

COMMUNICATIONS

The influence of cold on ticks and *Piroplasma parvum*

By A. THEILER.

Shortly after the introduction of East Coast Fever into the low-veld of the Elands River Valley in the Eastern Transvaal, and before legislation prohibited the movement of cattle, in several instances infected herds were brought up from that district to the high veld. One particular case came under my observation in the neighbourhood of Carolina. It was generally noted that directly after the introduction of sick cattle to the high veld, the infected cattle died out, and the remainder of the herd did not contract the disease, neither did the cattle which were grazing on areas over which the infected cattle must have dropped ticks. At that time it was not known that *Rhipicephalus evertsi* (the red tick) was a carrier of East Coast Fever, and the observation was apparently explained since *Rh. appendiculatus* (the brown tick) which is the principal carrier of the disease, was not found amongst the surviving cattle at the time the examination was made, and it was therefore concluded that *Rh. appendiculatus* could not live in the high-veld.

Later investigations however, proved that *Rh. appendiculatus* may live in the protected places in very high altitudes such as dongas, but it is not present in large numbers. In 1906, Mr. LOUNSBURY, Governement Entomologist of the Cape Colony, stated that *Rh. evertsi* was also a carrier of this disease, and in a former communication (1) I was able to corroborate this statement with the reservation that *Rh. evertsi* is not such a certain carrier of *Piroplasma parvum* as the brown tick, as in several instances I failed to infect *Rh. evertsi*.

(1) *Annual Report*, 1906-7.

Considering that *Rh. evertsi* is one of the most common ticks of the high-veld, although it is not found in such large numbers as in the low-veld, it became apparent that the disappearance of East Coast Fever from the high-veld had to be interpreted in a different way.

The influence of cold as a possible factor in the destruction of the virus within the tick, suggested itself, and for this purpose experiments were undertaken with *Rh. appendiculatus*.

In the first instance, it was surmised that on account of the considerable amount of liquid contained in engorged nymphae, this would be the stage more easily affected by cold, and should it not prove to be the case, it was thought that as a sexual development of the parasite probably ensues within the tick, the cold might retard that sexual development, or else completely inhibit it, in the same way as cold retards the development of the malarial parasite within the mosquito.

At the same time it was decided to note the influence of cold on larvae of the blue tick, which are the sole survivors of the winter months.

EXPERIMENT N° 1. — To infect a beast with East Coast Fever for the purpose of collecting engorged nymphae of *Rh. appendiculatus*.

Cow 455. Infested on the 23rd May 1907 with adults of *Rh. evertsi*, collected from *Ox 358* which at the time was suffering from East Coast Fever.

Cow 455 died on the 17th June 1907, from East Coast Fever.

Engorged *Rh. appendiculatus* nymphae were collected from *Cow 455* three days before death (14th June 1907).

EXPERIMENT N° 2. — To prove that these engorged nymphae of *Rh. appendiculatus* will transmit East Coast Fever in their adult stage.

The nymphae of *Rh. appendiculatus* which were collected on the 14th June, hatched on the 16th July, 32 days after they were collected.

Ox 467. Infested on the 22nd October 1907, with adults of *Rh. appendiculatus* from *Cow 455*.

Piroplasma parvum was noted from the 18th to 21st days, on which latter date the beast was killed.

Post Mortem examination shewed all the lesions of East Coast Fever.

CONCLUSION. — The adults of *Rh. appendiculatus*, which as engorged nymphae were collected from *Cow 455*, were capable of transmitting East Coast Fever.

EXPERIMENT N° 3. — To note the effect of exposing engorged nymphae of *Rh. appendiculatus* infected with *Piroplasma parvum* to a temperature of 0°C.

Some of the engorged nymphae of *Rh. appendiculatus* which had been

collected from Cow 455 on the 14th June, were exposed to a temperature of 0° C for $\frac{1}{2}$ hour daily from the 28th June to 19th July 1907.

Twelve days later — 31st July — they hatched.

(a) Ox 471. Infested on the 23rd September with four of these adult *Rh. appendiculatus* (53 days old). *Piroplasma parvum* appeared from the 23rd to 33rd days, on which latter date the beast died.

Post mortem Examination revealed all the typical lesions of East Coast Fever.

(b) Calf 441. Infested on the 22nd October 1907 with eight *Rh. appendiculatus* adults of the same brood which had been exposed to a temperature of 0° C for $\frac{1}{2}$ hour daily from the 28th June to 19th July (At the date of infestation these adults were 95 days old).

Piroplasma parvum appeared from the 10th to 19th days, and the beast died on the 11th November.

Post mortem examination revealed all the typical lesions of East Coast Fever.

CONCLUSIONS. — I. Engorged nymphae of *Rh. appendiculatus* when exposed to a temperature of 0° C. do not hatch as quickly as under normal conditions.

Of the engorged nymphae collected on the 14th June, those exposed to a temperature of 0° C. for $\frac{1}{2}$ hour daily from the 28th June to 19th July, 21 days, hatched on the 31st July, or 46 days after collection, whilst those kept in the ordinary Petri dishes at a normal temperature, hatched on the 16th July, or 32 days after collection.

II. Engorged nymphae of *Rh. appendiculatus*, collected from a beast suffering from East Coast Fever, and exposed to a temperature of 0° C. for $\frac{1}{2}$ hour daily for 21 days, were capable of transmitting *Piroplasma parvum* as adults; in one case these adults were 53 days old, and in the other 95 days old.

EXPERIMENT N° 4. — With larvae of *Rhipicephalus decoloratus* (the blue tick).

(a) Larval ticks exposed to a temperature of -18°C.

Date	Time kept this temperature.	Result
July 3,07	15 minutes	none died.
July 3,07	25 minutes	majority died.
July 3,07	30 minutes	all died.
July 2,07	60 minutes	all died.

(b) Larval ticks of *Rh. decoloratus*, exposed to a temperature of -5°C.

Date	Time kept this temperature.	Result
July 5,08	5 hours.	none died.
July 10,08	10 hours	none died.
July 11,08	24 hours.	none died.
July 12,08	48 hours.	majority died.

CONCLUSIONS. — I. Larval ticks of *Rh. decoloratus* die when exposed for 30 minutes to a temperature of -18° C.

II. Larval ticks of *Rh. decoloratus* do not die when exposed to a temperature of -5° C. for 24 hours.

RÉSUMÉ. — 1° A temperature of 0° C., retards the hatching of *Rh. appendiculatus* nymphae into adults;

2° A temperature of 0° C. does not interfere with the development of the parasite within the engorged nymphae;

3° A temperature of 0° C. does not kill the virus contained in engorged nymphae of *Rh. appendiculatus*;

4° Larval ticks of *Rh. decoloratus* die within 30 minutes when exposed to a temperature of -18° C.;

5° Larval ticks of *Rh. decoloratus* do not die when exposed to a temperature of -18° C. for 15 minutes;

6° Larval ticks of *Rh. decoloratus* do not die when exposed to a temperature of -5° C. for 24 hours;

7° The majority of larval ticks of *Rh. decoloratus* die when exposed to a temperature of -5° C. for 48 hours.

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