained in the tank. While this difficulty has been, it is thought, greatly over-estimated, the objection can be got over by not allowing the contents of the tank to become too foul for use. The hairs shed by cattle and horses in passing through the dip float for a considerable time before sinking, especially in comparatively freshly prepared dip, and are thus able to be removed with ease by skimming the surface of the dip with a board shortly after dipping. Where the fluid is old and foul it should not be used for the dipping of sheep, and in any case is better replaced by fresh dipping fluid.

An observation on this question of cattle and horse hairs was made in a tank used without cleaning out for twelve months for the frequent dipping of all farm stock. In this fluid the total solids in suspension directly after dipping amounted to as much as 1 per cent. Some sheep with long fleeces which had regularly passed through this tank every third day were shorn and the fleeces rinsed in cold water. Cattle hairs were present in extremely small numbers, often necessitating a lengthy search to detect one. This is the worst example obtainable, and the objection as to the presence of hairs in the fleece in harmful numbers will be able to be estimated from this extreme case. It is not in any case suggested that such a dip fluid should be used for sheep, although the use of even a foul dip of the kind instanced would, if actual necessity arose, be greatly to be preferred to the incurring of any delay in the eradication of a disease like scab, in which rapid and serious deterioration of value of a fleece takes place.

The above suggestions are intended, of course, to apply only in the case of a scabby flock or as a measure taken occasionally to ensure the prevention of the disease. It is not suggested that flocks should be dipped as a routine procedure, though the safety with which such could be done, as an experimental measure, was shown in my last report. Lambs dipped twice, at intervals of seven days, in full strength dip, or much oftener in three-day dip, suffered no ill effects.

Objections have also been raised as to the possibility of the several immersions necessary to eradicate the disease having a deleterious effect upon the wool. A sample of frequently dipped wool, together with a control fleece taken from an undipped sheep kept under the same conditions, was submitted for the critical examination and report of a well-known firm of wool merchants, who were so good as to take

considerable pains to inquire into the matter and to consult with other authorities in order to secure a consensus of expert opinion. Their reply will be found in Schedule IX.

This the writer feels will be sufficient to set at rest any objections existing to the use of the Laboratory Dip on the score of damage to the wool texture. The broader facilities afforded for the suppression of scab in South Africa by the general use of the dipping tank would, considering the enormous depreciation of value caused annually from the presence of scab among our flocks, more than outweigh any slight and temporary detriment to the wool, even if such could be shown to exist.

The question, however, of the hastened extermination of the disease scab by appropriate dipping measures may be looked upon as a side issue in consideration of the adoption of a general policy of tick destruction towards which these reports have been directed, but the writer is confident that the beneficial effects which can be shown to obtain in the case of scab repression will be found to exist to a more marked degree in the case of those other stock diseases which have proved so serious a check to the agricultural prosperity and development of South Africa. Dipping, though not a panacea for all the ills to which our domestic animals are heir, can yet claim to be a far reaching remedy—or better still preventive—whose beneficial influence will continue to extend and make itself felt increasingly.

Although we the men of the present generation can perhaps hardly hope to see so desirable a consummation the writer feels assured that our sons will be able, under a wisely directed policy, to lay aside the dipping measures (now so necessary for safety and progress) as an out-of-date defensive appliance, much as a man may abandon the old weapon which has served him well in the struggles of the past.

In concluding the above observations (which coincide with the conclusion of his sixteen years' work of inquiry into the animal diseases of South Africa) the writer expresses the hope that he may have the gratification in the future of seeing this inquiry into dipping and tick destruction productive of widespread results, not alone in the advancement of the material interests of the stock owner but also in the reduction of that great mass of animal suffering now directly attributable to the ravages of the tick.

(The writer again acknowledges his thanks and obligations to his assistant, Mr. A. W. Shilston, M.R.C.V.S., who, as formerly, has rendered the most valued help, and who, by his efforts, has conducted materially to whatever successful issue the foregoing work may be deemed to have attained.)

SCHEDULE I.

The two charts below illustrate the production of the disease East Coast fever by means of a single tick, a fact hitherto unrecognized. Although the periods of incubation differ somewhat the total period from infection to death is about the same.

In eight animals infected with a single tick five contracted the disease. It will be noticed that the ticks producing these reactions were more than six months old.

**DISEASE:**  
**EAST COAST FEVER.**

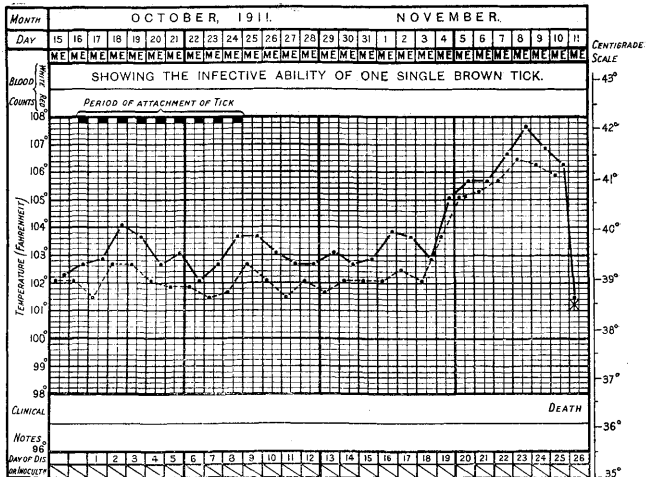
**SERIES:**  
**No. 1.**

**DESCRIPTION OF ANIMAL:**  
**YOUNG OX.**

**NUMBER OF ANIMAL:**  
**1 O B.**

**OBSERVATIONS:**  
Morning temperatures shown by dotted line, evening temperatures by continuous line  
One adult infectious Tick attached to tail of beast on October 16th  
Incubation period 19 days.  
Tick was infected (as nymph) on March 4th, and moulted March 28th.  
Age of Tick about 6½ months

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**DISEASE:**  
**EAST COAST FEVER.**

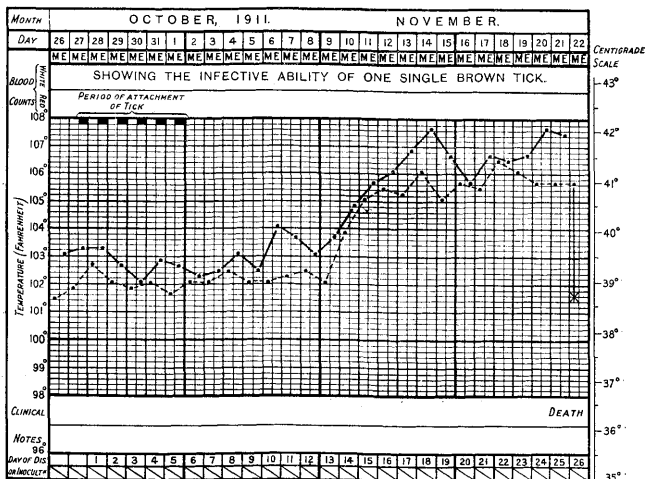
**SERIES:**  
**No. 2.**

**DESCRIPTION OF ANIMAL:**  
**DEVON HEIFER.**

**NUMBER OF ANIMAL:**  
**1 O 9.**

**OBSERVATIONS:**  
One adult infectious Tick placed on tail of beast on October 27th.  
Incubation period 14 days.  
Tick moulted March 28th.  
Age of Tick about 7 months.

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SCHEDULE II.

The following four charts show that after attachment for a certain period to its host the tick loses its power of infection.

Cases 1 and 2 illustrate the fact that the tick retains its infectivity after seventy-two and ninety-six hours attachment respectively, while cases 3 and 4 (next page) show that this power of infectivity is lost by the 120th hour (fifth day) of such attachment.

The ticks used in all four experiments were from the same batch and of the same age at time of attachment.

**DISEASE:**  
**EAST COAST FEVER.**

**SERIES:**  
**Case No. 1.**

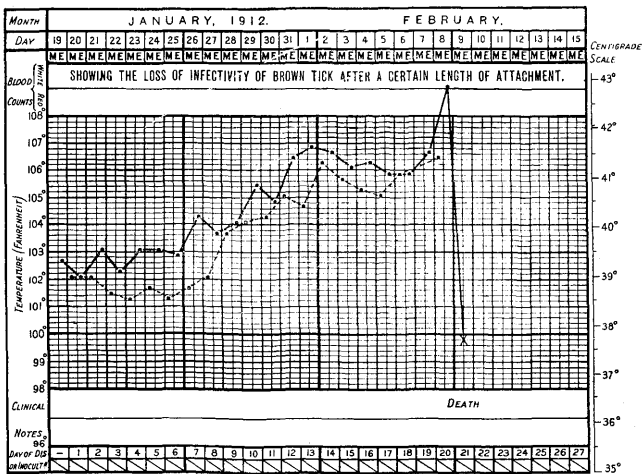
**DESCRIPTION OF ANIMAL:**  
**YOUNG BLACK OX.**

**NUMBER OF ANIMAL:**  
**128.**

**OBSERVATIONS:**  
Ticks from animals 136 and 147 (after 72 hours feeding on same) were placed on this beast 3.45 p.m. January 19th, and were removed 4 p.m. January 23rd

This animal contracts the disease and dies February 9th.

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**DISEASE:**  
**EAST COAST FEVER.**

**SERIES:**  
**Case No. 2.**

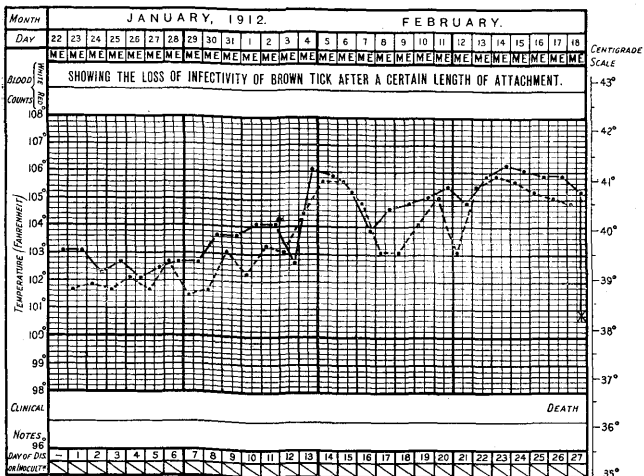
**DESCRIPTION OF ANIMAL:**  
**BLACK AND WHITE OX.**

**NUMBER OF ANIMAL:**  
**81.**

**OBSERVATIONS:**  
Ticks from Nos. 145, 150, and 66 (after 96 hours feeding on the same) were placed on this beast at noon January 22nd.

This animal contracts the disease and dies February 18th

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Showing the loss of infectivity of the tick between the 96th and 120th hour (fourth and fifth days) of its attachment.

**DISEASE:**  
**EAST COAST FEVER.**

**SERIES:**  
**CASE No. 3.**

**DESCRIPTION OF ANIMAL:**  
**YOUNG BULL**  
**BLACK AND WHITE.**

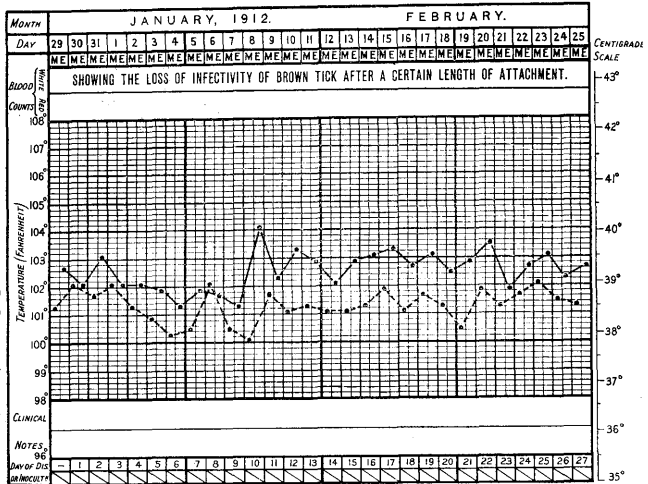
**NUMBER OF ANIMAL:**  
**130.**

**OBSERVATIONS**  
Ticks from Nos. 79, 145, and 150 (after 120 hours feeding on same) were placed on this beast at noon on January 29th

This animal does not contract the disease

These Ticks had previously produced the disease

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**DISEASE:**  
**EAST COAST FEVER.**

**SERIES:**  
**CASE No. 4.**

**DESCRIPTION OF ANIMAL:**  
**BLACK AND WHITE OX.**

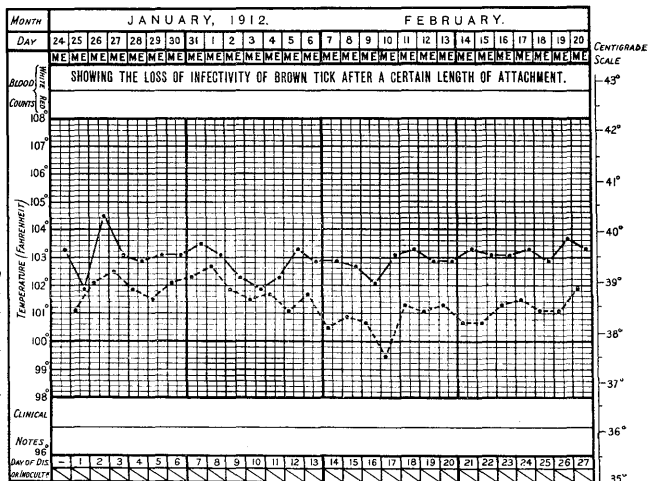
**NUMBER OF ANIMAL:**  
**83.**

**OBSERVATIONS:**  
Ticks from Nos. 132, 149, and 139 (after 144 hours feeding on same) were placed on this beast on January 24th

This animal does not contract the disease

These Ticks had previously produced the disease

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SCHEDULE III.

Illustrating the finding that the brown tick cannot infect its host until many hours after its effective attachment.

Cases 1 and 2 show that ticks (proved subsequently to be infectious) are not able to infect their hosts even after forty-eight hours (two days) and sixty hours (two and a half days) of effective attachment. Cases 3 and 4 (next page) show about the point when the ability to infect becomes established.

**DISEASE:**  
EAST COAST FEVER.

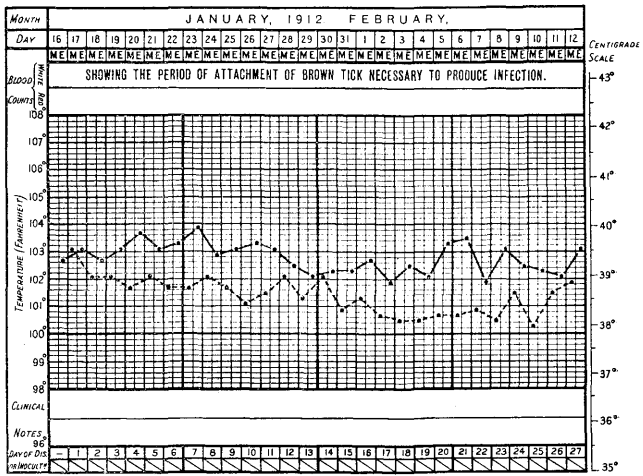
**SERIES:**  
Case No. 1.

**DESCRIPTION OF ANIMAL:**  
BLACK OX.

**NUMBER OF ANIMAL:**  
139.

**OBSERVATIONS:**  
Four infectious Ticks were placed on this beast on January 16th at 4.30 p.m., and were removed at 4.30 p.m. January 18th, giving a period of attachment of 48 hours  
These Ticks subsequently produced the disease in 132.

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**DISEASE:**  
EAST COAST FEVER.

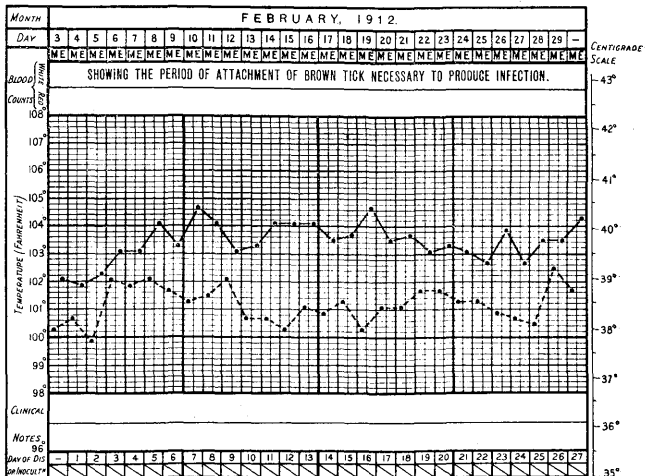
**SERIES:**  
Case No. 2.

**DESCRIPTION OF ANIMAL:**  
BLACK AND WHITE CALF.

**NUMBER OF ANIMAL:**  
88.

**OBSERVATIONS:**  
Six infectious Ticks were placed on this beast on February 3rd at 6 p.m., and were removed at 6 a.m. February 6th, giving a period of attachment of 60 hours  
No infection ensued.

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Showing that a period of attachment of seventy-two hours (or thereabouts) is necessary to develop the infectivity of the tick. Case 3 remains (as all shorter periods) uninfected, but case 4 contracts the disease (as in all longer attachments.) The accession of infective power is therefore at, or very near, the 72nd hour (three days).

**DISEASE:**  
EAST COAST FEVER.

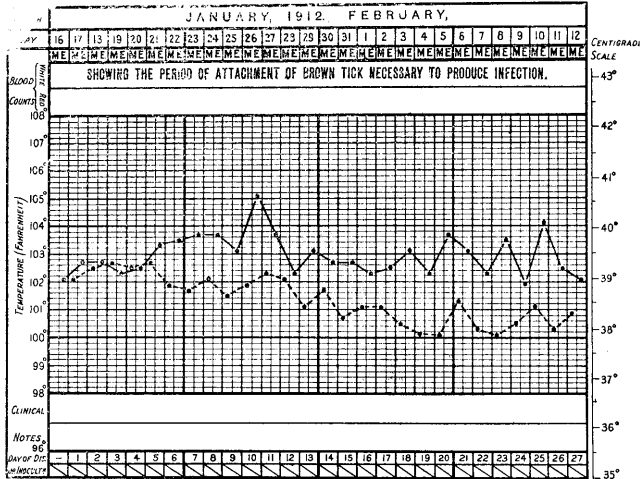
**SERIES:**  
CASE No. 3.

**DESCRIPTION OF ANIMAL:**  
RED AND WHITE OX.

**NUMBER OF ANIMAL:**  
147.

**OBSERVATIONS:**  
Eight infectious Ticks were placed on this beast on January 16th at 3.30 p.m., and were removed at 3.30 p.m. January 19th, giving a period of attachment of 72 hours  
These Ticks subsequently produced the disease in Case 128.

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**DISEASE:**  
EAST COAST FEVER.

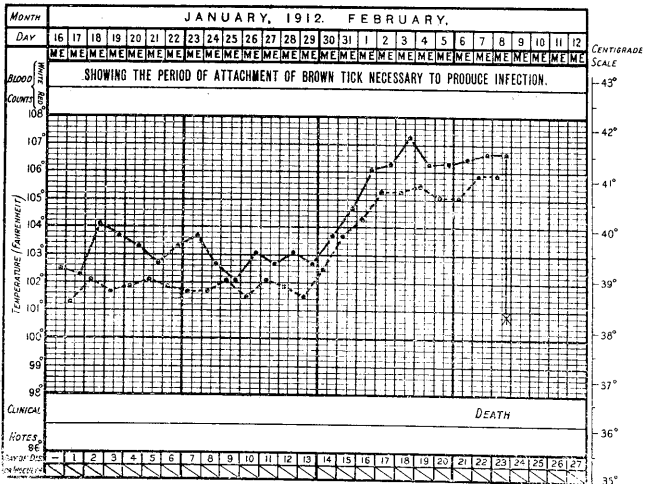
**SERIES:**  
CASE No. 4.

**DESCRIPTION OF ANIMAL:**  
BLACK OX.

**NUMBER OF ANIMAL:**  
136.

**OBSERVATIONS:**  
Five infectious Ticks were placed on this beast on January 16th at 3.30 p.m., and were removed at 3.30 p.m. January 19th, giving a period of attachment of 72 hours

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**DISEASE:**  
**EAST COAST FEVER.**

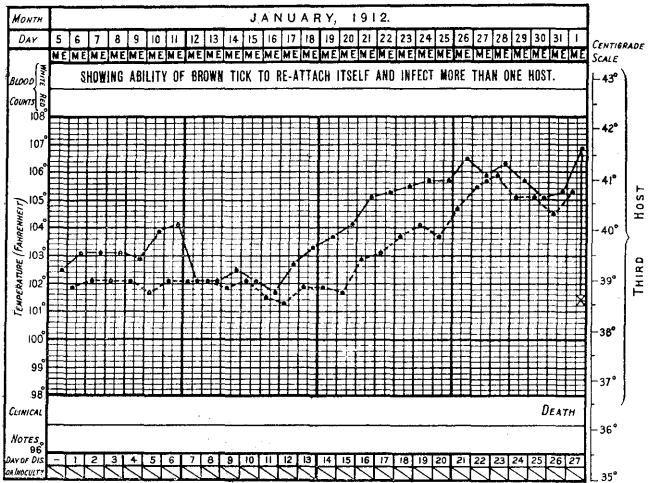
**SERIES:**  
**CASE No. 3.**

**DESCRIPTION OF ANIMAL:**  
**BLACK BULL CALF.**

**NUMBER OF ANIMAL:**  
**87.**

**OBSERVATIONS:**  
Seven Ticks were removed from 109a (No. 2 of this series) and placed on this animal on January 5th.  
This animal constitutes the third host for these same Ticks.

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**SCHEDULE V.**

Showing the ability of the horse to act as the host of, and convey the disease by means of, a single infectious tick.

Of eight bovines to each of which was attached a single tick taken from the horse four (or 50 per cent.) contracted the disease.

**DISEASE:**  
**EAST COAST FEVER.**

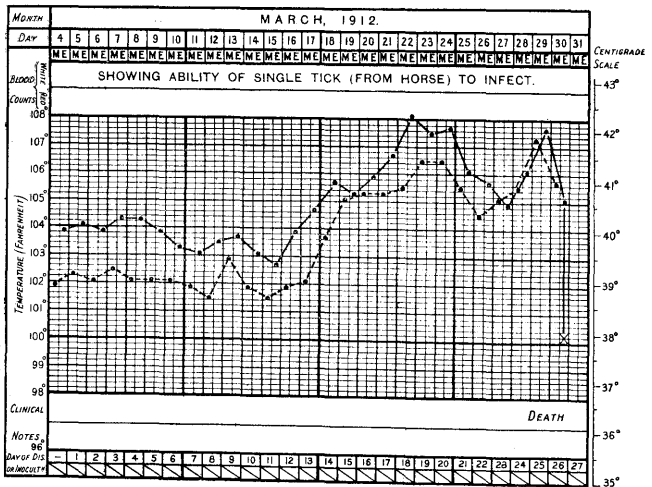
**SERIES:**  
**CASE No. 1.**

**DESCRIPTION OF ANIMAL:**  
**BLACK CALF.**

**NUMBER OF ANIMAL:**

**OBSERVATIONS:**  
One (attached) Tick removed from Foal and placed on this beast March 4th.

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DISEASE: EAST COAST FEVER.

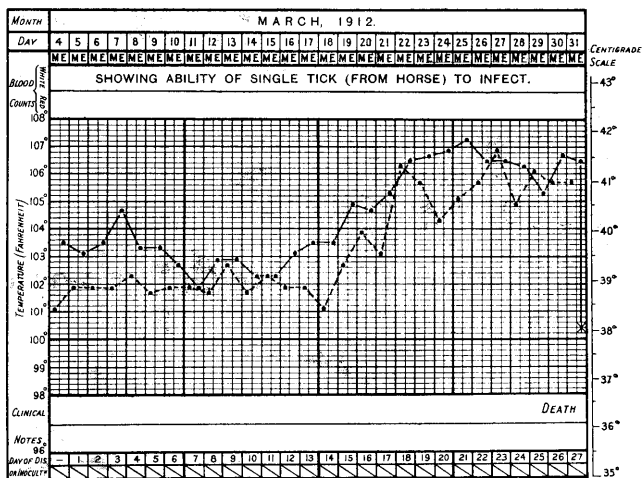
SERIES: CASE No. 4.

DESCRIPTION OF ANIMAL: BLACK AND WHITE TWO-YEAR-OLD.

NUMBER OF ANIMAL: 149.

OBSERVATIONS: One Tick removed from horse and placed on above beast March 4th.

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SCHEDULE VI.

The schema below shows the exact period or phase of the tick's attachment during which it is infectious.

It will be seen that all animals harbouring ticks at any time within the two and a half to five day period (shaded on the table) contract the disease, while those cases terminating before or commencing after these periods remain uninfected.

Length of attachment of Ticks	1 day		2 days			3 days		4 days		5 days		6 days		7 days
	24 hrs.	36 hrs.	48 hrs.	60 hrs.	72 hrs.	96 hrs.	120 hrs.	144 hrs.	168 hrs.	192 hrs.				
All the Ticks used in this experiment were from the same batch which fed as nymphs on N° 165 while suffering from East Coast Fever.	1	18 infected Ticks attached to N° 142 for 24 hours. NO REACTION.	The same Ticks re-attached to N° 109 for 48 hours. Animal CONTRACTED E.C.F.			The same Ticks attached to N° 87 (third attachment). Animal CONTRACTED E.C.F.								
	2	16 infected Ticks attached for 36 hours to Nos. 145 & 150. NO REACTION.	12 of the same Ticks re-attached to N° 86. Animal CONTRACTED E.C.F.			The same Ticks re-attached to N° 81 (third attachment). Animal CONTRACTED E.C.F.								
	3		4 of the same Ticks re-attached to N° 79. Animal CONTRACTED E.C.F.			The same Ticks re-attached to N° 130 (third attachment). NO REACTION.								
These adult Ticks were about two and a half months old at the time of attachment.	4	9 infected Ticks attached for 48 hours to Nos. 139 & 147. NO REACTION.	The same Ticks re-attached to N° 132. Animal CONTRACTED E.C.F.			The same Ticks re-attached to N° 83. NO REACTION.								
	5	10 infected Ticks attached for 60 hours to Nos. 88 & 110. NO REACTION.	Ticks not re-attached.			Ticks not re-attached.								
	6	13 infected Ticks attached for 72 hours to Nos. 136 & 147. One beast contracted disease one failed to react.				The same Ticks re-attached to N° 128. Animal CONTRACTED E.C.F. Some Ticks were re-attached to N° 82. NO REACTION.								