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Developmental Biology of *Argas neghmei* Kohls & Hoogstraal (Acari: Argasidae) under Laboratory Conditions

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ABSTRACT - In order to describe the developmental biology of the tick *Argas neghmei* Kohls & Hoogstraal under laboratory conditions, 40 females and 40 males were collected from chicken coops located in Calama (II Region, Chile). They were fed on chickens and maintained under two laboratory conditions: one group at 30 ± 5 ºC and 35 ± 5 % RH and another at 27 ± 5 ºC and 80 ± 5 % RH, both at 12: 12 h L:D photoperiod. The ticks were observed daily to determine larval feeding periods, preoviposition, oviposition, egg incubation as well as the frequency of egg laying, number of eggs laid, and percentage of larval hatching. Females did not lay eggs at 80 ± 5% RH, and data on the biology of this tick was obtained only at 35 ± 5% RH. The life cycle of *A. neghmei* lasted an average of 269 days. Feeding period of each nymphal stage as well as of adult females between oviposition events lasted less than a day. Females laid on average 1.8 egg batches and egg-laying period lasted on average 14 days, during which about 96 eggs were laid per female.

KEY WORDS: Neotropical region, soft tick, Argasidae, *Argas neghmei*, life cycle

There are twelve known species of *Argas* from the Neotropics (Estrada-Peña *et al* 2003, Guglielmone et al 2004), but very few studies on the biology of Neotropical *Argas* species under controlled conditions are available (Rohr 1909, Clifford & Kohls 1963, Clifford *et al* 1978, Kraiss & Gothe 1982).

Argas neghmei Kohls & Hoogstraal has been recorded in arid regions of Chile and Argentina and it is probably also present in Peru (Kohls & Hoogstraal 1961, Nava *et al* 2004). This species is especially important because it affects domestic birds and can also attack humans, producing erythematous nodular lesions with a central hemorrhagic point and intense pruritus (Reyes 1971, Burchard 1985, Aguirre *et al* 1997). Burchard (1985) found that up to 24% of the houses of northern Chile were infested with this argasid. We considered relevant to conduct the study here reported to obtain information on *A. neghmei* biology in the laboratory for comparison with related species.

Material and Methods

A total of 40 males and 40 females of unknown age of *A. neghmei* were obtained from chicken coops located in Calama (22º 27´S 68º 56´W), Chile. Ticks were let to feed for 10 min to 3h on chickens by placing them inside a plastic tube (15 mm of diameter, 17 mm of height) with a ventilated screw cap that was fixed below the wing (Kaiser 1966). Ticks were then separated in couples and each couple was maintained in a ventilated plastic capsule (30 mm in diameter, 50 mm in height). Twenty couples were held in an incubator at 27ºC and 80 ± 5% RH and the remaining 20 couples were held in another incubator at 30º C and 35 ± 5% RH, both at 12:12 h L:D photoperiod. The different levels of humidity were obtained by the use of sulphuric acid solutions of different concentrations (Solomon 1952); in each case, 80 ml of the corresponding solution were maintained in a glass jar (1.4 L capacity), and the capsules were held 2 cm above the solution, resting on a plastic support. As shown in the results section, no eggs were laid at 80% RH. Therefore, the remaining of the work was conducted only with ticks maintained at 35% RH.

Each couple was observed daily to determine the duration of the pre-oviposition, oviposition and incubation (time in days between the beginning of oviposition and emergence of the first larva) periods. When a female stopped laying the eggs of a batch, the couple was transferred to a plastic tube and fed again as previously described; the couple was then placed in a new capsule and returned to the humidity controlled plastic jar. Evaluations were done as previously indicated and the process was repeated with each couple until oviposition completely stopped. For subsequent oviposition cycles, the same parameters were measured by counting the number of larvae and unhatched eggs.

The larval feeding period was determined by exposing 5 d-old larvae to 30-60 d-old chickens that had no prior exposure to ticks, using the previously described method.

Table 1 Biological parameters of the life cycle of *Argas neghmei* fed on chickens and maintained at 30 ± 5ºC, 35 ± 5% RH and 12: 12 h L:D photoperiod.

Parameters[1]	N	Average	Range	Survival
Nº. of egg batches per female	20	1.8	1-3	-
Nº. of eggs per batch	36	96	24-180	-
% hatched	29	69	3-96	-
Preoviposition period	36	54	4-112	-
Oviposition period	33	14	3-28	-
Egg incubation period	33	24	12-37	-
Larval feeding period	384	8	7-12	35
Larva pre-molting period	136	24	16-67	100
Nymph I pre-molting period	56	35	19-73	41
Nymph II pre-molting period	31[2]	38	26-92	55
Nymph III pre-molting period	3[3]	86	48-125	15
Total for determined periods		269		

[1]Durations of different periods given in days
[2]All adults (n = 11) were males
[3]All females

Each engorged larva was deposited in a jar to determine the larval pre-molting period and larval survival. Nymphs obtained were subjected to an identical process until reaching maturity. The period needed for each stage to be able to attach to the next host could not be determined.

Results

No eggs were laid by females maintained at 27 ± 5ºC and 80 ± 5% RH. Thus, all subsequent results refer to ticks kept at 30 ± 5ºC and 35 ± 5% RH. Total oviposition of each female was done on the average in 1.8 batches, with a blood meal between batches (Table 1). On average, each meal allowed the production of 96 eggs. The duration of the different immature and adult stages were quite variable (Table 1). Preoviposition period (54 days) was about four times longer than the oviposition period. Egg and pre-molting larval stage had about the same duration (24 days), but pre-molting periods of subsequent immature stages were progressively longer, ranging from 35 days for nymph I to 86 days for nymph III. Larval feeding period was observed to be relatively long; although not determined, feeding periods for other developmental stages lasted less than a day. The total duration of the life cycle (from egg to egg) of *A. neghmei* was nearly 269 days. Survivorship was lower for the nymphal stages, especially for nymph III (only 15%).

Discussion

It is not known whether temperature, relative humidity or the combination of both with photoperiod induced the failure of *A. neghmei* to oviposit at 27 ± 5ºC and 85 ± 5% RH. It is possible that 85% relative humidity was too high, considering that this tick is found in arid habitats. *Argas cucumerinus* Neumann, another Neotropical tick, was also reported (Clifford *et al* 1978) to be unable to properly develop under those same conditions of temperature and relative humidity, although the authors attributed the lack of oviposition for this species to the unsuitability of the host used (doves).

The results obtained at 30 ± 5ºC and 35 ± 5% RH suggest that even these conditions are not totally adequate to *A. neghmei*. The length of the cycle was considerably longer and the nymphs survival was considerably lower under those conditions than usually reported for *Argas* species (Kraiss & Gothe 1982). The fact that the upper extremes of the ranges for different periods of the life cycle surpassed 30 days indicates the possible occurrence of diapause, especially the preoviposition and nymph III pre-molting periods. Diapause was also observed in other species of the genus (Hoogstraal 1985).

The cycle of *A. neghmei* was noticeably longer than inferred (but not shown) by Clifford & Kohls (1963). However, the long larval feeding period, the presence of at least three nymphal stages, shorter male than female cycle and the number of eggs laid are typical for *Argas* species.

The age of females obtained in nature was unknown, being uncertain how this affected the parameters tested, especially the preoviposition period.

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