The Study of the Effect of Temperatures Change on Hyalomma dromedatti (Ticks) Under Parametric of Laboratory Circumstances

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Abstract: The study focuses on the effects of the influence of two different temperatures on the growth and development of Hyalomma dromedatti during its life cycle. The study was accomplished using two different temperatures. The tests were conducted in the laboratory where the temperatures were kept at 30°C with 80% humidity, and 34°C with 80% humidity. The tests were conducted on engorged mature female ticks that were collected from an infected camel from a stockyard in the suburbs of Jeddah city, located on the west coast of Saudi Arabia. The larvae were fed on white rats, while the nymph were fed rabbits. The results were recorded after applying the following parameters: Eggs incubation, pre-feeding, and pre-molting larvae, larvae and nymph. In addition, the mature female ticks: pre-feeding, feeding, pre-oviposition, oviposition. A significant difference was observed ($P>0.005$) in the egg incubation stage ((5.0 ± 0.01) at 34°C), (8.0 ± 0.71) at 30°C, where as in the larvae pre-moulting stage ((5.01 ± 0.29) at 34°C); ((6.03 ± 0.43) at 30° c). Changes in nymphs in the pre-moulting stage were recorded at ((16.4 ± 0.94) at 34°C); ((18.4 ± 0.71) at 30° c). The median growth rate was 90.5 days at an average (74-107) days at 30°C and 76 days at an average (64-88) days at 34°C.

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Key words: Hyalomma dromedarri, oviposition, pre-ovipostion, Theileriosis, Hyalommam arginatum, Ambylomma, Boophilus annulatus, Boophilus decoloratus, Rhipicephalus sangineus, and Rhipicephalus evertsi, obligatory parasites.

1. Introduction:

The tick parasites are characterized by their effects on ruminant animals worldwide in many aspects including health, veterinary and economical situations. The ticks' have ability to transmit pathogenic vectors and diseases through blood leads to low productivity, and the deterioration of the animals' health (Rick, 1982; Garry, & Potgieter, 1982). Hard ticks such Hyalomma, Theileria and Boophilus, the most important genera in the fields of camels, sheep and other cattle animals.which are responsible for transferring blood parasites, which cause severe health and economical problems in producing countries. Anaplasma, Theileria and Babesia are some of the examples of blood parasites transferred by ticks. (Yadav et al 1985, Ashfaq, 1983) Climate change directly effects ticks and their relation with transferring the yellow fever disease (Theileriosis) to animals, where ticks' population dynamics reach climax during the spring and autumn seasons which corresponds to an increase in the infection rate in the cattle fields, and shows an infection at the salivary glands of ticks of the H.a.anatolicum species which is considered the transferring mediator of the Th. Annulata parasite. The parasite was not only found in the salivary glands of the female tick species, but also male species. Therefore, the tick of genus Hylomma plays an important role in transmitting blood parasites such as Yellow Fever (Majeed et al, 2012). The ticks' transmitted diseases cause outbreaks that can reach up to 80% of the ruminants around the world, especially in tropical and subtropical regions. The diseases have direct and indirect effects not only on the reduction of dairy and meat production, but also on daily productivity and agriculture, not to mention the increase in the fatality rates through nourishment of ticks on the blood host (De Castro, 1997). The disease outrage caused by blood parasites occurs when the amount of adult ticks increase during rainfall season between September and March, and the spread of nymph ticks during the dry season between May and August in East Zambia (Majeed et al, 2012).

It was proven than Psammonys obesus (Fat Sand Rat) is the main supporter of the development of larvae for these kinds of ticks at the Kingdom of Saudi Arabia. The viruses infect camels at different regions in the kingdom. Many viruses of such kinds were isolated from the Sand Rat including the Wanowire virus in Egypt (Majeed et al, 2012). Recently Dhori Virus was also isolated from the Sand Rat at the east region of the Saudi Kingdom (Al-Ghamdi et al, 2011).The viruses cause diseases to the infected animals and decreases their weight due to blood nutrition in case of severe infection. These species of ticks are considered to be the most common species prevalence around the kingdom, followed by H. dromedarri in terms of pervasion and popularity. These species of ticks are also spread globally especially in the Mediterranean Regions and North Africa. (Mohammed et al,1984)

Ticks are considered as obligatory parasites, transmitters the pathogens by attacking vertebrates and sucking their blood around the world. Ticks have the ability to cause severe subjective harms at contact point (allergic reactions, inflammation, sores). The harms have systemic effects including toxicities and paralysis (Anderson and Magnarelli, 2008). Although most significant medical concerns are caused by the ability of ticks to transmit various infections agents to humans and animals, many of the ticks' other characteristics made them an outstanding pathogenic agent including bacteria, protozoa and viruses. The ability of ticks to transfer contagious diseases have become a major research topic in last two decades. Ticks were ranked as the second highest pathogenic agent, behind mosquitos, around the world. Ticks have proven their massive ability to prevalence pathogens among both domestic and wild animals. (de la Fuente el at 2008).

Hyaloma dromedarri are the main cause of transmitting infectious diseases to humans, camels and sheep. Other studies mentioned the ticks' ability to transmit (Dermacentor marginatus, Rickettsia slovaca and also can transmit other species of Rickettsia, Ehrlichiacanis, Anaplasma ovis, Coxiella burnetii, Francisella tularensis, Babesia pps, in addition to tick-borne encephalitis complex virus (magdas et al, 2015)

There are many species of Hyaloma genus present around Kingdom of Saudi Arabia, therefore it is vital to conduct the required studies on this genus due to its medical and economical importance. Only few studies were conducted in the Kingdom on H. dromedarri, and their relationship with the effects of environmental changes though life cycle parameters. The studies found that the H. dromedarri genus is the most common in the Kingdom. (AL-Khalifa el al, 2006; Edrees 2010). Some studies predicted that temporal and spatial changes in the temperature and humidity at different climates cause different scenarios of infections, parasitic diseases, emerging infections and re-emerging infections from ticks transmitting various diseases (Magdas et al,2015).

Many experiments were conducted on the effect of temperature on the average growth of the mites and ticks (Edrees, 2006, 2009, 2010, 2012), and the change's significant effects on geographical distributions of the Ticks. From this viewpoint, the goal of the study was to test the effects of temperature change on the growth and development of H. dronedarri under parametric conditions, and its effects on the tick host-attachment behaviour.

2. Materials and Methodology:

The study was conducted during the spring of 2014 at Jeddah city in the Kingdom of Saudi Arabia. In preparation for oviposition, each engorged female tick was stored in a plastic tube containing a piece of dissecting sheet, then closed with a mesh (Pores < 100 µm). Half of the 15 tubes were stored at a temperature of 30^{o}C, and the humidity was kept at 80% at all cases and times. The photoperiod throughout the development stage 11/13 night /light. The engorged female ticks were then tested daily to determine the oviposition and pre-oviposition.

All the ticks were fed on lab animals, the hatched larvae were fed on Ruttus norvegicus, while the mature and nymphs were fed on Lepus capensis. All the animals were stored in lab cages which were kept at the same temperature as the ticks involved in this experiment. The cages were covered by a mesh. The ticks were unattached to the host, to observe the ticks' nature ability to find the host and attach to it.

After feeding the tick and detaching it from the host, the larvae and engorged nymphs were collected from the host, then they were put in plastic pipes at 30^{0} C and 34^{0} C in preparation for moulting. The procedure required a (5-7) day pause after each moulting stage and before entering the feeding stage. The pause was required since the new born ticks or directly after moulting have a very soft and inactive body until the body wall hardens. In this study, pre-feeding period was calculated, where the number of days varied (table 1). In addition to the number of days each stage requires to attach to the host. The results were analysed using (Unpaired t test (ANOVA- Graph Pad InStat).

The comparison between the data obtained from the two different temperatures was achieved to complete the Statistical calculation throughout the study. The parameters attained though each stage are: incubation, pre-moulting for both larvae and nymphs in the pre-feeding and feeding durations, and oviposition in adults female.

3. Results:

The duration required for each stage of the development of (H. dromedarii) were included at two different temperatures (Table 1) for each phase, and it was shorter at 30 ^{0} C, than 34^{0} C, Statistical significance differences were noticed in only 3 parameters of the data that were statistically analysed, no significant differences were recorded in the duration of pre-oviposition, oviposition, pre-feeding and feeding stages, in the larvae, nymphs, adult and female stages.

A total of 1000 larva were used to infest the mice at each of the different temperatures that were set for the study, out of which 131 (13.1%) were successfully detached at 30^0 C, and 165 (16.5%) at 34^0C.

98 larva were obtained after the moulting in the larval stage at 30^0 C at a percentage of (74.8%), and 145 larva at 34^0 C at a percentage of (87.9%), and out of 120 larva used to infest rabbit at 30^0 C, 42 larva succeeded in detaching from the host (35%), while out of the 176 larva used at 34^0 C, 34 (31.8%) collected from the bedding of the cage were full of the host's blood. 65 adults were collected after the larva's moulting, with percentage of (90%), 27 (65%) of which were female, and 15 (35%) were male, at a sex ratio of 1:1.86.

At 30^0C, 32 adults were obtained, with a moulting rate of 21 (65.6%) for female, and 11 (34.36%) for male, at a sex ratio of 1:1.9.

The number of the female adults was 48 female, they were divided equally in the cages according to the various temperature levels set for this study.

The adult female were freed in the rabbit's cages, where the adherence rate to nutrition completion was 75% (N=18) at 30^0 C, and 85% at 32^0C, the study was conducted under standard laboratory conditions.

The study showed that the Haylomma dromedarii life cycle takes 133.9 days at a rate of (122-154) at 30^0 C, and 94.2 days at a rate of (11-83) at 32^0 C.

Table 1 The duration of developmental stages of Dermacentor marginatus at two different temperatures

Stage	Period	Days, mean ± SD (range)		p
		30 ℃	34℃	
Female	Pre-oviposition	4.7 ± 1.21 (3–7)	4.1 ± 0.32 (3–5)	> **0.05**
	Oviposition	6.3± 1.09 (5–8)	5.4± 0.07 (4–7)	> **0.05**
Egg	Incubation	8.0 ± 0.71(7–9)	5.0 ± 0. 01 (4–6	> **0.05**
Larva	Pre-feeding	11.1 ± 0.89 (10–12)	9.0 ± 0.43 (8–10)	> **0.05**
	Feeding	2.5 ± 0.39 (2–3)	2.5 ± 0.12 (2–3)	> **0.05**
	Pre-moulting	6.03 ± 0.43 (5–7)	5.01 ± 0.29 (4–6)	> **0.05**
Nymph	Pre-feeding	12.7± 1.03 (11–14)	10.2± 0.05 (9–11)	> **0.05**
	Feeding	3.1 ± 0.57 (3–5)	3.1 ± 0.35 (2–4)	> **0.05**
	Pre-moulting	18.4 ± 0.71 (17–20)	16.4 ± 0.94 (15–18)	> **0.05**
Female	Pre-feeding	13.1± 0.94 (12–14)	11.3± 0.79 (10–12)	> **0.05**
	Feeding	6.1 ± 1.02 4–8)	4.6 ± 0.09 (3–6)	> **0.05**
Total duration		90.5 ± 2.15 (74–107)	76.0± 4.85 (64–88)	

4. Discussion:

A few studies on H. dromedarii were conducted under controlled laboratory conditions (table 2), but neither of these studies as such followed in Saudi Arabia to carry out a comparative study of the evolution under different temperature phases differentiated by using different-host for the study of the various phases. Ticks were obtained from natural stables, they had a life cycle of 39.7 days under laboratory conditions with 30^0 Celsius and 80% RH and 32^0 Celsius with 80% RH. Larvas and nymphs were put under similar laboratory conditions, it is noteworthy in this regard that the first study was to describe the entire life cycle of the

D. marginatus tick, with the average of 50 days under the temperature of 21^0 C had been done by Magdas et al 12015.

A recent study undertaken by Darvishi et al 014, under laboratory conditions with a temperature of 30^0 C and RH of 75%-95%, showed that an average of 92 days is necessary for D. Marginata to complete its life cycle, It is close to the results of another study conducted at a temperature of 30^0C and RH of 80%, a 92.2 day in a row. The threshold limit for the temperature needed in the beginning of Dermacentor marginatus activity is at the rate of $8\text{-}12^0$ C (Estrada et Al 1990), the regular activity in natural conditions for adults is between $12\text{-}26^0$C (Magdas et al 2015).

Papadopoulous et al (1996) has found 18 Species and sub-species of ticks in Macedonia, where Dermocentor and Haemophysalis were the most active in the winter and autumn. (Tavassoli et al, 2007) shows that in Zambia, Hyalomma, Boophilus, and Rhipicephalus are the most common species affecting cows. In Sudan the most important species of ticks that affected cows were Hyalommam arginatum, Ambylomma, Boophilus annulatus, Boophilus decoloratus, Rhipicephalus sangineus, and Rhipicephalus evertsi, and the most dominant species was Hyalomma a anatolicum, (Latif 2001).

Table 2 Comparison of datas (days) on development of Dermacentor marginatus with results obtained by other authors

Conditions	Host	Incubation	Larva			Nymph			Total duration	Reference
			PF	F	PM	PF	F	PM		
24°C	Guinea pig, rabbit	29-31	-	4	10-15	-	20-25	20-25	150 (142-163)	Nosek et al (1967).
20-22°C, 90% RH	Rabbit	25	3	4	5	7	5	11	83	Janisch andFarkas (1984)
		12-15	-	-	3-7	-	-	22-26	90-110	Balashov (1997)
26˚C, 75%RH , 12 light	Mouse, rabbit	17.5 (6.0-23.0)	6	5.5 (4.0-7.0)	9.0 (8.0-10.0)	-	-	-	92(75-104)	Darvishi et al (2014)
26˚C, 95% RH, 12h light	Mouse, rabbit	-	-	-	-	6	8.0 (6.0-9.0)	14.0 (12.0-15.0)	92(75-104)	
21˚C , 80% RH, 12h light	Mouse, guinea pigs	29.4±1.07 (28-32)	12.3±0.87 (11-14)	2.4±0.05 (2-3)	18.9±1.02 (18-21)	13.1±0.91 (12-15)	3.4±0.59 (3-5)	21.3±0.87 (20-23)	133.9±8.4 (122-154)	Magdas et al (2015)
27 °C , 80% RH, 12h light	Mouse, guinea pigs	5.9±0.73 (5-7)	12.2±0.83 (11-14)	23±0.47 (2-3)	6.1±0.58 (5-7)	13.3±1.03 (12-15)	3.3±0.57 (3-5)	19.9±0.71 (19-21)	92.2±5.45 (83-111)	

Conditions	Host	Incubation	Adult (female)				Total duration	Reference
24 ℃	Guinea pig, rabbit		PF	F	PO	O		
20-22 ℃, 90 RH	Rabbit	29-31	-	10-11	5-6	-	150(142-163)	Nosek et al (1967).
		25	10	6	7	-	83	Janisch andFarkas (1984)
		12-15	-	-	9-12	-	90-110	Balashov (1997)
26 ℃, 75 RH, 12 h light	Mouse, Rabbit	17.5(6.0-23.0)	-	-	-	-	92(75-104)	Darvishi et al (2014)
26 ˚C, 95 RH, 12 h light	Mouse, Rabbit	-	8	13	5.0(4.0-6.0)	16.1(10.0-24.0)	92(75-104)	
21 ˚C, 80 RH, 12 h light	Mouse, Guinea pig	29.4±1.07 (28-32)	14.1±1.46 (13-17)	6.1±1.06 (5-8)	5.7±1.05 (4-7)	7.2±0.91 (6-9)	133.9±8.4 (122-154)	Magdas et al (2015)
27˚C, 80 RH, 12 h light	Mouse, Guinea pig	5.9±0.73(5-7)	13.9±0.94(13-16)	6.3±1.0(5-8)	4.9±1.28 (3-7)	6.1±1.19 (5-8)	94.2±5.45 (83-111)	
30 ˚C, 80 RH, 11 h light	Rat , Rabbit	8.0 ± 0.71(7–9)	13.1± 0.94 (12–14	6.1 ± 1.02 4–8)	4.7 ± 1.21 (3–7	6.3± 1.09 (5–8)	94.2 ± 5.45 (74–107)	Current study
34 ˚C, 80 RH, 11 h light	Rat , Rabbit	5.0 ± 0. 01 (4–6	11.3± 0.79 (10–12	4.6 ± 0.09 (3–6)	4.1 ± 0.32 (3–5)	4.1 ± 0.32 (3–5)	94.2 ± 5.45 (64–88)	Current study

The results were consistent with findings of (Khan et al, 2004) in the high incidence rate by increasing the population dynamics of ticks in the spring and their transfer of the yellow fever disease or the Theileriosis to ruminant, also Theileria parasite was found when the salivary glands of the Hyalomma species were examined, and it was not found in other species, as well as the existence of consensus between infection with the prevalence of ticks that collect during the months of the year had the highest rate in the month of April which is the spread of hard tick season and did not find a tick consensus in winter. The reason why buffalo is being infected with Theileria and Anaplasma might be because of the prevalence of the intermediary carrier tick Hyalomma with the increasing of the heat and humidity which affect their reproduction and prevalence. (Rajput et al 2005), (Radostits et al 2007, Majeed 2012). (Majeed et al, 2012)., confirmed that most species of ticks prevalence in most seasons of the year and it is increasing significantly in the spring and autumn, Hyalomma prevalence in all seasons throughout the year and increase in numbers during summer and fall in the middle and southern parts of Iraq, the number of ticks reached its peak during spring and fall. An epidemic survey was conducted to find out seasonal changes of some tick species that infest animal producing milk in Ninawa province in Iraq, the survey covered cows, buffalo, sheep, goats, horses, camels and dogs, it was found that the highest presence rate was in summer followed by spring and autumn, and the least rate was in winter in the following rates: 45%, 37%, 13% and 5% respectively, and that the cow was the animal most infested around the years, and that the species of the highest prevalence is Hyalomma anatolicum, (Majeed et al, 2012).

The difference between the short life cycle of the tick in this study (Jeddah) in comparison with other studies conducted in cold European countries, might be due to the difference in climate and geographical environment, the temperatures, in this study, are very high, and the temperatures in winter and autumn are close to those of the European countries in summer and late spring, which affect the physiological activities which, in turn, affect the length of the life cycle of the ticks, the subject of this study, this effect was approved by previous studies about the effect of the temperature and the relative humidity on the survival and activities of the immature stages (Larvae and nymph), and mature stages, (Al-Khalifa, 2006, Edrees 2006, 2008a,c, 2010, 2012).

The tick adaption in two extremely contrasting components in its environment, it is very sensitive to the weather in non-parasitic periods stage, and hence the temperature is certainly a very important factor, where it affect the tick life cycle, and the epidemics science as to the transfer of the vector-borne diseases, which is certainly very interesting in terms of climate changing, and it contribute in the predicting the dangerous consequences of the climate changing on the biology and distribution, that causes the severity of the pathogens transmitted by the ticks, is a challenge.

References

1. Ali Al-Ghamdi, Kareem Morsy, Abdel-Rahman Bashtar, Fathy Abdel-Ghaffar, Khaled Al-Rasheid, Saleh Al-Quraishy and Heinz Mehlhorn. (2011). Developmental stages of Hepatozoon hemprichii sp. NOV. Infecting the skins scincus Hemprichii and the tick Hyalomma impeltatum from Saudi Arabia. *The Journal of Parasitology*. Vol. 97, No. pp. 878-883.
2. AL-Khalifa M.S., A.A.AL-Lahoo and H.S. Hussein., 2006. The effect of temperature and relative humidity on moulting of engorged larvae and nymph of Rhipicephalusturanicus Pomeranzer, 1936. Saudi Journal of Biological Sciences, 13(1):35-43.
3. Anderson JF, Magnarelli LA (2008) Biology of ticks. Infect Dis Clin N Am 22:195–215.
4. 4. Ashfaq, M.; Ajmal, M. & Ahmad, S. (1983). An outbreak of theileriosis in crossbredneonate calves. Paki Vet. J., 3: 44-46.
5. Balashov YS (1997) Distribution of ixodid ticks (Acarina, Ixodidae) over landscapes within their ranges in Russia. Entomol Rev 77:625–637.
6. Darvishi MM, Youssefi MR, Changizi E, Shayan P, Lima RR, Rahimi MT (2014) Biology of Dermacentormarginatus (Acari: Ixodidae) under laboratory conditions. Asian Pac J Trop Dis 4:284–289.
7. De Castro, J. J. (1997). Sustainable tick and tick-borne disease control in livestock improvement in developing countries. Vet. Parasitol., 71: 77-97.
8. De la Fuente J, Estrada-, Estrada-Pena A, Venzal JM, Kocan KM, Sonenshine DE (2008) Overview: ticks as vectors of pathogens that cause disease in humans and animals. Front Biosci 13:6938–694.
9. Gray, I. S. & Potgieter, F. T. (1982). Studies on the infectivity of Boophilus Decoloratus Babesiabigemina, males and larvae infected with Onderstcpoort. Vet. Res., 49: 1-2.
10. Edrees N. O, 2006. Studies on house dust mites in Jeddah Governorate. Ph. D. Thesis, Girls Collage, Zool. Dept. King Abdel- Aziz Univ., Jeddah.
11. Edrees, N. O. (2008a). Abundance, distribution, and species diversity of house dust mites in homes of patients with asthma in middle region

of Jaddah city. Egypt. J. Exp. Biol. (Zool.), 4: 279- 283.
12. Edrees, N. O. and Saleh, S. M, (2008c). Population dynamics of house dust mites in Jeddah Governorate. Egypt. J.Exp.Biol.(Zool.), 4: 139- 146.
13. Edrees N. 2009. Distribution dynamics of dust mites in two locations of patient homes with respect to the allergical kind. American-Eurasian J. Agric. & Environ. Sci., 6(6): 680 – 688.
14. Edrees N.O, 2010. Effects of Temperatures and Dehydrating Conditions on Hyalommadromedarii. Global Veterinaria 4 (3): 307-311, 2010.
15. Edrees, N.O. (2012). Prevalence of House Dust Mites in Two Levels of Dorms (Hotel and Motel) of Jaddah District Western SaudiArabia.Life Science: 9(4): 3673-3863.
16. Estrada-Pena A, Dehesa V, Sanchez C (1990) The seasonal dynamics of Haemaphysalispunctata, Rhipicephalus bursa and Dermacentormarginatus (Acari: Ixodidae) on sheep of Pais Vasco (Spain) Acarologia 31:17–24.
17. Khan, M. Q.; Zahoor, A.; Jahangir, M. & Ashraf, M. (2004). Prevalence of blood parasites in cattle and buffaloes. Pakistan. Vet. J., 24(4):193-195.
18. Latif, A. A.; Hove, T.; Kanhai, G. K.; Masaka, S. & Pegram, R. G. (2001). Observations of Zimbab weanth eileriosis. Disease incidence and pathogenicity in susceptible cattle during Rhipicephalusappendiculatusnymphal and adult seasonal activity. Onderstepoort J. Vet. Res., 68:187-195.
19. Magdas.C; Magdas.V.A; Milhalca, A.D; Baciu H; Gherman C.M, Stefanut C. L; Lefkaditis M and Cozma V. (2015). Laboratory development of Dermacentormarginatusticks (Acari: Ixodidae) at two temperatures. Exp Appl Acarol, 67:309–315.
20. Majeed, Sh. A., Al-Amery, A. M. A. and Fara, A. A. (2012). J. AL-Anbar for Veterinary Science. (5): 229-232.
21. Mohammed S. Al-Khalifa, Nasser A. Al-Asgah, Fathi M. Diab. (1984). Ticks (Acari: Ixodidae) Infesting Common Domestic Animals in Al-Qasim Province, Saudi Arabia. J. Med. Entomol.(21):114-125.
22. Papadopoulos, B., Morel, P. C. & Aeschlimann, A. (1996). Ticks of domestic animals in the Macedonia region of Greece. Vet Parasitol 63, 25–40.
23. Radostits, O. M.; Gay, C. C.; Hinchcliff, K. W. & Constable, P. D. (2007). Veterinary Medicine. 10thed. Philadelphia, USA. W. B. Saunders CO., PP.407-408,1526-1527.
24. Rajput, Z. I.; Hu, S. H.; Arijo, A. G.; Habid, M. & Khalid, M. (2005). Comparative of Anaplasma parasites in tick carrying buffaloes and cattale. J. Zhei. Univ. Sci., 6b:1057-1062.
25. Rick, R. F. (1982). Epidemiology and transmission of Theileria species of cattle in Australia. Aust. Vet. J., 59: 82-92.
26. Tavassoli, E; Rahimi-Asiabi and Tavassoli, M. (2007). Hylomma aegyptium on Spur-thighrd Tortoise (Testudo graeca) in Urmia Region West Azerbaijan, Iran. Indian. J. Parasitol.2:40-47.
27. Yadav, C. L.; Gupta, R. P. &Ruprah, N. S. (1985). The prevalence of heamoprotozoon infection in cattle and buffaloes. Indi. Vet. Med. J., 9: 205- 209.

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