Trop. Anim. Prod. Invest., 1: 66-71 (1990)
ISSN 1115 2540

EXPERIMENTAL INFESTATION OF RABBITS WITH AMBLYOMMA VARIEGATUM LARVAE: HOST EFFECTS ON LARVAL YIELD, ENGORGED WEIGHT AND ENGORGEMENT PERIOD

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ABSTRACT

Rabbits infested with Amblyomma variegatum larvae were not able to acquire a resistance which effectively inhibited their feeding. There was no significant difference in "larval yield", engorged weight and engorgement period of the larvae harvested from the primary, secondary and tertiary infestations. While environmental temperature had a marked influence on the "larval yield", engorged weight and engorgement period of the larvae, the sex of the rabbits did not affect them.

Short title: Infestation of rabbits with Amblyomma variegatum larvae.

Key words: Rabbits, larvae, resistance, engorge infestations; larval yield; Amblyomma variegatum

INTRODUCTION

The main method of controlling ticks of livestock in Nigeria is by the use of acaricides either as dips or sprays. Ticks are now becoming resistant to acaricide treatment. As a result of this experience, alternative methods of control are now being sought. Bagnall and Rothwell (1974), Branagan (1974), Roberts and Kerr (1976), Fujisaki (1978), Dipeolu and Harunnah (1984) and Amoo (1984) all established that laboratory hosts are able to acquire resistance to tick infestation.

The resistance mechanism tends to inhibit tick feeding and is manifested by both a decline in the number of ticks completing engorgement and a reduction in the weight of the engorged ticks. Norval (1975) found that ticks with long and deeply penetrating mouthparts (e.g. Hyalomma and Amblyomma), generally, are less susceptible to hosts' resistance mechanisms than superficially attaching short mouthed ticks (e.g. Boophilus and Rhipicephalus). This difference in susceptibility to host resistance mechanisms apparently arises from differences in the tick feeding mechanism.

In Australia, the tick B. microplus (Canestrini) had posed a big threat to the livestock industry with losses estimated at four to five dollars per animal annually (Wharton and Morris, 1980). Bos indicus (Zebu) was shown to have more resistance to the tick B. microplus than Bos taurus. As a consequence of this phenomenon, resistance to ticks associated with Bos indicus and the hybrid resulting from a cross between B. indicus and B. taurus. had become the basis for the control of B. microplus (Wharton, Utech and Sutherst, 1973; Powell, 1977; Sutherst and Utech, 1980).

A. variegatum is a known vector of Theileria mutans in Nigeria (Mohammed, 1974). T. parva causes East Coast Fever, a fatal disease of cattle in East Africa. It is estimated that 75% of cattle in Africa are infested with this parasite (Balashov, 1972; Mohammed, 1974). So far in Nigeria, T. mutans is latent but could be a threat in future.

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Since A. variegatum is also a vector of other parasites such as Cowdria ruminatum a thorough understanding of its host-parasite relationship in terms of resistance to tick infestation should be useful.

The aim of this experiment is to investigate the concept of resistance of rabbits to infestation by the larvae of A. variegatum and to see if the larvae can be made to induce resistance in rabbits.

MATERIALS AND METHODS

Eight New Zealand White rabbits aged 6 months and bred in the animal unit of the Faculty of Veterinary Medicine of the University of Ibadan were used for this experiment. The rabbits were housed in cages.

Ticks were bred directly from engorged female A. variegatum detached from cattle stationed in the Veterinary Control Post at Ibadan. Methods of breeding and maintenance are as described by Dipeolu and Ogunji (1977). In all experiments, the larvae of A. variegatum were maintained in an incubator at 25°C and 85% relative humidity. The larvae were fed on rabbits' ears enclosed in muslin ear-bags into which they dropped after engorgement. In the first experiment, 100 larvae were fed on one ear of the 8 rabbits. All rabbits were infested on the same day with larvae originating from the same female tick. Larvae of different ages were used at each infestation to ensure that any progressive seasonal changes in feeding could not be attributed to the physiological state (age) of the larvae. The larvae were 7 days old before using them for the experiments. They fed on the rabbits' ears for 7 days before the muslin bags were removed. The number and weight of the engorged larvae after each infestation were recorded. In all cases, six weeks were allowed to elapse between the completion of engorgement from one population and the application of the following batch of unfed larvae. The way resistance was expressed varied greatly, depending on the host and tick concerned. In this experiment, the total number of engorged larvae, the engorged weight and the length of the engorgement period of each infestation was recorded. Each rabbit was infested for three consecutive times, the first referred to as primary infestation (1°); the second, secondary (2°) infestation; and the third, tertiary (3°) infestation.

Results were analysed by analysis of variance and Duncan's Multiple Range Test (Snedecor and Cochran, 1973).

RESULTS

"Larval yield"

The 8 rabbits used for this experiment showed a wide range of "larval yield" (Table 1). The rabbits on which the lowest larval yield was recorded, were found to spend a longer time grooming. Rabbits 3 and 8 were found to have the lowest "larval yield" and each of them had ulcers on their ears as a result of larval bites. Table 1 shows that there was no significant decrease in "larval yield" in the three infestations.

It was observed that high temperature greatly affected the attachment of the larvae. Table 1 shows that the rabbits infected during the cooler months (July and August, when temperature were between 28°C and 30°C) had a higher larval yield than rabbits infected during the warmer months of the year (October and November when temperatures were between 32°C and 34°C) ($P<0.01$).

Engorged weight

There was no significant difference between the engorged weights of the larvae harvested from the primary, secondary and tertiary infestations (Table 1).

High temperatures also affected the engorged weights of the larvae. In the cooler months of July and August, the engorged weights of the larvae were greater than those recorded for the warmer months of October and November. Larvae which fed on

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rabbits that gave the lowest numbers of "larval yield" (Rabbit 3) generally had heavier weights than the others.

Engorgement Period

The engorgement period of the larvae on rabbits (Table 1) ranged between 7-15 days. There was no significant difference in the engorgement period in the secondary and tertiary infestations. It was observed that during the cooler months the female engorgement was shorter than during the warmer months.

DISCUSSION

Results indicate that the rabbits were not able to acquire a resistance which could effectively inhibit feeding of A. variegatum larvae. It was observed that variation in "larval yield" among rabbits was determined mainly by grooming behaviour of the individual rabbits. Rabbits that had ear ulcers were those that groomed more regularly. There was some degree of correlation between "larval yield" and the environmental temperatures which resulted in larvae attaching in greater numbers at lower temperatures.

Dipeolu and Harunnah (1984) had observed that rabbits acquired a resistance to infestation with adult A. variegatum after previous exposure to various developmental stages. They also found that the degree of acquired resistance was highest in rabbits on which adults and nymphs of A. variegatum had fed previously and lowest in those exposed only once to larvae. Similar reports on the acquisition of resistance by guinea pigs to infestations with Ixodes ricinus were made by Bowessidjaou, Brossard and Aeschlimann (1977) and with Dermacentor andersoni and D. variabilis by Allen (1973) and Wikel and Allen (1976). Allen (1973) and Wikel and Allen (1976), concluded that immunological mechanism was involved in triggering off the reduction in weight of ticks on resistant animals. From this experiment, it was confirmed that rabbits were unable to acquire detectable resistance to Amblyomma variegatum larvae. This agrees with the findings of Norval (1975, 1978).

Acquired resistance of cattle to tick infestation is extremely important in principle and has proved to be effective in the control of Boophilus microplus in Australia (Wharton, Utech and Sutherst, 1973; Powell, 1977; Sutherst and Utech 1980). Practical application of this will help in tick control. It is now widely used in Australia and in the United States to reduce acaricide applications especially when they are found ineffective in resistant tick populations.

From an ecological point of view, the inability of hosts to acquire an effective resistance to A. variegatum larvae is important as it allows the larvae to utilize a wide host range.

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Table 1. Feeding data for A. variegatum larvae in the three infestations on New Zealand white rabbits.

Criteria	Rabbit Number	1° Feeding (Mean ± SD)	2° Feeding (Mean ± SD)	3° Feeding (Mean ± SD)	Average ambient temperature (°C)
"Larval yield"*	1 -4 (July/August)	34.25 ± 9.18[a]	35.50 ± 9.00[a]	35.50 ± 10.41[a]	29.9
	5-8 (October/November)	15.00 ± 7.26[b]	15.50 ± 5.45[b]	15.25 ± 5.74[b]	32.6
Engorged weight (mg)	1-4 (July/August)	2.73 ± 0.15	2.68 ± 0.17	2.68 ± 0.10	29.9
	5-8 (October/November)	1.95 ± 0.24	1.93 ± 0.25	1.95 ± 0.13	32.6
Engorgement period (Days)	1-4 (July/August)	10.00 ± 2.45	10.00 ± 2.16	10.25 ± 1.71	29.9
	5-8 (October/November)	14.00 ± 0.82	13.00 ± 2.00	13.25 ± 1.26	32.0

*N.B.: "Larval yield": According to Roberts (1968) "larval yield" refers to the proportion of larvae which engorge to completion in an experimental infestation.

a,b: Seasonal "larval yields" were significantly different ($P<0.01$).

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