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Effects of temperature and relative humidity on the egg laying pattern of *Rhipicephalus sanguineus* (Koch, 1844) infesting sheep in semi-arid region of Nigeria

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Abstract
The ovipositional pattern of fully engorged adult female *Rhipicephalus sanguineus* infesting sheep was studied under belljar conditions of mean ± SD (range) temperature of 25.4±2.16 (23-29^{o}C) and relative humidity 90% and ambient conditions of 26.4±2.4 (23.6-31.6^{o}C) and relative humidity 63.0±3.93 (51.3-72%). The pre-oviposition days under belljar conditions (11.1±9.15) was significantly shorter ($p<0.05$) than ambient conditions (14.5±14.9 days), each having post oviposition weights of 0.11±0.04 grams and 0.17±0.012 grams respectively, indicating a decrease in weight of the ticks after oviposition. The mean ±SD oviposition period (days) was shorter ($p>0.05$) under belljar (22.3±9.69) than ambient (23.7±10.7) conditions with the total mean ± SD number of eggs laid under each condition as 1021.9±1082.4 and 1096.9±1173.0 respectively ($p<0.05$). The peak oviposition period was day 13 for belljar and day 16 for ambient conditions each with mean ± SD egg lay of 2100 and 2260, and peak total of 3936 and 3610 eggs respectively. It is concluded that the ovipositional behaviour of *Rh*. *sanguinues* could be influenced by temperature and humidity changes.

Keywords: egg-laying pattern, humidity, *Rhipicephalus sanguineus*, semi-arid, Nigeria, temperature.

Introduction

Ticks with approximately 850 species, described worldwide as blood sucking ectoparasites of mammals, birds and reptiles transmit a variety of disease causing pathogens that include bacteria, rickettsia, protozoans and viruses that are associated with production losses and death (Irshad *et al*., 2010). The importance of ticks relies on their capacity to successfully multiply and establish in their environment, with ability to transmit diseases to their host and to maintain their physiological requirements (Akinboade, 1986; Adejinmi, 2011).

Extrinsic factors such as rainfall, humidity, temperature, floods, winds and physical damage affect the success of their reproductive performance and survival upon detachment from their hosts (Dipeolu, 1984; Adejinmi, 2011); and their response to these factors remarkably determines their preponderance and abundance in the environment.

Rhipicephalus sanguineus is a parasite of dogs that can occasionally parasitize other hosts including sheep due to the close association of these animals with heavily infested dogs and highly infested environments such as in this study area. More so, *Rh*. *sanguineus* has been described as a catholic tick, being able to adopt different strategies for survival, as needed (Dantas-Torres, 2010)

In this paper the ovipositional pattern of *Rhipicephalus sanguineus* as affected by changes and the temperature and relative humidity is described.

Materials and methods

Fully engorged adult female *Rhipicephalus sanguineus* were collected by hand picking from infested sheep, put into specimen bottles and transported to the Parasitology Laboratory of the Faculty of Veterinary Medicine, University of Maiduguri, Nigeria, where they were identified using morphological features that include hypostomal teeth, adanal shields, anal grooves, hexagonal basis capitulum and the wider than long rostrum as described by the methods of Soulsby, (1982) & Walker *et al.,* (2007).

Twenty fully engorged adult female *Rhipicephalus sanguineus* were individually weighed to obtain 1 gram using a sensitive Sartorius Balance Type 2472. Ten of each tick were reared in separate clean glass test tubes plugged with cotton wool at ambient temperatures of 26.9±2.44 (23.6-31.6 ^{o}C) and relative humidity of 63.0±3.93 (51.3-72%) and bell jar temperature of 25.4±2.16 (23-29.6 ^{o}C) and relative humidity of 90% obtained using saturated solution of potassium chloride as described by Basu & Haldar (2008).

Oviposited eggs were collected daily using a fine hair brush spread over a clean petri-dish and counted using a digital counter with the aid of a hand lens.

The post oviposition weight, preoviposition, oviposition and peak egg lay periods in days, and the total number of eggs laid and the peak total lay were recorded as mean ± standard deviation.

Results

The results of this study as shown in Table 1 indicated that ticks maintained at ambient relative humidity (RH) of 63.0±3.93 (51.3-72%) and temperature of 26.9±2.44 (23.6-31.6^{o}C) had a preoviposition period of 14.5±14.9 (4-54days), oviposition period of 23.7±10.7 (9-32days), total number of eggs laid as 1096.9±1173.0 (0-4142), peak period at day 16, peak total of 3610 eggs, and a post oviposition weight of 0.17±12 grams. Similarly the table also shows that ticks maintained under dessicator conditions of 25.4±2.16 (23-29.6^{o}C) and 90% RH had a preoviposition period of 11.1±9.15 (6-36 days), oviposition days of 22.3±9.69 (9-39), total number of eggs laid as 1021.9±1082.4 (0-3410), peak period at day 13, peak total lay of 3936 eggs and a post oviposition weight of 0.11±0.04 grams.

Table 1: Ovipositional data of *Rhipicephalus sanguineus* based on temperature and relative humidity conditions

Parameters	Experimental Conditions	
	Ambient	Belljar
Pre oviposition weight (g)	1.0	1.0
Post oviposition weight (g)	0.17±0.12	0.11±0.04
Pre oviposition period (days)	14.5±14.9 (4-54)	11.1±9.15(6-36)
Oviposition period (days)	23.7±10.7 (9-32)	22.3±9.69(9-39)
Peak egg lay period(day)	Day 16	Day 13
Peak total lay	3610	3936
Total number of eggs laid	096.9±1173.0 (0-4142)	21.9±1082.4 (0-3410)
Temperature (^{o}C)	26.9±2.44 (23.6-31.6)	25.4±2.16 (23- 29.6)
Relative Humidity (%)	63.0±3.93 (51.3-72)	90

Discussion

The findings in this study have shown that variations in temperature and relative humidity conditions on exposed *Rhipicephalus sanguineus* influenced their preoviposition and ovipositional periods. This agrees with the reports by Adejinmi & Akinboade, (2011) attributing low temperature and humidity values for increase in the length of preoviposition and oviposition periods. However, Soulsby, (1982) has reported that under field conditions in the tropics significantly from those under ambient conditions indicating a positive correlation between these values and extrinsic factors of temperature and the preoviposition period is between 6-24days, while the female could lay upto 4000 eggs . These values contradict those in this study due to the lower values of temperature and relative humidity. Ixodid ticks generally could be 10,000-20,000 eggs under favouarble conditions depending on temperature, humidity, tick strain and body weight (Tamirat *et al.,* 2009; Binni *et al.,* 2010). The peak period and total number of eggs laid under belljar conditions differ humidity reported to influence the reproductive performance of ticks (Adejinmi, 2011). In general high temperature increases the rate of

poikilothermic organisms which in turn increases the rate of physiological processes involved in production leading to fluctuations in preoviposition and ovipositional periods (Binni *et al*., 2010; Dantas-Torres, 2010). In conclusion, the response of ticks to these factors remarkably determines their preponderance and abundance in the environment.

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