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Biological Studies on the Brown Dog Tick, *Rhipicephalus sanguineus* (Latreille)

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ABSTRACT

Rhipicephalus sanguineus (Latreille, 1806) was reared under laboratory conditions of 27± 3° C and 75± 5% R. H., for three generations. The mean of life cycle duration was 41- 73 days. The conversion efficiency index (CEI) was 0.3130± 0.173, the reproductive efficiency index (REI) was 33257.9± 14895.7 and the reproductive fitness index (RFI) was 9288.6 ± 4481.9. The males/ females ratio was 1.1:1. Females fed for 9± 1.16 days. Pre-oviposition and oviposition periods were 4.0± 0.81 and 7.5± 1.72 days respectively. Number of oviposted eggs per female averaged 4598± 429.7. A positive correlation was observed between the weight of engorged female and number of its deposited eggs (r= 0.76). However, the highest number of eggs was recorded on the 4th day (1751 eggs/ female). Pre- hatching period was 15± 1.87 days and hatching rate was 92.4 %. Larvae and nymphs feeding periods were 4.5± 1.16 and 5.5± 1.12 days respectively,.

Key Words: *Rhipicephalus sanguineus*, Ixodidae, Life cycle, Biological parameter.

INTRODUCTION

Ticks (Acari: Ixodidae) are ectoparasites of great medical-veterinarian importance. As blood-feeding parasites, they cause direct damage to the infested animals due to their feeding behavior. They are implicated in the transmission of different pathogens (protozoa, bacteria, viruses and filarial nematodes), that cause tick-borne diseases affecting companion animals and humans (Azad and Beard, 1998; Jongejan & Uilenberg, 2004 ; Parola *et.al.*,2005 and Dantas-torres,2007). Although *Rhipicephalus sanguineus* (Latreille, 1806) feeds primarily on dogs (Evans *et,al.*, 2000), it can be found on a diverse range of wild and domestic animals, including humans (Estrada-peña and Jongejan, 1999; Dantas-torres *et.al.*, 2006). Accordingly, *R. sanguineus* is a competent vector of several pathogens causing diseases to dogs like *Babesia vogeli*, *Ehrlichia canis* and *Hepatozoon canis*. Also, ticks cause diseases to humans such *Rickettsia conorii* and *R. rickettsii* (Dantas-torres, 2008). Furthermore, it has been suggested that *R. sanguineus* could be involved in the transmission of several other pathogens such as, *Anaplasma platys* (Simpson *et. al.*, 1991) and *Leshmania infantum* (Coutinho *et. al.*, 2005). Although, a number of studies on the biology and ecology of *R. sanguineus* have been conducted in different parts of the world, there are still further investigations regarding the biology and ecology of this species. Therefore, life cycle of *R. sanguineus* under controlled laboratory conditions was conducted in this study.

MATERIALS AND METHODS

Tick collection and identification:

Adult ticks were manually collected from dogs at the Experimental Station Farm (Abies), Faculty of Agriculture, Alexandria University. Ticks were placed individually into clean plastic vials and identified using the diagnostic keys and species description of walker *et. al,.* (2000).

Colonization:

R. sanguineus adults were colonized for three generations under laboratory conditions (darkened incubator at 27± 3°C and 75± 5 % RH). Larvae, nymphs and adults were fed on domestic rabbits using capsule technique.

Biological parameters assessed:

The following biological parameters were recorded: engorged female weight; pre-oviposition period; oviposition period; pre-molting period; feeding periods of larvae, nymphs and adult females; egg mass weight; Conversion efficiency index (CEI), (weight of eggs/ weight of engorged female), Reproduction efficiency index (REI), (number of eggs/ weight of the engorged female), Reproductive fitness index (RFI), (number of hatching eggs/ weight of the engorged female) and egg incubation period.

RESULTS AND DISCUSSION

Biological parameters recorded for *R. sanguineus* fed on rabbits and maintained under laboratory conditions (27±3°C and 75±5 % R.H.), for three laboratory generations, are shown in tables (1&2).

Adult stage: The female completed feeding in 9.0 ±1.16 days (7-10 days). The duration of the pre-oviposition period based on 15 females was 4.0± 0.81 days.

Oviposition period: The mean of oviposition period was 7.5 days (5-10), and that of eggs laied

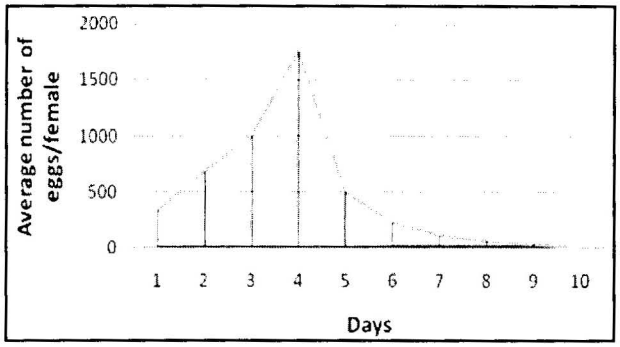

Fig. (1): Daily average oviposition of *R. sanguineus* maintained at 27°C and 75 % R.H.

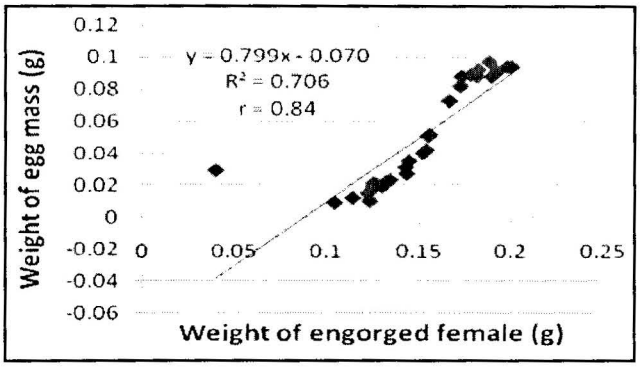

Fig. (2): Relationship between weight of eggs and weight of engorged females of *R. sanguineus.*

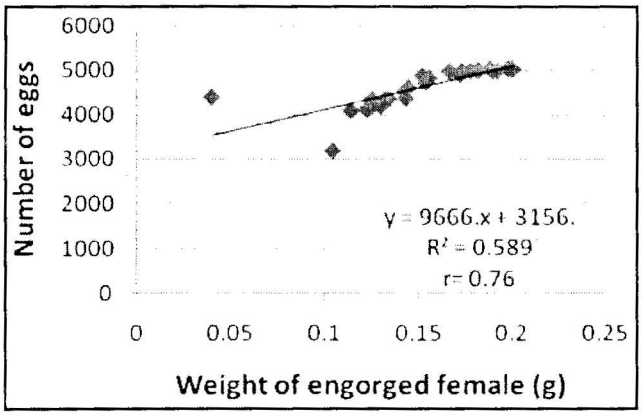

Fig. (3): Relationship between number of eggs and weight of engorged females of *R. sanguineus.*

Table (1): *Rhipicephalus sanguineus* life cycle duration under laboratory conditions (27± 3°C and 75± 5 % R.H.) fed on domestic rabbits

Stage	Duration (days)	
	range	mean± SD.
Pre-oviposition	3- 5	4± 0.81
Oviposition	5- 10	7.5± 1.72
Prehatching period	10- 20	15± 1.87
Feeding larvae	3- 6	4.5± 1.16
Pre-molting larvae	10- 14	11.6± 1.41
Feeding nymphs	4- 7	5.5± 1.12
Pre-molting nymphs	9- 16	12.5± 2.09
Feeding female	7- 10	9±1.16

Table (2): *R. sanguineus* females biological parameters

Biological parameters	Range	Mean ±SD.
Weight of engorged females (gm)	0.0399- 0.2001	0.149± 0.034
Number of eggs laid/ female	3200- 5045	4598± 429.7
Pre-oviposition period (days	3- 5	4± 0.81
Oviposition period (days)	5- 10	7.5± 1.63
Egg mass weight (gm)	0.009- 0.097	0.049± 0.032
Egg hatch rate (%)	76.4- 99.5	92.4±7.389
REI	25137.4- 34804.4	33257.9± 14895.7
CEI	0.081- 0.515	0.3130± 0.173
RFI	43418.9- 57356.5	9288.6± 4481.9

REI: The index of Reproduction Efficiency.
CEI: The index of Conversion Efficiency.
RFI: The index of Reproduction Fitness.

per female was 4598± 429.7. The mean daily oviposition rate is presented in (Fig.1). Oviposition proceeded rapidly reaching a peak on the 4th day (1751 eggs/female), then declined thereafter. A positive correlation was found between the numbers of eggs laid and the weight of the engorged females (r= 0.76), (Fig. 2). A positive correlation was also found between the weight of the egg mass and the weight of the engorged females (r= 0.84), (Fig. 3).

Eggs: Mean of pre-hatching period (incubation) was 1.0 ± 1.87days (10- 20 days).

Immature stages: The larval feeding period was 4.5± 1.16 days (3- 6 days). Mean of larval pre-moulting period was 11.6± 1.41 days (10- 14 days). Nymphs fed for 5.5± 1.12 days (4- 7 days), and its pre-moulting period was 12.5 ± 2.09 days (9- 16 days).

The life cycle of *R. sanguineus* ranged between 41- 73 days under laboratory conditions (Table 1). Male/ female sex ratio was 1.1: 1. The percentage of nymphs molted to males (52.5%) was slightly higher than that molted to females (47.5%).

R. sanguineus is a three-host tick that is, each active developmental stage (larva, nymph and adult) feeds only once. The life cycle was studied under laboratory conditions. The pre-oviposition period at 27°C was 4.0± 0.81 days, similar to the same periods (3.8±1.1 days) at 26±1°C reported by Dantas-Torres and Otranto (2011), as they indicated

this period was longer in females exposed to low temperatures.

Oviposition reached its peak on the 4th day, and sharply declined through the remaining oviposition period. Ixodid ticks are well-known for their prolific reproductive capacity. The number of eggs laid per female (averaged 4598) is higher than previously recorded by Dantas-Torres *et. al.*, (2010). This may be due to the heavier engorgement weights of the females.

Significant linear relationship was found between the weight of engorged female of *R. sanguineus* and the number of egg masses laid (Figs. 2&3), this was also reported by Dantas-Torres *et. al.*, (2010a). Also, there was a positive relationship between CEI, REI and RFI and the weights of the females (Table 2). Dantas-Torres *et. al.*, (2010a) reported similar correlations for *R. sanguineus.*

The mean prehatching period of *R. sanguineus* eggs at 27°C was 15± 2.95 which was longer than that reported by Dantas-Torres *et. al.*, (2010b) at 26°C and was shorter than that reported by Dantas-Torres *et,al.* (2010a) for the same species and under the same temperature.

Males slightly out-numbered females (1.1:1) in our study. The sex ratio of *R. sanguineus* ticks collected from dogs is usually male-biased (Dantas-Torres *et. al.*, 2009) due to the fact that males remain longer on the host than females.

In conclusion the of life cycle duration under laboratory conditions (41-73 days) lasts shorter than that reported for the same species (101.4 days) at 26°C (Dantas-Torres *et,al.,* 2010a). In favorable conditions, the life cycle can be completed in 63-91 days (Goddard, 1987; Bechara *et,al.*, 1995; Louly *et,al.*, 2007). Under laboratory conditions, the biological parameters of *R. sanguineus* ticks vary greatly with temperature, relative humidity and host type (Bellato and Daemon, 1997).

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