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PROTOZOAN PARASITES IN CAMELS (*CAMELUS DROMEDAIRUS*) INFESTED WITH TICK DURING SUMMER AND WINTER IN LIBYA

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Abstract

This study was carried out to investigate prevalence of tick infestations and identify tick genus and species that parasitized one humped dromedary camels from random farm houses in Sebha city, southern Libya. Out of 225 camels examined, 172 (76.44%) were infested with one or two of tick species. Prevalence rate was (100%) in summer compared to (57.6%) in winter, with significant difference ($P < 0.05$). The recovered ticks were *Ixodes avatus* (24.8%) in winter followed by *Argas persicus* (12%)*, Haemophysalis* sp. (9.6%), *Hyalomma dromedarii* (7.2%) and *Rhipicephalus annulatus* (4.0%). But, in summer ticks were *A. persicus* (30.0%) followed by *R. annulatus* (29.0%), *H. dromedarii* (17.0%), *I. avatus* (13.0%) and then *Haemophysalis* sp. No doubt, global climate changes increase ectoparasites on animal and humans, and hence increasing arthropod-borne infectious diseases.

Keywords: Libya, Camels, Ticks, Summer, Winter, Protozoa, Pathogenicity

Introduction

Ticks are obligate blood-sucking arthropods parasitizing every class of terrestrial vertebrate, including mammals, birds, reptiles, and even amphibians (Lane and Crosskey, 1993). Tick sp-ecies are reservoirs and vectors for a multitude of pathogens such as helminths, protozoa, bacteria, and viruses (Shomaker *et al,* 2013). Apart from infectious diseases, ticks cause tissue injury, body paralysis, and anemia in massive infestations (Morsy *et al,* 2021). Abdullah *et al.* (2018) in Egypt, by molecular analyses found that *Hyalomma dromedarii* and *H. excavatum* transmit zoonotic spotted fever & Q fever to camels. Thus, ticks expanding their ranges and population sizes in response to the global climatic changes (Dantas-Torres, 2015), introducing tick-borne pathogens into new areas (Ogden and Lindsay, 2016). Annual economic losses induced by ticks control and tick-borne diseases were estimated to be about $30 billion annually (de la Fuente *et al,* 2017). In Saudi Arabia, tick infesting camels were *Hyalomma dromedarii, H. anatolicum excavatum, H. marginatum marginatum, H. asiaticum asiaticum, Rhipicephalus sanguineus*, and *Ornithodoros savignyi* (Ali *et al,* 2023). Generally, ticks are common in African, Asian and Mediterranean countries (Georg *et al,* 2022). Thus, climatic changes orientation is indicated (Kienberger and Hagenlocher, 2014). The one humped camel is a comparatively hardy animal herded in semiarid and arid areas in Africa (OIE 2003) with estimated annual global population of 17.44 million increasing at a rate of 1.62% (Biu and Abbagana 2007). Tick *Hyalomma dromedarii* is the most common in Africa, in the Middle East, and Asia (Apanaskevich *et al*, 2008). In Egypt 95% camels were infested by *H. dromedarii* (Elghali and Hassan, 2009). In Yemen, the most abundant ticks were *Hyalomma* spp., particularly on camels (MacArtan *et al*, 1987). In Sudan, Karrar *et al* (1963) reported that *H. dromedarii* was the main species of camels.

In Libya, one-humped camels, *Camelus dromedarius* are domesticated local breed and imported in human benefits Hoogstraal and Kaiser (1960) reported 14 ticks' species of from Libya and small wild animals as hosts of *Hyalomma* spp. Gabaj *et al.*(1992) in Libya over three years in58 farms identified 14 hard ticks and 2 argasid ones, which were *R. annulatus, R. microplus, R. decoloratus, R. sanguineus, R. evertsi, R. bursa, H. anatolicum, H. excavatum H. dromedarii, H.*

franchinii, H. impeltatum, H. rufipes, and *H. turanicum* as well as *Argas* species and *Ornithodoros* species. Also, in north western Libya *R. appendiculatus* was isolated from Jackal and Hedgehog (Hosni, 2006; Hosni and El Maghrbi, 2014) respectively.

This study aimed to determine ticks population infesting one-humped camels in Sebha City, southern region of Libya and to clarify the seasonal climatic conditions on both ticks and camels.

Materials and Methods

This study was carried out in summer of July2021 and winter of December 2021) at Sebha City, southern Libya. One humped camels were selected randomly from different farms. In the month of July 2021, 33 camels were from locally breed and 67 camels were imported from Niger in summer. All 125 camels, of December 2021 were imported from Niger.

A total of 225 camels (192 imported from Niger and 33 local ones) were examined for tick's infestations. Ticks 2-5 were collected from each camel in labeled vials of 70 % ethanol and transported to laboratory. They were identified by species by using standard keys (Hoogstraal and Kaiser, 1960). Parameters were summer and winter infestations on both sexes among two age groups.

Statistical analysis: Data were computerized and analyzed by using SPSS software version 19. Chi squire test compared ticks' seasonal infestations, and camel sexes and ages. $P < 0.05$ was considered significant.

Results

Of 192 camels imported from Niger, 139 (72.39%) and 33 locally breed were infested with ticks. In winter, camels 91/125(72.8%) were male, and 34 (27.2%) were females ticks infested. Of 125, 72 (57.6%) were in winter. But, in summer of 37/100 (37.0%) were males and others were females. Camels were infested by one or two tick species but, rarely three species. In winter, infestation of tick was higher in 1-5 years old camels but, in summer was higher in 6-15years with significant difference (χ^2 =6.453, P=0.011) of tick infestation in two age groups in winter.

Ticks were of five genera, except *A. persicus* (soft), all were hard ticks namely *Haemophysalis* sp. and *H. dromedarii*, *I. avatus,* and *R. annulatus*. Details were given in tables (1, 2 & 3) and figure (1).

Table 1: Seasonal Ticks infestation in camels in Sebha City

Season	Male (No & %)	Female (No & %)
Winter	51/89 (57.30%)	21/36 (58.33%)*
Summer	37/37 (100.0%)	63/63 (100.0%)*
total	88/126	84/99

* Winter verses Summer $P < 0.05$

Table 2: Age of camels infested with ticks in Sebha City

Season	Camel 1-<5years (No & %)	Camel age >5-15year (No & %)
Winter	45/57 (78.94%)	27/68 (39.7%)*
Summer	43/43(100%)	57/57(100%)
Total	88/100	84/125

*$P < 0.05$

Table 3: Seasonal frequency of ticks infested camels in Sebha City

Tick species	Total	Winter	Summer
Argas persicus	45	15(33.3%)	30(66.7%)
Haemophsalis sp.	23	11(47.8%)	12(52.2%)
Hyalomma dromedarii	26	9(34.6%)	17(65.4%)
Ixodes avatus	44	13(29.5%)	31(70.5%)
Rhipicephalus annulatus	34	5(14.4%)	29(85.3%)
Grand total	172	53 (30.8%)	119(69.2%)

Discussion

Genially speaking, Zhu *et al.* (2019) reported that one-hump dromedary camel (*Camelus dromedaries*) could be more that 30 million in Africa and the Middle Eastern Countries. They are friendly domesticated animal with a peculiar status: highly adapted to a specific desert ecosystem for production (milk, meat, wool, skin, and manure), leisure (racing, sport such as polo, tourism, beauty

contests, and festivals), transport (riding, carting, pack carrying), and agricultural work (Faye, 2016). Nevertheless, their ecto-parasites, mainly ticks that transmit many zoonotic pathogens to camels affecting man by meat consumption (Bellabidi *et al,* 2020), and making camels as a reservoir hosts for human infection (Alanazi *et al,* 2020). This is particularly true with the global climatic changes as to arthropod-vectors (Kandil *et al,* 2023) and infective pathogens (Morsy *et al,* 2024). The economic loss due to tick-borne diseases among ruminants in tropical and subtropical areas was annually calculated to be several billion dollars (Jongejan and Uilenberg, 2004).

In Libya, a total of 25 tick species were recorded Abdulsalam *et al,* 2022). Besides, camels are the preferred host for the most common tick, *H. dromedarii* in Nigeria (Biu and Konto, 2011) and Egypt and Africa in general (Saleh *et al,* 2016). Ticks are considered the second most important vectors after mosquitoes in regard to disease transmitting agents (Morsy *et al,* 2023).

Also, Hoogstraal and Kaiser (1960) in Libya, identified *Hyalomma m. turanicum* & *H. m. rufipes* on small wild animals. Gajab *et al*. (1992) reported 13 species of ixodid ticks and two of argasid species, which were *Rhipicephalus annulatus*, *R. microplus*, *R. decoloratus*, *R. sanguineus*, *R. evertsi*, *R. bursa, Hyalomma anatolicum*, *H. excavatum H. dromedarii*, *H. franchinii*, *H. impeltatum*, *H. rufipes*, *H. turanicum*, *Ornithodoros foleyi* and *Argas persicus*. Also, Hosni and El Maghrbi (2014) found that *R. appendiculatus* infested the wild animals.

In the present study, four hard tick species (*Haemophsalis sp*., *Hyalomma dromedarii*, *Ixodes avatus,* and *Rhipicephalus annulatus* and one soft tick (*Argas persicus*) were recovered from camels. Ticks were more in the summer season (119=69.2%) than in winter (53=30.8%). This agreed with data in Ethiopia (Zeleke and Bekele, 2004) in Sudan (El Ghali and Hassan, 2009) in India (Kumar *et al*, 2014), Iran (Moshaverinia and Moghaddas, 2015) and in Tunisia (Elati *et al*, 2921), who reported high infestations in summer and less in winter.

In the present study, camels less than five years old were more ticks' infested 45/57 (78.94%) than those more than five years old 27/68 (39.7%). However, in summer the infestation rates were 43/43(100%) and 57/57 (100%) respectively.

Salim-Abadi *et al.* (2010) in Iran reported that *H. dromedarii* was in all seasons, but with the highest prevalence in summer, as this species is well adapted to extreme dryness weather. Gharbi *et al.* (2013) in Tunisia found that ticks only have positive correlation with high temperature, but don't correlate with relative humidity. But, *Rhipicephalus* species is linked with relative humidity (Hoogstraal, 1956). *H. dromedarii* was the most common species among Egyptian camels (Diab *et al,* 2001), in Sudan (Elghali and Hassan, 2009), in Iran (Moshaverinia and Moghaddas, 2015), and in Tunisia (Elati *et al*, 2021). Moreover, the significant global climatic changes led *Hyalomma* species and others to infest even the European Union (Georg *et al,* 2022).

In the present study, species of *Babesia*, *Borrelia* and *Theileria* were diagnosed randomly blood smears of camels fixed in methanol and Geimsa stained (Zipfel *et al,* 1984).

Babesia was *B. microti*. This agreed with AbouElnaga and Barghash (2016), who reported *Babesia* spp. in camels in the Egyptian Northern West Coast. Ashour *et al.* (2023) in Egypt, who reported that babesiosis in dromedaries camels caused anemia, fever, hemoglobinuria, and gastrointestinal stasis; icterus, which pathogenicity varied according to species (Swelum *et al,* 2014). Also, three babesiosis cases were detected in Egypt asplenic farmers who acquired infection from infected livestock (Michael *et al,* 1987).

The *Borrelia* in camels was *B*. *miyamotoi.* This agreed with Ashour *et al.* (2023), they reported *B. miyamotoi* and *B. afzelii* in Egyptian camels. Also, it agreed with Heidari *et al.* (2022), who by molecular biology identi-

fied *Coxiella burnetii* and *Borrelia* spp. in the Iranian camels.

In the present study, the detected *Theilaria* was *Theileria camelensis* mainly among old camels. This agreed with Nassar (1992), who in Egypt examined 200 apparently healthy camels under field conditions and found that 30% of them were infected with *T. camelensis.* Mazyad and Khalaf (2002) reported that both *Babesia microti* and *T. camelensis* in the living and slaughtered camels in North Sinai Governorate, Egypt. Hamed *et al*. (2011) reported *T. camelensis* in *H. dromedarii* in Upper Egypt. A'aiz *et al.* (2021) reported that *T. camelensis* and *T. dromedaryii* were infecting the Iraqi one-humped camel (*C. dromedarius*). The epidemiology of theileriosis is complex; likelihood of fatal disease depends on the interplay of parasite, vertebrate host, and tick vector as well as environmental factors (Clift *et al,* 2020). However, some *Theileria* species are pathogenic such as *T. parva*, which causes East Coast fever, *T. orientalis*, which causes *Theileria*-associated bovine anemia, and *T. annulata*, which causes tropical theileriosis in cattle, clinically manifesting, such as fever, lacrimation, lymphadenopathy, and corneal opacity (Agina *et al,* 2020).

Apart from zoonotic diseases transmission, by ticks, they cause anemia and blood losses (Pfäffle *et al,* 2009), dermatitis and tick toxicosis (Pasalary *et al*, 2017). Besides, tick paralysis was reported among hospitalized feverish Egyptian children (Mosabah and Morsy, 2012).

Undoubtedly, the world climatic changes of mean temperatures and increased humidity facilitate tick survival on certain latitudes which facilitate the survival and establishment of colonies in regions where tick species were not prevalent before (Estrada-Pena, 2009). The developing control methods and predicting disease risk to better target to control tick borne diseases were indicated (Kandil *et al,* 2023). One health approach is a must to tackle the zoonotic diseases by considering all components including environmental and ecological/wildlife (Abdel-Baset *et al,* 2022) as well as domestic animal and the human habitat factors (Cunningham *et al,* 2017).

Conclusion

The outcome results showed that ticks and other Arthropod-borne infectious diseases have a risky effect on man, animals, and environment. At least regional collaborations are a must for the human welfare.

Recommendations

Undoubtedly, the worldwide geographical expansion range of ticks, the prevalence and transmission of tick-borne infectious diseases to man and livestock animals are risky.

This must be in the mind of the Public Health, Agriculture and Veterinary authorities.

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Authors' activities: Dr. Elsalem, RMA designed the protocol and got the ethical approval. Drs. Elsalem, Al-Kilani, AAZ, and Alrifae, A, did all the field collection of ticks, blood sampling staining and examination. Dr. Fahmy, SA, identified the ticks by genus and species and verified the protozoa identifications. All the authors shared in writing and revising the manuscript and all approved the publication.

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Explanation of figure

Fig. 1: Ticks attached to camels, a; showed hair loss and thickening, b, c, d & e- thickening and white black heavy crusts areas, f- ticks attached to mother-camels mammary glands.

Fig. 2: A- Camels' examinations for ticks, b- Ticks manually collected from infested camels.

Fig. 3: Blood parasites,

Fig. 3A Enlarged *Babesia microti* in blood