

Reproductive Aspects of *Haemaphysalis leporis-palustris*

Marcelo Bahia Labruna⁺, Romário Cerqueira Leite

Departamento de Medicina Veterinária Preventiva, Escola de Veterinária, Universidade Federal de Minas Gerais, Caixa Postal 567, 31270-901 Belo Horizonte, MG, Brasil

The adult stage of Haemaphysalis leporis-palustris was studied. Two infestations consisted of male and female ticks on two rabbits (Oryctolagus cuniculus). Other two infestations consisted of only female ticks on two O. cuniculus. Females fed without males showed differences in some biological parameters when compared to females fed with males. Parthenogenesis is reported for the first time by one H. leporis-palustris female.

Key words: *Haemaphysalis leporis-palustris* - Ixodidae - biology - parthenogenesis

Few tick species reproduce successfully by parthenogenesis, as *Amblyomma rotundatum* in the tropical and subtropical areas of New World and some populations of *Haemaphysalis longicornis* in Oceania and East Asia. Therefore the majority of Ixodidae and Argasidae species are normally bisexual. Sporadic parthenogenesis is reported in normally bisexual tick species: *Ornithodoros verrucosus*, *O. papillipes*, *O. moubata* (Balashov 1972), *Dermacentor variabilis*, *Boophilus microplus*, *Hyalomma anatolicum*, *Rhipicephalus bursa*, *Amblyomma dissimile* (Oliver 1989), *B. microplus* (Ribeiro & Gonzales 1980). The present work is about the biology of the adult stage and verifies the occurrence of parthenogenesis in a tick sample from a normally bisexual population of *H. leporis-palustris*.

MATERIALS AND METHODS

Ticks - A laboratory colony of *H. leporis-palustris* was established from an engorged nymph and an adult male collected from a rabbit *Sylvilagus brasiliensis* live-trapped on Belo Horizonte, State of Minas Gerais. Ticks were indentified as *H. leporis-palustris* (Packard 1869) according to Cooley (1946). Ticks were taken to a biochemistry oxygen demand (B.O.D.) cabinet at 27°C and relative humidity superior to 85%, where the engorged nymph molted to a female. Some days later this female and the male were allowed to feed on a rabbit *Oryctolagus cuniculus*. After natural detachment from the rabbit the engorged female laid eggs that produced a generation of larvae. This generation of ticks was used in successive infestations on

O. cuniculus and *S. brasiliensis* in laboratory originating engorged nymphs. Each individual engorged nymph was observed for molting in the B.O.D. cabinet. Ticks were identified according to the sex on the day that each one completed molting to adult. Adult males were put in a covered tube labelled as Y and adult females were put in another covered tube labelled as X. When adult ticks were 8 to 20 days old, and no adult had had contact with adults of the other sex, 12 males were put together with 14 females in another covered tube labelled as X+Y. This was the first contact of adult males with adult females. Eleven males remained in the Y tube and 15 females in the X tube.

Infestations - When adults were 18 to 30 days old, they were used in 4 infestations, each one on a different *O. cuniculus* with no previous tick infestation. Infestation 1: 10 males and 7 females from the X+Y tube were allowed to feed on an *O. cuniculus*. Infestation 2: 7 females from X+Y tube were allowed to feed on an *O. cuniculus*. Infestation 3: 10 males from Y tube and 7 females from X tube were allowed to feed on an *O. cuniculus*. Infestation 4: 7 females from X tube were allowed to feed on an *O. cuniculus*.

Each *O. cuniculus* was observed daily for engorged female natural detachment. Records were made of the parasitic time in days for each engorged female and its weight in an electronic balance. On the same day, the females were individually transferred to a B.O.D. cabinet under the same conditions mentioned above where they were observed for pre-oviposition and oviposition periods. If females oviposited, their egg output was observed daily in the B.O.D. cabinet to determine the incubation period and the hatching period. The incubation period consisted of time taken from the first day of oviposition until the first emergence of larva from the total egg output of each female. The hatching period consisted of time from the emergence

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⁺Corresponding author. Fax: +55-31-441.9918

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of the first to the last larva from the total egg output of each female. The hatching success of eggs (% hatching) was determined in 5-5% intervals by visual estimating of hatched eggs in a stereoscopic microscope, according to Leite (1988). The index of reproductive efficiency (IRE) was calculated for the females that layed eggs, according to the formula (Deamon & Freire 1984):

$$IRE = \frac{\text{total egg output weight (g)}}{\text{total female weight (g)}} \times 100$$

RESULTS

The engorged females recovered in each infestation and the parasitic period and non-parasitic data from these females and their egg output are presented in Tables I, II, III and IV.

DISCUSSION

Females from infestations 2 and 4 parasitized for a longer period but engorged less than those from infestations 1 and 3. It probably resulted from the absence of males during the feeding period in infestations 2 and 4. This agrees with the findings of Balashov (1972), Norval et al. (1980), Ribeiro and Gonzales (1980), Ntiamoa-Baidu (1987), Oliver (1989), working with various ixodid *Metastricata* species. Balashov (1972) said that absence of males during *Metastricata* female feeding increases the slow feeding period and there is no defined rapid feeding period as in copulated female feeding. This author also said that many of the females fed without males laid fewer eggs than females fed with males. Balashov (1972) said that ovary enlargement is slow in non-copulated females and when these females detach, their ova-

TABLE I
Parasitic and non-parasitic data of *Haemaphysalis leporis-palustris* females recovered from infestation 1 on *Oryctolagus cuniculus* and egg data from these females

Infestation 1: 10 males and 7 females from the tube X+Y									
Females	Parasitic time (days)	Engorged weight (mg)	Pre-oviposition period (days)	Oviposition period (days)	Egg output weight (mg)	Incubation period (days)	Hatching period (days)	Hatching (%)	Index of reproductive efficiency (%)
1	14	417	4	20	256	34	22	99	61.4
2	15	370	4	23	185	34	21	80	50.0
3	15	355	5	22	190	32	24	70	53.5
4	17	n	-	-	-	-	-	-	-
5	18	237	nn	-	-	-	-	-	-
Mean	15.8	344.7	4.3	21.6	210	33.3	22.3	83	54.9

n: female dead by accident; nn: female did not lay eggs

TABLE II
Parasitic and non-parasitic data of *Haemaphysalis leporis-palustris* females recovered from infestation 2 on *Oryctolagus cuniculus* and egg data from these females

Infestation 2: 7 females from the tube X+Y									
Females	Parasitic time (days)	Engorged weight (mg)	Pre-oviposition period (days)	Oviposition period (days)	Egg output weight (mg)	Incubation period (days)	Hatching period (days)	Hatching (%)	Index of reproductive efficiency (%)
1	17	374	4	26	212	53	42	<5	56.7
2	20	245	8	14	34	nh	-	-	13.9
3	21	42	nn	-	-	-	-	-	-
4	21	113	9	15	36	nh	-	-	31.8
5	22	112	10	13	17	nh	-	-	15.2
6	23	n	-	-	-	-	-	-	-
Mean	20.6	177.2	7.7	17	74.7	53	42	<5	29.4

n: female dead by accident; nn: female did not lay eggs; nh: no egg hatched

TABLE III

Parasitic and non-parasitic data of *Haemaphysalis leporis-palustris* females recovered from infestation 3 on *Oryctolagus cuniculus* and egg data from these females

Infestation 3: 10 males from the tube Y and 7 females from the tube X									
Females	Parasitic time (days)	Engorged weight (mg)	Pre-oviposition period (days)	Oviposition period (days)	Egg output weight (mg)	Incubation period (days)	Hatching period (days)	Hatching (%)	Index of reproductive efficiency (%)
1	14	368	5	18	220	37	24	85	59.8
2	14	332	5	20	206	34	30	50	62.0
3	14	374	4	20	233	35	30	60	62.3
4	14	248	6	22	145	36	18	55	56.2
5	14	n	-	-	-	-	-	-	-
Mean	14	330.5	5	20	201	35.5	25.5	62.5	60

n: female dead by accident

TABLE IV

Parasitic and non-parasitic data of *Haemaphysalis leporis-palustris* females recovered from infestation 4 on *Oryctolagus cuniculus* and egg data from these females

Infestation 4: 7 females from the tube X									
Females	Parasitic time (days)	Engorged weight (mg)	Pre-oviposition period (days)	Oviposition period (days)	Egg output weight (mg)	Incubation period (days)	Hatching period (days)	Hatching (%)	Index of reproductive efficiency (%)
1	21	144	5	24	62	61	3	<1	43.1
2	27	265	6	20	105	nh	-		39.6
Mean	24	204	5.5	22	83.5	61	3	<1	41.3

nh: no egg hatched

ries are much smaller than copulated females, which could justify the low mean IRE found for females from infestations 2 and 4, when compared with infestations 1 and 3.

A few eggs from one female from infestation 2 and one female from infestation 4 hatched and some larvae were obtained. As females from infestation 4 had no contact with males either before or during feeding, it can be concluded that larvae obtained from female 1 from infestation 4 (Table IV) were originated by parthenogenesis. The same can not be said for female 1 from infestation 2 (Table II) as this female had contact with males before feeding. Although many authors report that *Metastrata* ticks do not copulate before feeding (Balashov 1972, Oliver et al. 1974, Kettle 1984, Oliver 1989), there is one report for *Amblyomma triguttatum* in which unfed males copulated successfully with unfed females (Guglielmone & Moorhouse 1983). The present work is the first report of this sporadic type parthenogenesis for a normally bisexual population of a *Haemaphysalis*

species, which occurred similar to other reports of parthenogenesis for normally bisexual ixodid species: i.e. despite the majority of eggs not hatching, a few eggs developed, hatched and originated weak larvae that died in few days (Balashov 1972, Ribeiro & Gonzales 1980, Oliver 1989). Oliver (1989) reported that despite this sporadic type parthenogenesis is of little practical significance as most of the few larvae produced are unable to feed, it is of potential evolutionary significance since these tick populations could serve as new material for natural selection.

The parasitic periods of females from infestation 1 and 3 (fed together with males) were generally shorter than the reported in the literature by other authors working with geographical different populations of *H. leporis-palustris*. Rhor (1909) reported this period ranging from 19 to 25 days and Diamant and Strickland (1965) reported it ranging from 17 to 35 days. Therefore these authors did not report the host species in which the females fed what makes not possible to conclude if these

differences are due to host species or a character regard to different tick populations. The non-parasitic data reported by these authors are not comparable to data from the present work as these works were conducted under different environment conditions.

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