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Effects of Temperatures and Dehydrating Conditions on *Hyalomma dromedarii*

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Abstract: Ticks are obligate ectoparasites, which infest every major vertebrate animal group, including man and feed on their blood. They are vectors of numerous pathogenic viruses, rickettsia, bacteria, protozoa and filaria. Many of these pathogens are transmitted to the host either directly during the tick bite or indirectly by contact with coxal fluids, excreta, or crushed bodies. The different stages in the life cycle of *Hyalomma dromedarii* were investigated under laboratory conditions. The larval, nymphal and adult ticks were all fed on rabbits at 25–27°C, 50% relative humidity (RH) and exposed to daylight. All free-living stages were maintained in an incubator at 26 ± 1°C, 70% RH and daylight conditions. The life cycle of *H*. The results confirmed the significant correlation between the mortality of the mature and immature stages and the temperature and the relative humidity.

Key word: *Hyalomma dromedarii* % Humidity % Ticks % Dehydration % Saudia Arabia

INTRODUCTION

The genus *Hyalomma* contains 21 species. *Hyalomma* is distributed throughout the world and nine species and subspecies occur in Saudi Arabia [1].

The ticks, *Hyalomma dromedarii*, are considered to be the species most closely associated with camels. *H. dromedarii* and can behave as a three-, two-, or one-host species, with the two-host life cycle seemingly most common. Camels are the main hosts of the adults, which also parasitize other domestic animals. Nymphs and larvae can use the same hosts, especially camels, as the adults, but can also parasitize rodents, leporids, hedgehogs and birds. *H. dromedarii* is widely distributed in North Africa, the northern regions of West, Central and East Africa, Arabia, Asia Minor, the Middle East and Central and South Asia. Camels are the principal hosts of the adults, with some records from cattle and goats, whereas the immature stages infest hares, burrowing rodents and hedgehogs [2]. The purpose of this study was to systematically investigate survival of *Hyalomma dromedarii* (different life stages) following exposure to specific relative humidity and temperatures, to determine whether these factors would increase mortalities during dehydration. In Saudi Arabia due to the variation in geography and climate. Particularly humidity of the regions which vary significant. Riyadh in the central region is considered to have low humidity [3]. While humidity in western coastal region , Jeddah and southern region of Abha is comparatively higher which helps ticks thrive, in autumn and winter not during summer, especially in Jeddah and Riyadh due to the increasing of temperature up to 50EC [4].

MATERIALS AND METHODS

The different developmental stages (mature and immature stages) in the life cycle of *Hyalomma. dromedarii* were collected from special goat reared at Abrug-AL-Rughama around Jeddah city, Saudi Arabia.

The ticks were maintained and reared in wide mouth sample bottles (50x19mm), each covered with cotton cloth secured to it by a rubber band. The bottles containing the tick stages were kept inside desiccators over saturated salt solutions to maintain various levels of relative humidity according to the method of Winston and Bates [5]. The desiccators were placed in incubators set at various temperature levels (25, 28, 35, 40 and 45°C) to study the combined effects of temperature and RH (75, 65, 55, 45, 35%) on the development of the various tick instars. The tick instars were allowed to feed on white, male New Zeland rabbits according to the method of

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Table 1: Calculated of mortality and survival in test population among the mature females, males and immature stages of *Hyalomma dromedarii* at specific time intervals when exposed to various temperature and humidity

Humidity	Female	Male	Immature	Male	Immature	Male	Temperature
75%	99.40±0.58	98.80±0.40	97.80±0.86	98.80±0.40	97.80±0.86	98.80±0.40	25
	0.300	0.975	0.926				
65%	85.20±1.01	72.60±0.93	49.00±2.85	72.60±0.93	49.00±2.85	72.60±0.93	28
	0.285	0.043*	0.760				
55%	64.80±1.66	50.40±0.51	32.60±1.81	50.40±0.51	32.60±1.81	50.40±0.51	35
	0.200	0.063*	0.062*				
45%	36.60±4.80	27.20±4.80	8.60±0.51	27.20±4.80	8.60±0.51	27.20±4.80	40
	0.046*	0.207	0.661				
35%	13.20±1.98	9.40±1.44	4.00±0.71	9.40±1.44	4.00±0.71	9.40±1.44	45
	0.888	0.455	0.117				

Varma [6] and they have been maintained at 25±2°C and 45±5 % RH in Zoology Departmental facility, College of Science King Abdulaziz university, at Jeddah. On the other hand, engorged tick instars were collected from metallic capsules by holding the rabbit in an upside down position and shaking over a plastic box for the ticks to drop.

The relative humidity (RH) level inside the desiccators was maintained using saturated salt solutions according to the method of Winston and Bales [5]. The solutions were prepared by dissolving enough salts for saturation at boiling at room temperature (25°C) and when a small amount of salt is added. Further quantities of salt were also added following considerable cooling of the solution. The solution is then allowed to stand at room temperature for 1-2 weeks to insure saturation and then used at the rate of 100 ml in each desiccators. The RH in each desiccators was periodically monitored with a conventional RH meter.

The various temperature regimes were maintained in the laboratory in five s incubators with an environmentally controlled room. These were set at 25, 28, 35, 40 and 45°C, respectively. Into each of these, 5 desiccators have been introduced to formulate a total of 25RH/temperature regime. All desiccators and the instruments used were washed with micene antifungal solution (Sipa, Milano, Italy) before being used [1].

Statistical Analysis: The data in Tables (1) are presented as mean ±. The statistical analysis between the mites species and the different sex of each species were performed using paring " t – test " [7]. All statistical were computed by SPSS 14.

RESULTS

Increasing in mortality is recorded gradually by increasing temperature which consequently lead to decrease the humidity as a result of dehydration, the investigation had been recorded each 24 hours to count the survival ticks *Hyalomma lusitanicum*. The calculated of mortality and survival in test population male, female and immature stages at specific time intervals when exposed to various temperature and humidity were shown in Table 1. Female have tolerated desiccation better than did males and immature stages at all RH tested at all temperature regimes tested (Table 1, Fig. 1, 2,3).

DISCUSSION

The results reported here demonstrated that temperature and relative humidity are the domineering environmental component on the rate of survival of both mature and immature stages (larvae and nymph). Similar observations were recorded on *Rhipicephalus appendiculatus* [8,9], *Amblyomma americanum* [10] *Hyalomma lusitanicum* OCH [11] *Hylomma dormederaii* [12]. The mortality of both stages seem to be increased very rabidly at 45°C by decreasing the RH , which might indicate that both stages are not capable of active water vapor uptake from the surrounding at low RH [13 -15].

In environments containing water vapor below the CEA, more water is transpired than absorbed from the atmosphere and thus dehydration occur. An increase in temperature seems to increase the rate of dehydration [16]. Following exposure to increased dehydration the mortality rate increased in response to an increased temperature and decreasing of humidity [17]. A similar trend was found with increasing temperature

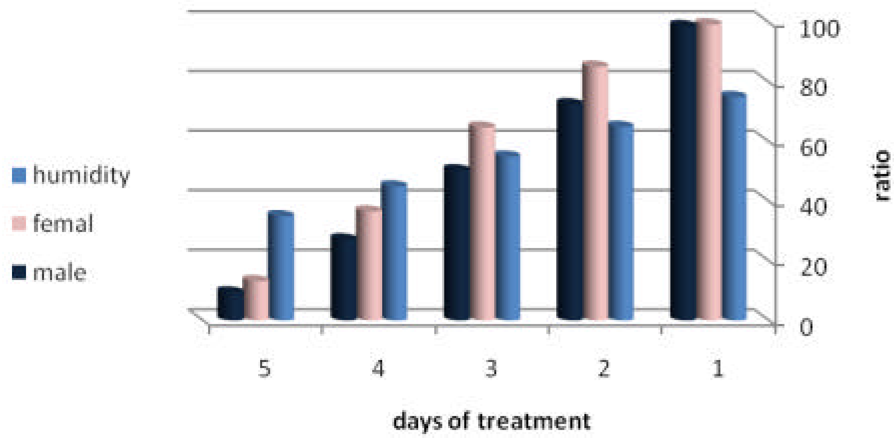

Fig. 1: Effect of the decreasing of relative humidity on male and female of *Hyalomma dromedarii*

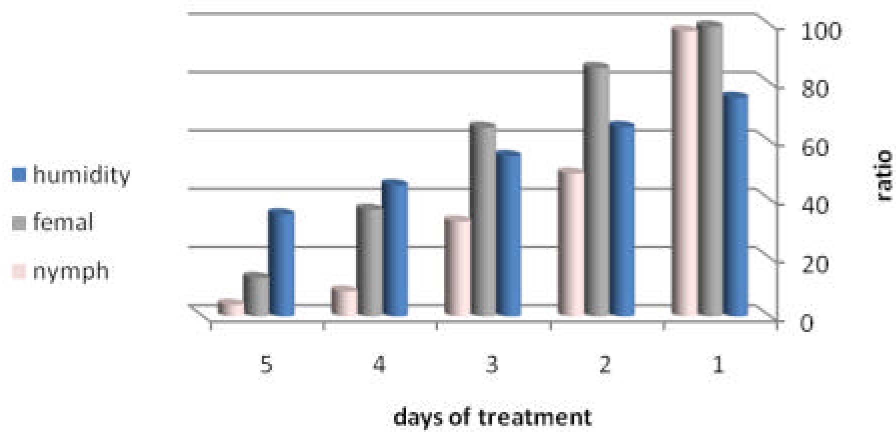

Fig. 2: Effect of the decreasing of relative humidity on mature female and immature stages of *Hyalomma dromedarill*

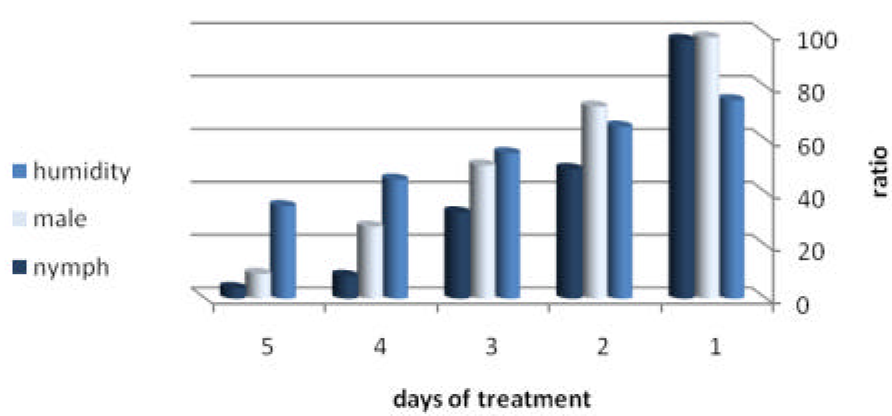

Fig. 3: Effect of the decreasing of relative humidity on mature male and immature stages of *Hyalomma dromedarii*

when exposed to the same dehydrating conditions Mating (breeding) activity is only slight following the rains (November). Few larvae and nymphs were found during this period; those present were mainly on sheep and goats, with a few on cattle and these were usually feeding on the hoofs of their hosts [18]. These observations suggest that the similarity in pattern of these species under studied conditions are necessarily imply similarity in mortality response of these species to artificial environmental factors. Thus it could be suggested that the inter specific negative correlation of the mortality of these species my reflects the effects of lower humidity. In every case the mortality for females were markedly lower than those for males. The lower mortality of immature stages may be accounted for by their smaller surface area to volume ratio , which result in transpiration occurring at a greater rate than in mature [19, 4, 20].

Results have shown that long exposure of the instars to constant temperatures produces little variation in length of life which vary inversely with the temperature 40,45°C where as the development for immature stages has stopped. Similar finding were report with *S.americaum* [21]. Unlike other observations on *A.americaunm* [22, 23] the present result have clearly demonstrated that, RH has clear effect on life and development of immature stages, which proved to be incapable of surviving which decreasing of the relative humidity as well. The mature and immature stages were also unable to moult or survive at high temperature and low RH.

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