Indian Journal of Animal Sciences **83** (4): 357–359, April 2013/Article

Bionomics of ixodid ticks of ruminants in Namakkal, Tamil Nadu, India

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Received: 25 January 2012; Accepted: 10 October 2012

ABSTRACT

The bionomics of 4 ixodid ticks viz. *Hyalomma marginatum isaaci*, *Boophilus microplus*, *Rhipicephalus haemaphysaloides*, and *Haemaphysalis bispinosa*, was were studied under laboratory condition. Soviet Chinchilla rabbits were used as host for all species of ticks except for *Boophilus microplus*. For the latter one, crossbred calves were used as host. In this study, various feeding and reproductive parameters such as feeding, moulting, preoviposition and oviposition periods, engorgement weight and egg rate conversion efficacy (ERCE) of female ticks at temperature of 33.16–34°C and RH 68.7–78.48% were observed. There were significant differences in the larval and nymphal moulting period among 1 host, 2 host and 3 host ticks. The engorgement and egg mass weight of *Hyalomma marginatum isaaci* was higher than the other 3 ticks. The ERCE was > 60% in *Hyalomma marginatum isaaci* and *Haemaphysalis bispinosa* whereas < 50% in *Boophilus microplus* and *Rhipicephalus haemaphysaloides*. The minimum time required for each species to complete one life cycle was as follows : *Hyalomma marginatum isaaci*,73–82 d; *Boophilus microplus*, 45–57 d; *Rhipicephalus haemaphysaloides*, 81–88 d; and *Haemaphysalis bispinosa* 67–73 d. The tick *Hyalomma marginatum isaaci* on one occasion behaved as 3 host tick, but mostly as 2 host tick otherwise in 3 experiments conducted.

Key words: Bionomics, *Boophilus microplus*, *Haemaphysalis bispinosa*, *Hyalomma marginatum isaaci*, *Rhipicephalus haemaphysaloides*,

Ticks, important ectoparasites of ruminants, besides causing direct injury to the host, transmit many diseases to animals and man leading to heavy economic losses in the livestock industry in developing countries like India (Steelman 1976). A control programme to eradicate ticks must be based upon their biology as they show extreme variations in each stage (Nunez 1985), largely depending on the temperature and relative humidity prevailing in a particular region (Dantas – Torres 2010). Owing to climatic changes, it is being anticipated that incidence of ticks and tick-borne diseases will be on rise in coming years in tropical countries. Information pertaining to bionomics of all common ticks affecting livestock is not available at one source. Generally, works carried out in abroad are being referred to get information related to biology of tick, but this may not be correct to adopt suitable control measures because our tropical climatic conditions may favour ticks to grow at a faster rate than temperate region. So, the aim of this study was to find out life cycle duration of common tick species affecting ruminants in Namakkal.

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MATERIALS AND METHODS

Maintenance of tick colonies: Engorged adult females of different tick species were collected from naturally infested ruminants. The ticks were kept individually in glass vials for oviposition and hatching under room temperature. The questing larvae, nymph and adult ticks were maintained in biological oxygen demand (BOD) incubator at 18° C temperature and 85% relative humidity until use.

Tick feeding

The larvae (100), nymph (50) and adult stages (15 pairs) of *Hyalomma marginatum isaaci*, *Rhipicephalus haemaphysaloides* and *Haemaphysalis bispinosa* were allowed to feed on Soviet chinchilla rabbits by ear bag method, while cattle tick *Boophilus microplus* larvae (100) were introduced on crossbred calves. Ear bags were opened daily in the morning and evening hours to monitor tick attachment, dropping of fed ticks, pairing of male female, and larval and nymphal moulting in 1 and 2 host ticks. The fed larval and nymphal tick stages were collected, counted and kept whole daily collection in vials at room temperature for moulting, whereas, fed female ticks were weighed and kept in an individual vial for oviposition. In this study, feeding, moulting, preoviposition and oviposition periods,

engorgement weight and egg mass weight were recorded. The egg rate conversion efficacy of the female ticks was arrived using formula as follows (Chilton 1992)

$$\frac{\text{Egg mass weight}}{\text{Engorgement weight of the tick}} \times 100$$

Meteorological data: During the study period data related to temperature, relative humidity and rainfall were obtained from climate observatory section of the college.

RESULTS AND DISCUSSIONS

During the study period Namakkal, where the present study was undertaken, experienced temperature ranging 33.16 –34°C, relative humidity: 68.7–78.48% and 91 mm rainfall for 12 months from October 2008 to October 2009. The data recorded pertaining to feeding and reproductive parameters of ticks in the present study are shown in the Table 1. The biology of different tick species studied was discussed separately.

Hyalomma marginatum isaaci: In the present study, *Hyalomma marginatum isaaci* behaved like 2 host tick barring one experiment. Here, the larvae fed, moulted to nymph on the animal body, which then fed and dropped. The engorged nymph moulted to adult under laboratory condition. This 3 host tick behaviour may be due to ageing of larvae due to prolonged storage in BOD. These observations are in agreement with findings of Latha *et al.* (1998) who observed 3 host behaviour in *Hyalomma* spp when rabbits were used as host, while Apanaskevich (2004) reported that *H. marginatum* behaved as 2 host tick. However, the feeding and reproductive parameters of tick recorded in the present study do not corroborate with findings of Ponnudurai *et al*. (2007) who recorded a short adult feeding period (7.6±0.34 days) with an increased engorgement weight (480±30.38 mg), preoviposition period (10±0.21days), oviposition period (11±0.19 days) and egg mass weight (347.78±18.43 mg) in ticks from control group while studying effect of immunization on tick biology in crossbred calves immunized with midgut antigen. These differences might be attributed to animal species used as host because, larvae and nymph of *Hyalomma marginatum isaaci*. ticks prefer to feed on small mammals (hare) while adult prefers to feed on ruminants (Geeverghese and Dhanda 1987). It is presumed that since in the earlier study, crossbred calves, a natural host of *Hyalomma marginatum isaaci,* were used as host, ticks were able to suck more blood in a short feeding time. This was later expressed as better reproductive performances. In the present study, *Hyalomma* tick required minimum time of 73 – 82 days to complete one life cycle. This finding is not in consonance with Taylor *et al*. (2007) who reported that *Hyalomma* ticks took 98 and 128 days respectively to complete life cycle from egg to egg. The difference in the number days required for completion of its life cycle might be due variations in the climatic conditions of place where study was carried out. Galila and Ahmed (1988) who noted that temperature variation had a marked effect on tick biology.

Boophilus microplus: In this study, all the developmental stages, viz. larvae, nymph and adult ticks fed on a single host as reported by Johnston *et al*. (1986) and Ghosh and Khan (2000b). However, a significant difference in the time taken for completion of one life cycle was observed between present study and earlier studies. In this study, *Boophilus microplus* took minimum time of 6 – 9 weeks for completion of one life cycle, whereas Soulsby (1982) reported that it was 5–40 weeks. The engorgement weight of female in the present study (118.65±28.22 mg) is much lower than the observation of Londt and Arthur (1975) who recorded 240 mg as engorgement weight of female *B. microplus* ticks in South Africa. Similarly Ivancovich (1975) reported that environmental factors have a definite influence on the duration oviposition period and he recorded 27 days in

Table 1. Feeding and reproductive parameters of ixodid ticks of ruminants (mean±SD)

Parameters	Tick species			
	Hyalomma marginatum isaaci	*Boophilus microplus*	*Haemaphysalis bispinosa*	*Rhipicephalus haemaphysaloides*
Larval feeding period (days)	2.7±0.2	2.2±0.7	3.7±0.3	3.9±0.7
Larval moulting period (days)	3.6±0.5	2.1±0.9	10.2±0.7	10.7±0.1
Nymphal feeding period (days)	8.8±1.3	5.5±0.6	4.1±0.6	5.9±1.6
Nymphal moulting period (days)	15.5±2.12	3.9±0.2	13.5±1.0	15.7±0.6
Adult feeding period (days)	9.3±2.2	6.4±3.1	7.3±1.3	8.2±1.4
Engorgement weight (mg)	339.6±75.6	118.6±28.2	120.1±27.4	166.8±68.5
Preoviposition period (days)	5.3±0.9	3.8±0.4	4.1±0.4	4.9±0.9
Oviposition period (days)	8.7±0.7	5.1±0.6	5.7±1.0	13.3±1.5
Egg mass weight (mg)	226.1±52.3	58.0±19.7	76.7±19.1	81.3±15.3
Incubation period (days)	23.0±1.4	20.2±1.2	21.0±1.7	23.0±1.4
Egg rate conversion efficacy (%)	66.59	48.91	63.88	48.73
Duration of life cycle (days)	73 –82	45 – 57	67 – 73	81 –88

August, 9–10 days in June, but in the present study it was 5.17±0.65 days. These differences might be chiefly due to climatic variations.

Rhipicephalus haemaphysaloides: In the present study, each developmental stage of tick fed on different host and required minimum time of 81 – 88 days to complete one life cycle. The feeding and reproductive parameters observed in this study are not akin to the findings of Kavitha *et al*. (2007) who observed a short adult feeding time (5.42±0.09 days) with an increased engorgement weight of female (344.65±11.83 mg) and egg mass weight (241.04±11.79 mg) despite of the fact that same species of animal was used as host. The above study was carried out at Chennai, since it is located near the coast of Bay of Bengal, where temperature and relative humidity is higher than Namakkal. This could be the reason for a marked variation in the biology of ticks from 2 different places within a state. Aforementioned fact is evident from the findings of Dantas – Torres (2010) who demonstrated that *Rhipicephalus sanguineus* ticks exposed to high temperature attach and feed on rabbits more rapidly. The biology of *R.haemaphysaloides* observed by us is more or less identical to the biology of *Rhipicephalus bursa* by Soulsby (1982) who reported that *R.bursa* is a 3 host tick, larval feeding (3–7 days), larval moulting (10–49 days), nymphal feeding (3–7 days), nymphal moulting (10–61 days), adult feeding (4–10 days) and incubation period (28 days).

Haemaphysalis bispinosa: In this study, each stage fed on 3 different hosts and behaved as 3 host ticks. Though, the genus of the tick is same, the feeding parameters of *H. bispinosa* observed in the present study is not in agreement with observation of Labruna *et al*. (2000) observed an increased larval feeding period (8.0±3.7 days), nymphal feeding (8.1±1.4 days), adult female feeding (20.9±5.9 days) and incubation (33 – 34 days) while studying the life cycle of *H. leporis – palustris* under laboratory condition. However, larval and nymphal moulting and preoviposition periods are as that of what was observed in the present investigation. Soulsby (1982) mentioned that *Haemaphysalis longicornis* required minimum time of 94–213 days to complete one life cycle, whereas in the present study *H. bispinosa* required 67–73 days as minimum time to complete life cycle.

The biology of various species of ticks is largely determined by the temperature and relative humidity prevailing in a particular region. However, host species used for feeding also determines the feeding period and engorgement weight of the female ticks.

ACKNOWLEDGEMENT

The authors are very grateful to the Dean, Veterinary College and Research Institute, Namakkal for the facilities provided to carry out the work

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