SOME OBSERVATIONS ON THE FEEDING BEHAVIOUR OF THE TICK RHIPICEPHALUS APPENDICULATUS (NEUMANN, 1901) ON CATTLE AND RABBITS IN THE LABORATORY

A. D. IRVIN*, R. E. PURNELL* and M. A. PEIRCE**

Immunological Research on Tick-borne Cattle Diseases and Tick Control Project†
East African Veterinary Research Organization, Muguga, P.O. Kabete, Kenya.

SUMMARY

A series of experiments, designed to improve the feeding methods used for the tick Rhipicephalus appendiculatus in East Coast fever research, were carried out in the laboratory using rabbits and cattle as tick hosts. When nymphal ticks were fed on cattle in varying numbers, large numbers of ticks took longer to engorge and mean engorged weight of tick batches was lower, than for ticks fed in smaller numbers. Two thousand nymphs per ear fed satisfactorily, and this number is now used as a standard.

INTRODUCTION

Rhipicephalus appendiculatus Neumann, 1901 is the usual vector of Theileria parva, the causative agent of East Coast fever (ECF) of cattle. Methods for the routine feeding and maintenance of this tick have been given by Bailey (1960), Branagan (1969, 1970) and Irvin & Brocklesby (1970). This present paper describes a number of experiments designed to improve the efficiency of the production of ticks used in ECF studies.

MATERIALS AND METHODS

(a) Ticks. R. appendiculatus came from a clean laboratory colony which has been maintained at the East African Veterinary Research Organization (EAVRO) for approximately 20 years. The methods described by Bailey (1960) formed the basis of tick feeding procedures supplemented by the modifications recorded by Branagan (1969) and Irvin & Brocklesby (1970).

Moulting ticks were stored in an incubator run at approximately 25°C and 80 per cent relative humidity. Unfed forms were stored in an open cupboard in the laboratory (temperature range 17°C to 22°C). Tick counts were carried out where possible on inactive forms (i.e. ova or engorged stages) and were subject to the following approximate errors: larvae 10 per cent, nymphs 5 per cent, adults 1 per cent. Larval ticks were used approximately one month after hatching, nymphs five to six weeks after moulting and adults six to eight weeks after moulting.

(b) Rabbits. The rabbits were chinchilla crosses from the small animal unit at EAVRO. They had not been previously exposed to ticks.

** On ODA secondment from the Central Veterinary Laboratory, Weybridge, Surrey, U.K., to which he has now returned.
† Project supported by the United Nations Development Programme/Special Fund, with the Food and Agriculture Organization of the United Nations as the Executing Agency, in co-operation with the East African Community. The Project is also assisted by the Overseas Development Administration of the United Kingdom (Research Projects 2396 and 2494), the United States Department of Agriculture, the Rockefeller Foundation, the International Atomic Energy Agency and the Pfizer Corporation.
(c) Cattle. The cattle were Friesian steers approximately 18 months old. They came from farms where strict acaricidal regimes are practised. These cattle were thoroughly washed on 3 consecutive days to remove any traces of residual acaricide, before experimental ticks were applied.

TICK FEEDING EXPERIMENTS

(a) Cattle

1. The effect of varying the number of nymphs applied to cattle

Nymphs were applied in ear bags to each ear of four cattle in the following numbers (right ear/left ear): 1000/500, 2000/1000, 4000/5000 and 4000/2000. After 24 hours unattached nymphs were removed and counted and their numbers expressed as a percentage of the calculated total applied. Ear bags were examined daily thereafter and engorged nymphs collected, counted and weighed. When tick feeding was finished the ears of the cattle were carefully examined for signs of oedema or suppuration which might have been brought on by the large numbers of ticks feeding.

The results of this experiment are shown in Table I. Four cattle showed mild transient oedema of the ears, but this was not apparently related to the number of ticks applied, and probably resulted from ear bags being applied too tightly. The mean weight of engorged nymphs bore an inverse relationship to the number applied and the time to engorgement was extended when more nymphs were applied. When 4000 nymphs were applied to an ear, a considerable percentage were still unattached after 24 hours; whereas with smaller numbers of ticks, 24-hour attachment was satisfactory.

2. Effect of environmental temperature on nymphal feeding

Two thermostatically controlled three Kw air heaters were installed in a loose box 6×4×3.3 m (18×12×10 ft.) and the windows of the box were boarded-up. Inside there were three pens 2×2 m (6×6 ft.) each surrounded by a shallow moat filled with water. The temperature during tick feeding experiments was maintained at 23°C with an approximate variation of ±3°C. The relative humidity ranged between 70 per cent and 90 per cent. Two identical adjacent loose boxes were left unheated. The temperature in these boxes ranged from 12°C to 25°C and the relative humidity ranged from 50 per cent to 95 per cent.

Two thousand nymphs were placed on each ear of cattle in these heated and unheated boxes and the time to engorgement of the ticks was recorded as the daily cumulative total. Fig. 1 shows the mean percentage cumulative totals of ticks engorged on five cattle in the heated pens and eight cattle in non-heated pens. Time for 50 per cent engorgement of ticks on cattle in the heated pens was almost one day faster than that for cattle in non-heated pens.

A further attempt to correlate nymphal engorgement time with temperature was made by examining the records from nymphal feeding experiments including those mentioned above over the previous year and relating the average time to engorgement to the average mean air temperature, recorded from an adjacent meteorological site. The results are shown in Table II. As the mean air temperature, during tick feeding, increased, the mean time to engorgement was reduced. At the lower temperatures there was also more variation in engorgement time.

3. Feeding adult ticks on cattle

Ten male and ten female ticks were applied to each ear of a steer, nine completed engorgement and one died. The mean values for tick engorgement time and egg production are shown in Table III.

* Nu Aire HC3, Nu Aire Ltd., Longmoore St., London, S.W.1.