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A STUDY ON THE LIFE CYCLE OF RHIPICEPHALUS SIMUS AND HAEMAPHYSALIS SPINULOSA (IXEDOIDEA: IXODIDAE)

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INTRODUCTION

The length of the period ticks can withstand in the absence of a suitable host, depends largely on their water balance. They can survive for longer periods at humidities above the equilibrium than below it. Ixodes Ricinus females survived for more than three months at 95% RH and did during 4-8 days at 70% RH. Larvae of Boophilus microplus survived for 240 days at 90% RH and 12 days at 70% RH. (Less, 1964; Hitchoock, 1955 and Knulle, 1966).

The variability in duration and phenology of the tick life cycle as stated by Balashov, (1967) depend on the nature of the distribution area, habitat type and other environmental associations.

Rhipicephalus appendiculatus occurs in areas of not less than 25 inches of rainfall. However, in less humid places it occurs under dense vetetation cover. This may also explain the northward extension of R.simus along the Nile due to the modification of the environment, which was previously arid, by water and vegetation of the pump irrigation scheme.

Temperature variation greatly influences the length of the developmental periods of ticks as well as the developmental habits of some of them. Hyalomma anatolicum & Hyalomma aegypticum change from three to two hosts if incubated at 5°C (Deply, 1947; Balashov, 1967). Lower temperature is fatal to engorged instars, (Brangan, 1973).

The life cycle of Rhipicephalus simus was studied by Lownsbury, (1905), Lowis, (1932) and Theilaer, (1956) but the life cycle of Haemaphysales spinulosa under natural and laboratory conditions is yet to be determined. According to previous investigations both species occurred on the body and nests of Arvicanthus niloticus testicularis, in dense vegetations of some areas along the Nile. The study of developmental habits under laboratory conditions was initiated with the intention to understand various parameters that govern their ecological association.

The ticks used in this experiment were obtained from laboratory colonies that originated form larval and nymphs collected from Nile rats and raised on rabbit blood. The

developmental periods were observed on larvae; nymphs and adults which were applied to the same host on the same day and engorged at the same time. Groups of twenty larvae and ten nymphs were placed inside 74x7.5 mm tubes blugged with cotton wool. Engorged females were housed individually in 78x10 mm tubes. All tubes were blugged with cotton wool and placed inside the A. niloticus testicularis nests. These groups of ticks were observed daily for moulting, egg laying egg hatching and the hardening of subsequent instars.

The relative humidity used to study the effect on the duration of various developmental phases of R.simus and H. spinulosa was controlled by means of saturated solution. (Winst on and Bates, 1960).

Engorged females of either species were weighed after their detachment from rabbits and kept at 97% 92% 85% 65% 44% and 33% RH. In tightly sealed desiccators they were kept at room temperature 24°C - 28°C. The number of eggs deposited byy each female and their percentage hatchability were recorded. Egg size in relation to female engorged weight was also observed and recorded.

The effect of temperature on the development of R. simus and H. spinulosa was studied by deeping engorged instars of both species at 34°C, 32°C and 18°C and 85% RH. One to two hundred engorged larvae, derived from the laboratory colony of each species, were kept under similar conditions. Groups of the species were individually placed into 30x25 mm. tubes were plugged with cotton wool and kept in desicators over a saturated solution of potassium choloride adjusted to give 85% RH. at the desired temperature level. The desiccators were then kept in incubators adjusted at the required temperature level.

RESULTS:

1. The preoviposition period.

The preoviposition period of R. simus and H. spinulosa which were kept inside the Nile rat nest is 2-3 days. At 34°C the mean preoviposition period for both species was two days. At 22°C the mean period was 3 5 days for both species. At 18°C R.simus females did not differ from those incubated at 22°C while H. spinulosa females incubated at 18°C during the preoviposition period laid eggs after 16 days incubation. Females which were transferred from 18°C to 22°C commenced laying eggs on the 2nd. or third day following transference to higher temperature.

2. The preeclosion period.

The term is applied to the interval between the commencement of oviposition and the first larval emergence. Egg hatching in both species occured after 20-26 days following oviposition under natural conditions and almost 90% hatched. The resulting larvae hardened in 6 days. Hatchability at 75% 97%RH. But at 65%RH. the hatchability decreased to 21%. while only 1% hatched at 44%. none of the eggs held at 33%. hatched.

The egg hatching duration at 75-97% did not differ and it was the same as the hatching duration obtained under nest conditions (20-26).

3. The premoulting period.

The term describes the interval between engorgment of larvae and nymphs and their moulting to the respective phase. A hundred and fifty larvae that engorged on rabbit blood and dropped after 3 days completed their under nest condition moulting in 10-12 days and 85% of the moult was on the 10th. day. A hundred nymphs kept under the same conditions required 20-14 days to moult and 85% of their moult was on the 12th. day. The resulting nymphs and adults hardened after eight and ten days respectively. Both R. simus and H.spinulosa took 10-12 days to complete their larval nymphal moult and 20-14 days were spent before their numphal adult mounlt at all the experimental humidity level. At 45%RH. and 33%RH. the survival period of under larvae and nymphs was 1-4 days only. Engorged larvae of both species kept at 34°C moulted after 10-14 days. At 18°C larvae of R.simus moulted after 17-18 days and those of H. spinulosa took 30-31 days to become nymphs. The nymphal premoulting period was 12 days for both species at 34°C but at 22°C R.simus nymph moulted to adult after 28 days while H.spinulosa nymphs moulted after 36 days. However at 18°C H.spinulosa nymph moulting process was completely arrested during days of observation period (Tables, 1 & 2).

DISCUSSION:

Rhipicephalus simus was reported from the Sudan by King 1926, Hoogestraal 1956 and Osman 1980 and 1983. but, the occurrance of immature stages in association with Haemophysalis spinulosa on the Nile rat in arable land arround the Nile was first recorded by Hussein and Bedawi, 1982.

This study of their life cycle initiated an attempt to understand the ecological factors that render such association possible. Rabbits were selected as laboratory hosts after realizing the difficulty of maintaining the the Nile rats in the laboratory. Moreover, it was found that rabbits have additional advantage of being host for adult stages of both ticks. Therefore our colonies were fed on rabbits.

In the present study the development of the species under Nile rat nest microclimate was compared to that under different regemes of humidity and temperature. The developmental durations under the nest conditions matched the laboratory results under 26°C and 75%RH. Conditions may be optimum for the develop- ment of these ticks in nature. However, 26°C was reported, by Brangen and Bail 1968, as optimum for the development of R.simus.

Progressive elevation of temperature was found to accelerate the development of both R. simus and H. spinulosa instars. But at low temperature (less than 22°C), the rate of development differed considerably. The

percentage relative humidity difference seems to affect only the egg hatchability and at 33%RH. the survival of unfed instars was impaired. This result is similar to the results obtained by Sonenshine and Tinger, (1969) who worked on Dermocentor Variabilis and Amblyuma americana.

H.spinulosa developmental instars seem to go into a state of staper when subjected to low humidity. As it was clear that moulting was arrested, at least during the whole observation period (60 day), further work to study this phenomenon in H.spinulosa and perhaps other tropical ticks is needed.

Being more sensitive to low temperature may explain why H.spinulosa distribution is more restricted than R. simus. However, its distributions; Hussein and Mustafa, (1982) showed that adult H. spinulosa in Sudan were only restricted to hedge-hogs, but Hoogstraal (personal communic-ation) suggested a wider host range.

Both R. simus and H.spinulosa eggs and immature stages seem to be drastically affected by low relative humitidy. Eggs, and unfed larvae and nymphs shrivelled and died at 33% RH. while fed ones could undergo moulting. it could therefore be stated that the level of relative humidity has no direct effect on the process of tick development but it has an effect, whe. lowered on egg hatchability and the survival of immature stages.

SUMMARY

Rhipicephalus simus and Haemaphysalis spinulosa immature stages were reported from the body and nest of the Nile rat Arvicanthus niloticus in arable land North of Khartoum. This study was made to examine the factors influencing the association between the species. Their developmental durations under 26°C and 75%RH. were equal to the durations in the life cycle of the species under nest conditions. Higher temperature up to 34°C shortened their developmental periods while lower temperatures up to 22°C lengthened them. H. spinulosa eggs containing fully developed embryoes did not hatch at 22°C lbut they did so when the temperature was raised. Low humidity was drastic for both eggs and immature stages.

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Table I

The Effect of Temperature On The Development of Rhipicephalus simus and Haemaphy salis spinulosa

Temp. C	Preovisposition period (days)		Larval Nymphal Moult (days)		Nymphal Adult Moult (days)	
	H.spinulosa	R. simus	H.spinulosa	R. simus	H.spinulosa	R. simus
/34	2	2	7	/	12	12
22	3 4	3 4	10 114	10 114	36	28
18	16	4	31	14 17		45

Table 2

Developmental Periods of Haemaphysalis spinulosa and Rhipicephalus simus under Natural Condition (in days).

	H.spinulosa	R.simus
Previposition period	2-3	2-3
Preeclosion period	20-26	20-26
Larval hardening period	6	6
Larval feeding period	3	3
Premoulting period	10-12	10-12
Nymph hardening period	8	8
Nymph feeding period	3-4	3-4
Premoulting period	10-14	10-14
Adult hardening period	10	10
Feeding period	7	7