

Some Aspects of the Biology of Female *Rhipicephalus decoloratus* (Koch, 1844) in the Laboratory

Nkegbe Emmanuel, Julius Beyuo, Ohene Siaw Richard and Humphrey Amafu-Dey
Council for Scientific and Industrial Research (CSIR), Animal Research Institute,
P.O. BOX AH 20, Achimota, Ghana

Abstract: *Rhipicephalus decoloratus* infests a wide range of livestock. Control is mainly by acaricides based on a good knowledge of its reproductive life cycle. The ability of the control regime to effectively destroy the larvae, nymphs and the adults would enhance the success of the control strategy. Also the effectiveness of the control process is dependent on incorporating the effect of variations in physical parameters of the ecological zone and their effect on life cycle of the ticks. In this study, the life cycle of the tick was studied in the laboratory to maximize their survival and ascertain their possible maximum reproductive capacity so as to effectively develop the most acceptable acaricide control strategy for the tick. Engorged weight, fecundity, larval survival to adult tick, number of days for eggs to hatch to larvae and percentage survival of larvae to adult ticks were studied. Egg output per engorged female was 1720 to 3158 ($p < 0.05$), eggs needed 24 to 25 days ($p < 0.05$) to hatch to larvae and survival rate of larvae to adulthood was 25 to 47 ($p > 0.05$) per total number of eggs laid. Eggs output, hatching period did not differ from literature values. With this low survival rate, it should be possible to design an effective control strategy to reduce their menace on livestock production. We therefore concluded that current control methods especially, the use of acaricides based on the ticks reproductive life cycle should be maintained.

Key words: Acaricide, engorged, hatching, reproductive, tick, weight

INTRODUCTION

Rhipicephalus decoloratus (Koch, 1844) is also known as the blue tick because of the colour of the engorged females. It is the commonest and most wide spread and frequent of the one-host cattle tick in Africa (Walker *et al.*, 2003).

Cattle are the main host of this tick but it also feeds on horses, donkeys, sheep, goats and the preferred feeding sites of all stages on cattle are, back, upper legs, neck, shoulders, dewlap and the belly. These particular types of ticks exhibit monotropic type of behaviour.

The engorged females lay 1000-2500 eggs about one week after detaching from the host. It takes 3-6 weeks for the eggs to hatch into larvae. The larvae quest for the appropriate host and on host location attach, engorged and moult to nymphs on the host after one week. All the stages up to the adult attach to the same host. It takes about 2 weeks for the larval stages to reach the adult stage. The fully engorged and fertilized females detached after about a week to the ground to lay its eggs (Walker *et al.*, 2003).

The tick is found in West Africa, East Africa and Southern Africa. It is responsible for the transmission of Babesiosis in cattle and also Anaplasmosis as well as

Theileriosis. In heavy infestations, it may lead to dermatophilosis.

One major means of tick control is the use of chemical toxic acaricides. This however gives partially successful results. Also it is coupled with certain implicit drawbacks such as the presence of residues in the milk and meat, as well as development of chemical resistance ticks (Nolan, 1990; Willadsen and Kemp, 1988).

The use of acaricides is targeted at the stages of the tick's life cycle normally, the larvae and the feeding adults. Understanding therefore the life cycle should be advantageous in formulating the acaricide application methodology.

In this study, the reproductive life cycle of this tick was monitored in batches (same tick generation divided into cohorts) to determine engorged weight, egg mass weight and fecundity or egg number per ovipositing female, survivability of larvae to adult stage.

MATERIALS AND METHODS

Experimental stocks of *Rh. decoloratus* were supplied for the study by trained veterinary technicians of the Ministry of Food and Agriculture (MoFA) Ghana. To determine the engorged weights of the ticks they were

Table 1: Biological parameters obtained in the laboratory for *Rh. decoloratus* cohorts

<i>Rh. decoloratus</i>	Engorged weight (n = 8)	Egg no. (n = 6)	Egg output (mg) (n = 6)	(Hatch days) (n = 8)	Percentage survival (n = 6)	No. survived (n = 8)
Batch 1	266	3333	110	26	1.29	43
Batch 2	230	3212	106	26	1.58	51
Batch 3	178	2515	83	26	1.83	46
Batch 4	116	1909	63	24	1.46	28
Batch 5	133	1545	51	26	2.72	42
Batch 6	104	-	-	25	-	19
Batch 7	222	-	-	24	-	35
Batch 8	139	2121	70	25	1.23	26
Mean	174	2439.4	81	25.3		36.3
Standard Deviation	59	718.83	24	0.89		11.11
	p<0.05	p<0.05	p<0.05	p<0.05		p<0.05

weighed on electronic balance (ace ADAM AAA 250L), labeled singly into experimental vials with known masses, covered with muslin cloths, held in place by rubber bands. They were then placed in experimental breeding troughs made of unused laboratory desiccators. Petri dish containing wet filter pads was placed in the bottom to maintain constant high humidity. 10:12 day and light periods were maintained for the samples.

They were monitored daily till eggs were laid. The dead, dried ticks were removed by a pair of forceps while the egg mass was weighed and total egg laid calculated by dividing by a predetermined laboratory formula for total number of eggs.

The vials were covered back and monitored till the eggs hatched into larvae. After one week, the larvae were fed in vivo on naive cattle. Corsets of diameter 25cm and sleeve length of 40 cm were attached on the flanks of the cattle.

Two corsets were attached to each experimental animal by holding them in place by adhesives. The attached larvae were monitored till engorged adult females dropped. These were picked to the laboratory and the breeding process repeated. Each study batch contained 100 adult female ticks.

Statistical analysis: Biological data obtained were subjected to mean values, Standard Deviations and the various batches subjected to Analysis of variance (ANOVA) using SPSS.

RESULTS AND DISCUSSION

Engorged weight: An engorged weight for adult female was found to be between 115 to 233 mg (Table 1).

Egg output: Fecundity or eggs produced by an ovipositing tick was between 1500 to 3300.

Hatching period: The eggs took between 24 to 26 days to hatch into larvae (Table 1).

Survivability (%): Survivability was very low for the experimental ticks. Only about 1 to 2% of the ticks survived from larval stage to adulthood (Table 1).

Ticks and tick-borne diseases threat are approximately 80 percent of the world's cattle production. *Rhipicephalus* ticks are among the important, if not the most important ticks affecting the economics of cattle productivity by disease transmission and weight loss (Sutherst, 1987; Ellis, 1986).

Understanding the life cycle of the tick enables us to design an appropriate control strategy. Understanding the life cycles gives a fair idea about the point along the transmission cycle which is vulnerable and when attack can cause derailment of the parasite transmission cycle. In the use of acaricides, one wants to harm as many larvae, nymphs and adults as much as possible to reduce transmission loads. Where completion of parasite life is short, then the acaricide should be geared towards a single application method that causes enough casualties but where a longer life cycle is maintained, multiple acaricide application can be effected.

In previous study conducted by Walker *et al.* (2003), they found out that engorged females lay 1000-2500 eggs in about one week after detaching from the host and takes 3-6 weeks (21-42 days) for the eggs to hatch into larvae. The findings from our present study showed that the engorged females lay 1500 to 3300 eggs after detaching from the host and hatch within 24 to 26 days into the larvae. These agreed with the findings of Walker *et al.* (2003) and the wider ranges found in hatching days might be due to several reasons.

Optimal environmental conditions, (relative humidity of 78-80% and laboratory temperature of 20-25%) for growth and multiplication of ticks were provided and maintained constant and so the effects of fluctuating temperature and low relative humidity which could result in dehydration of the ticks leading to low number of eggs being produced and hatched were reduced. Again the size of the feeding cloth in which the ticks were put and attached to the host was larger enough to reduce intra-competition among the ticks for feeding space.

From the results of our findings, notwithstanding the higher number of eggs laid by the engorged females, the study showed that the number of larvae that survived to adult ticks were low. Thus, only a few number and percentage of ticks survived up to adulthood. Factors that might have militated against higher survival rate of the ticks to adulthood included a greater number of the hatched eggs being males, or unfertilized eggs, competition among the larvae in the feeding cloths resulting in some deaths.

CONCLUSION

We therefore, concluded that since the experimental values obtained did not differ from the existing literature values, the current control strategy of the use of acaricides based on the ticks' life cycle be maintained.

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