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Survey of *Hyalomma Dromedarii* on camels at Taif, Saudi Arabia

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The ticks (*Hyalomma dromedarii)* are significant disease transmit vectors to camel in Saudi Arabia. They transfer a range of pathogens such as bacteria, protozoa and viruses to people and animals. This study was carried out during the six months (2015-2016) for identify *Hyalomma dromedarii* on Camels at the three Areas (Area A= North of Taif, Area B= South of Taif , Area C= Southeast of Taif) in Taif Governorate area. The results showed the presence that female camels are more affected than males, as the number of female injuries was 83, while males were 9. The results also show that the number of injuries in the Belly and at the genital area is more than 107, because the presence of high blood vessels, which leads to the availability of a large amount of blood. The *Hyalomma dromedarii* lives on blood absorption from the camel's body. The following study suggested a proper handling management of *Hyalomma dromedarii* on the camel in the study area should be proposed. Development of pest integrated management system is paramount. The study filled the gap of establishing the proper solution of the effective management control.

Keywords: word1, word2, word3

INTRODUCTION

Ticks are all over the world consider significant vectors of arthropod due to the large number of animal and human pathogens that can be able to be transmitted (Mahmoud Dogara & Ishaq Jumare, 2014). As a results of the degree of the pathogens specify, there is need pattern, distributional information, ticks phenology that will aid in designing and management of the ticks (Estrada-Peña, Ayllón, & De La Fuente, 2012). Similarly Abdulrahman et al. (2018) reported the documented information will aid in management of the ticks. The relative abundance and the microfilaments of the main host resulted in seasonal patterns of the ticks behavior. The survival rate of the ticks depend largely on the relative humidity and temperature (Estrada-Peña & Salman, 2013). Though it has been argue ticks life span are not dependent completely on the temperature. The habitat determination contribute to the periods in which the ticks stay in a particular host (Feria-Arroyo et al., 2014).

Environments with extreme temperature, relative humidity and inclement are known to harbor Hyalomma populations. Environments where no other life can survive, Species of Hyalomma can thrive and survive successfully (Mahmoud Dogara Abdulrahman, Abdul Manaf Ali, H Fatihah, Mohammed Moneruzzaman Khandaker, & Nashriyah Mat, 2018).

Hyalomma dromedarii in particular are consider to have significant economic importance, due to the facts they are main parasites of domesticated animals and the most efficient vectors with a variety of diseases harmful to organisms (Uilenberg, 1995).

Hyalomma dromedarii is a common ticks found on the body surface of the camel that are

distributes in plain and semi plain of the deserts (Davari et al., 2017). Researchers have established from fossil records that Hyalomma dromedarii were originated from the southern part of Soviet Union and north west part of India to Peninsular of Saudi Arabia and later to the North African (Estrada-Peña, Bouattour, Camicas, & Walker, 2004). The growing period of Hyalomma dromedarii is determine by the relative humidity, temperature and the kind of camel hosting the tick (Elghali & Hassan, 2010). The life cycle of Hyalomma dromedarii is largely dependents on the temperature and the humidity. The egg production, crushing rations and the hatchery depends on the habitat temperature (Choubdar et al., 2019). Hyalomma dromedarii life cycle was studied and observed under the laboratory conditions to avoid interruption of unfavorable factors (Zijlstra, Roe, Leonora, & Krediet, 1999). Hyalomma dromedarii it development was also studied under the natural environments to document the most favorable time for its development, eggs laying and hatching period (Vasankari et al., 2007). The study found Hyalomma dromedarii move from one host to another to avoid disaster on its laid eggs or larval developments (Boero, 1984). Its also observed 70% of Hyalomma dromedarii changed 3 host during development stage (Oue et al., 2005).

In region of Arabian Peninsula, farming with camels have significantly improved due to the enhances economic development. The particular region improved their economic development also due to the trade hub(Nyarko, 2010).

The region is completely covered by desert which is the favorable environments to camels. As 1980 there are more than 596,000 camels in Saudi Arabian Peninsula. Camels are consider special animal for their uniqueness in browsing behavior that enable it to be superior to the ruminants animal as a results of the ability of conserving vegetation cover (Menhas, Mahmood, Tanchangya, Safdar, & Hussain, 2019).

.The Hyalomma dromedarii tick primarily feeds on the camels (McLoughlin, 1962). The rearing of camels in mixed herd always contributing to the adaptability of the wide variety of pathogens in camels (Zumbach, 2010). The mixed herd farming of sheep, camel, cattle, and goat production take an integral part of agriculture and significantly contribute to the security and food sector of country. Livestock and agriculture are contributing more 2.8% of the (Gross Domestic Product) GDP of Saudi Arabian Peninsula, and the population of livestock estimated to be more than 28 million head (Canagasaby Devendra, 1993; C Devendra & Chantalakhana, 2002).

Despite this amount large enormous number are imported from all over the world to the peninsular like turkey, Oman, Sudan, Oman, and Argentina (Taibah & MacDonald, 2015; Woertz, 2010).

Peninsula of Saudi Arabia is one of the most countries with number diverse species of wild mammals in the whole Middle East. However, despite the abundance of mammal animals in particular camel in the region, there have been no much data regarding diversity of species and the seasonal distributions of hard ticks in in Province(Josephson, 2020; Smil, 2016). Therefore, the aim of this study was to investigate the abundance and distribution of Hyalomma dromedarii on the body parts of camel in Taif, Saudi Arabia.

MATERIALS AND METHODS

Study area

*The Taif Area on the eastern slopes of the Sarwat Mountains at an altitude of 1700 m above sea level, and increases the rise as we head to the west and south, up to 2500 m, located between (N 20-22^{o} and E 40-42^{o}). Taif area is famous in the animals field. Therefore, three locations were chosen according to the following coordinates: Area A= North of Taif (N*21.572487-*E*40.533898*), Area B= South of Taif (N*21.1560661 - *E*40.3637353*), Area C= Southeast of Taif (N*21.2378605 - *E*40.4727339*) (Majrashi; Majrashi, Dalorima, Mahmud, & Khandaker, 2018).*

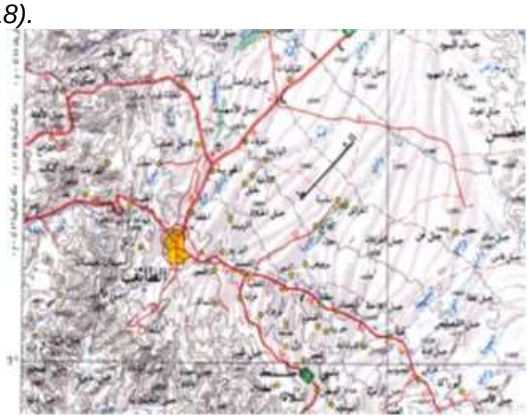

Figure1: A map showing the area of Taif Source

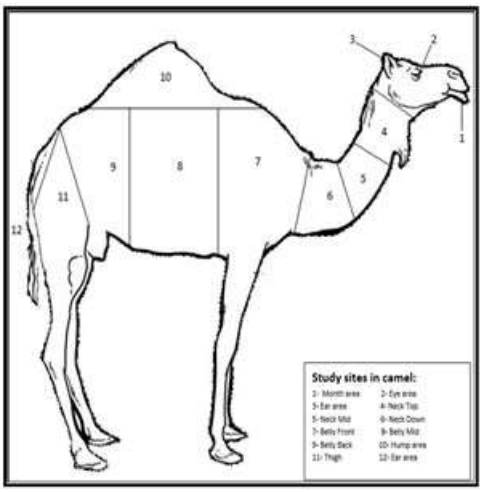

Figure2: *Hyalomma dromedarii* in different sites on camels at *Taif Governorate*

Tick Sampling and Identification

Hyalomma dromedarii were collected from twelve different parts of each of the camel; 1 mouth area, 2 eye area , 3 ear area, 4, neck top, 5 neck mild, 6 neck down,7 belly front , 8 belly mild 9 belly back, 10 hump area , 11 thig area and 12 ear area.

With aid of forcep Hyalomma dromedarii anterior part were taken at the junction with the host, and then the Hyalomma dromedarii were rotated around the forceps axis and were carefully withdrawn from the camel skin and placed it into the vials containing ethyl alcohol 70%. Each vial was labeled according to parts of the animal the ticks were collected. Parasitology Laboratory at Taif University in Saudi Arabia (Estrada-Peña, Bouattour, Camicas, & Walker; Majrashi et al., 2018).

Scanning Electron Microscope

Hyalomma dromedarii micromorphology was determined using Scanning Electron Microscope (JEOL6360LA) with the aid of a hand microtome and fixed immediately in a buffer solution aof 2.5% and 0.1 M of glutaraldehyde and sodium cacodylate, respectively, at room temperature for 24 hours using oven dryer (gas). 0.1 M Buffer of sodium cacodylate at pH 7.2 was used in washing the oven dried sample three times at 10 minutes interval at room temperature, and osmium tetroxides in sodium cacodylate buffer (pH 7.2) at 1% and 0.1 M was used for post fixation for 2 hours at room temperature. Another series of washing was carried out 3 times at 10 minutes interval using 0.1 M sodium cacodylate buffer (pH 7.2). Dehydration was carried out using a series of ethanol at 35, 50, 60, 70, 80, 90 and 100% concentrations at 10 minutes intervals, respectively. Samples were air dried using Hexamethyldisilazane (HMDS) at 310 room temperature for 48 hours and immediately mounted on a stub iron, then mounted with double sided Carbon and coated with gold with the aid of auto fine (MAHMOUD DOGARA Abdulrahman, ABDUL MANAF Ali, HNN Fatihah, MOHAMMED MONERUZZAMAN Khandaker, & NASHRIYAH Mat, 2018; Mahmoud, Labaran, & Yunusa, 2020).

Statistical Analysis

Data obtained were transformed to $\log^{+1}$ or log prior to the statistical analysis and subjected it to one-way (ANOVA) and their treatment means were tested for significant difference, if any, using *t*-tests Similar analyses have been used in many previous studies (Abdulrahman, Fatihah, Khandaker, Ali, & Mat, 2019).

RESULTS

Determination of allelopathic potential using sandwich method

Ticks are considered as agents of global arthropod vectors of disease in both veterinary and medical and clinical, leading to zoonotic and threat to both human and animal health. Tick is among the arthropods group and reservoir of many pathogenic microorganisms. Transmissions of pathogens in humans and animal are significantly carried out by hard ticks. Hard are blood sucking arthropods. Anemia, immunosuppression, paralysis are diseases caused by the direct effect of blood sucking by the ticks. Ticks bite results to the invasion secondary bacterial pathogens in the wound. Food security, welfare and health treat of domestic livestock are at serious threat as a result of the combined effects of the in directs and directs effect of ticks bite all over the world. Several studies was carried out in Saudi Arabia on the significant impact of ticks to domestic livestock. Study from the three study area revealed *Hyalomma dromedarii* on camels in three area at Taif Governorate. From the three study area 129 camels were study (Table 1 and Figure 4). Area A was found to have 48 camels, B 32, and C 49 camels, respectively (Table 1 and Figure 4).

Table1: Number injury by *Hyalomma dromedarii* on camels in three area at Taif Governorate.

The area of study	Number of Sample Camels	Number of injury Camels	Number of sample Camels (Female)	Number of sample Camels (Male)	Number of injury Camels (Female)	Number of injury Camels (Male)
Arae A	48	29	43	5*	25	4*
Arae B	32	19	32	0*	19	0*
Arae C	49	44	42	7*	39	5*
Total	129	92	117	12*	83	9*

Table 2: The number of *Hyalomma dromedarii* in different sites on camles area at Taif Governorate.

The area of study	The front area						Central area				Back area		
	Head			Neck			Belly			Hump	Thigh	Tail	Directive members
	Mouth	Ear	Eye	Down	Mid	Top	Front	Mid	Back				
Arae A	1	5	0	0	3	0	27	0*	29	0	1	5	11
Arae B	1	2	0	1	2	0	9	1*	14	0	1	2	8
Arae C	2	8	0	0	0	1	19	3*	41	0	2	14*	20
Total	4	15	0	1	5	1	55	4*	48	0	4	21	39
	19			**7***			107						

Hyalomma dromedarii was found to cause to a significant injury to the domestic camels study in the area. A total of 92 injury was recorded with area A having 29, B 19and C 44 injury, respectively (Table 1 and Figure 1).

The study classify the camel into three regions the front area, central area and back area. With the following 12 area were study camel: 1 mouth area, 2 eye area, 3 ear area, 4, neck top, 5 neck mild, 6 neck down,7 belly front , 8 belly mild 9 belly back, 10 hump area , 11 thig area and 12 ear area. The head has the following mouth, ear, eye, down, mid, and top. In the mouth area total number of 8 *Hyalomma dromedarii* were found, while the ear has 30, eye has 0and the down area 2: the head region has 19 *Hyalomma dromedarii.* The neck region found to have total of 7 *Hyalomma dromedarii;* down 2, mid 10 and top 2. The central area was found to have 107 *Hyalomma dromedarii* around the belly region consisting the front having 110, mid 8 and back 132 while 0 *Hyalomma dromedarii* was found in the hump region. The back area consist total of 64 *Hyalomma dromedarii* (Table 2).

All the collected *H. dromedarii* were identified and documented. The presence of H. dromedarii on the study camels were found be 100% which made the overall prevalence 99% in the study area. Averagely all the study camels are infested 20-100 *H. dromedarii*. The H. dromedarii were found on the different part of the camel. The prevalence mean of abundance and mean of intensity of H. dromedarii on the body of the camel differ with the location of the body of the camel. The figure 3 below represent the anatomical picture of *Hyalomma dromedarii* through scanning electron microscope to understand the clear picture of the species

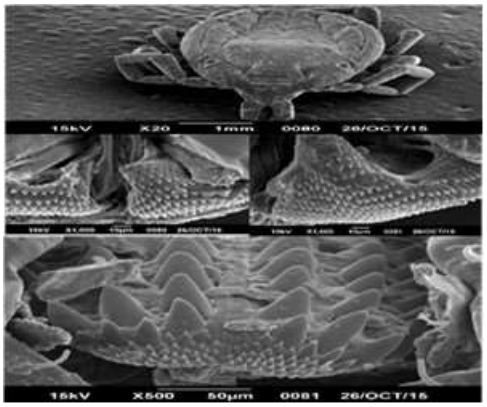

Figure3: Pictures of *Hyalomma dromedarii* parts by an electron microscope

DISCUSSION

Tick-borne pathogens and ticks caused challenge to human and animal all over the world.

Despite acting as vector of pathogens, ticks affect livestock wellbeing directly through blood loss, irritating bites, skin damage and anorexia resulting to stunted growth (Broughton, 2017). Saudi Arabian Peninsula has been consider as a country with high population of camel. Camel population was approximated to be 500,000 in the early 2000. The population was predominant in Riyadh. Camel plays a significant role in Arabian culture and their economy (Abdulrahman, Abdullahi, Uwais, & Tahir). Camel were also utilised in this region for the production of milk, racing, hair, meat production, tourism, and transportation purposes. The animal are known to be good dwellers of hot environment (Raziq, 2009). Production of camel is largely affected by enormous diseases due to the absences qualified veterinarian . Many ecto and endo parasite affect the productivity, health, and performance of the camel (Park, Haenlein, & Ag, 2013). The most prevalent species among ticks are *Hyalomma* acting as vector. Production of camel suffers numbers of challenge including virus, pathogenic bacteria, parasitic protozoan which are imported mostly from neighbouring countries through movement of animals. Ticks in camels are consider as ectoparasite with blood feeding capacity enable to transmit bacterial and viral to people and animal. Ticks biology, distribution and host parasite interactions has been poorly investigated in the Arabian Peninsula especially Saudi Arabia.

Hyalomma is ticking in general and H. Drome darii, in particular, are of great economic significan ce as they are the main parasites of domestic ani mals and the effective vectors of a number of dise ase-causing species. Hyalomma populations survive in inclement conditions and are affected by extreme temperature , humidity, and host conditions. Extraordinary survival factors play a major role in allowing these ticks to exist and even thrive where few or no others live. H. dromedarii are ectoparasite blood feeding tics capable of transmitting diseases to camel while people interact with them. Present research filled the gap on the information needed to document the load of the ticks on the animal and the most loaded area within the animal. The present study provide the baseline information need by the health authorities in Saudi Arabia for the effective management of H. dromedarii. All the sample camels from the present investigations revealed high prevalence of the ticks on them. Previous studies reported by Davari et al. (2017) revealed free H. dromedarii may be observed on the camels if large samples were study. The study classify the camel into three regions the front area, central area and back area. This has been previously reported by Park et al (2013) where they classify the camel into three region. With the following 12 area were study camel: 1 mouth area, 2 eye area, 3 ear area, 4, neck top, 5 neck mild, 6 neck down,7 belly front , 8 belly mild 9 belly back, 10 hump area , 11 thig area and 12 ear area. The head has the following mouth, ear, eye, down, mid, and top. In the mouth area total number of 8 *Hyalomma dromedarii* were found, while the ear has 30, eye has 0and the down area 2: the head region has 19 *Hyalomma dromedarii.* The neck region found to have total of 7 *Hyalomma dromedarii;* down 2, mid 10 and top 2. The central area was found to have 107 *Hyalomma dromedarii* around the belly region consisting the front having 110, mid 8 and back 132 while 0 *Hyalomma dromedarii* was found in the hump region. The back area consist total of 64 *Hyalomma dromedarii.* Abdulrahman et al (2018) reported abundance of *Hyalomma dromedarii* on the central part of the camel. The study also observed moisture on the cave area of the animals resulted on the number of H. dromedarii on the studied camels. Majrashi et al. (2018) suggested that the local farms are habitat to H. dromedarii which increased the population number. H. dromedarii feeds on the infested animal blood leading to transmission of diseases observed in the following study. The overload number of the ticks on the animal body pose a serious health challenge to the animal. H. dromedarii were found on different parts of the camel. All the observed area in the study were found to have large number H. dromedarii. Large number was found at the tail end of the body this may be as a results of the H. dromedarii found a feeding niche. Elghali et al .(2010) reported the presence of the large number of H. ticks on the tail parts is as the results of their ability to hide as their habitat under the tail. Though in a similar study carried out Oue et al. (2005) found abdomen to carry the huge number of ticks. The presence of large number of ticks on the camel revealed a serious management action is needed in the study area. The study also observed *Hyalomma dromedarii utilised* every part of the body in order to survive for their feeding and shelter. The present study established local farmers were not able to control the *Hyalomma dromedarii* by removing them with hand on the camels or birthing them with chemicals. Abdulrahman et al. (2019) reported that the above process is labor intensive and subjecting the

camels to the serious hardship. Menhas et al. (2019) also reported the chemical process can lead to the resistance of the *Hyalomma dromedarii* on the camel. The following study suggested a proper handling management of *Hyalomma dromedarii* on the camel in the study area should be proposed. Development of pest integrated management system is paramount.

CONCLUSION

The present study investigated the population dynamics of *Hyalomma dromedarii* on the camels in Taif region of Saudi Arabia. the camels were found to be infested throughout the year. The study established the backbone of the population of *Hyalomma dromedarii. The* camels were found to be infested with *Hyalomma dromedarii* throughout the year. The following study suggested a proper handling management of *Hyalomma dromedarii* on the camel in the study area should be proposed. Development of pest integrated management system is paramount. The study filled the gap of establishing the proper solution of the effective management control..

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

The author designed the experiments, performed data analysis, wrote the manuscript read and approved the final version.

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