

Epidemiological Study on Brown Dog Tick *Rhipicephalus sanguineus* at Sadat District, Egypt

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Abstract

This work aimed to study the epidemiological status of *Rhipicephalus sanguineus* ticks in dogs at Sadat district, Mid-Delta, Egypt. During the period elapsed in-between September- 2015 and August- 2016, a total of 380 dogs (190 stray dogs, 130 animal guard dogs and 60 household dogs) were examined for the presence of hard ticks. Results showed that; 89.4% (340/380) dogs were infected with one species of hard tick "*R. sanguineus*". The most affected group was animal guard dogs (56.1%), followed by stray dogs (34.2%) and lastly, household dogs (10%). There was no significant variation between the dog breeds, or sex of dogs and the percent of infection ($p>0.01$), but an obvious significant difference was found between age and infection rate and site on the body and infection rate ($p<0.01$), the highest percent was in young ages less than 6 months, and external ear. Seasonal dynamics of *R. sanguineus* infection revealed that; it was more prevalent during summer 45% (63/140), than in spring 34% (55/162), in autumn 13% (5/43) and lowest prevalence was detected in winter 8% (3/35). The current study highlights the high prevalence of *Rhipicephalus sanguineus* infecting dogs in Egypt. Also, provide basic line information on such infection that might help to design a control program for this important canine hard tick. Further investigations on dog ectoparasites in Egypt are required.

Keywords: *Rhipicephalus sanguineus*, Tick, Dog, Epidemiology, Egypt.

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INTRODUCTION

Rhipicephalus sanguineus tick is found world-wide, and a very much perceived vector of numerous pathogens influencing canines and also people, infecting mainly dogs causing irritation and skin damage. It is the main vector of *Babesia canis* which is the primary cause of canine babesiosis. *R. sanguineus* also act as the main vector for other pathogens of dogs such as *Ehrlichia canis* which cause the canine ehrlichiosis and *Rickettsia conorii* which cause tick typhus (Sonenshine, 1979; Dantas-Torres, 2008; Dantas-Torres, 2010; Lord, 2011). Moreover, *R. sanguineus* can infect human (Dantas-Torres *et al.*, 2006). A recent study (Ghafar and Amer, 2012) proved that *R. sanguineus* can play a role in transmitting the human pathogen *Anaplasma phagocytophilum*. *R. sanguineus* is distributed mainly in warmer and tropical regions of the world. Nevertheless, *R. sanguineus* can be found on puppies living in both urban and country zones, being very adjusted to live inside human abodes and being dynamic during the time in tropical and subtropical districts, as well

as in some calm territories (Rozental *et al.*, 2002; Dantas-Torres, 2010; Lord, 2011). In Egypt, *R. sanguineus* was found to infect dogs since ancient times (Otranto *et al.*, 2014). Few studies in Egypt (Amin and Madbouly, 1973; Ramadan and Abd-El- Mageid, 2010) were conducted to elucidate the status of dog ectoparasites, particularly hard ticks. But, updated information on the epidemiological status of dog ticks in Egypt is unclear. So, the aim of this work was to investigate the epidemiological status of *R. sanguineus* at Sadat district, Mid-Delta of Egypt to open the way for further works in order to prevent and control the transmission of zoonotic pathogens by this species.

MATERIALS AND METHODS

Study area

Sadat district located northwest to Cairo, in the Nile Delta of Egypt (30.418243°N 30.574722°E). According to climatic and geographical classification, this region is a newly cultivated desert area and it has a tropical atmosphere with the downpours concentrated from harvest

time to winter. The yearly normal temperature is 35°C, changing from 24°C to 46°C, while the relative humidity differs from 72.5 to 85% (Wikipedia, 2015).

Animals' inspection and ticks collection

During the period elapsed in-between May 2014 and April 2015, a total of 380 dogs (190 stray dogs, 130 animal guard dogs and 60 house hold) were screened for the presence of hard ticks by the aid of hand lenses and a fine tooth-comb. Examined dogs were divided according to several factors; including their shelters (into animal guard dogs, stray dogs and house hold dogs); breed (Black Jack, German Shepherd, Dalmatian and Baladi "local"); sex (male and female) and ages (0-6, 6-12 and 12-36 months old). Different areas of each dog body such as external ears, perineum, lateral abdomen, chest, and shoulder region were inspected for ticks.

Ticks were manually collected carefully by non-toothed forceps (Sayyad *et al.*, 2016; Ashraf *et al.*, 2016), encountered on infested dog. Collected ticks were preserved in 70% ethanol in a plastic bottle, labeled and sent to the laboratory for further identification.

Identification of collected ticks

Ticks were identified using a stereomicroscope according to available literature (Sonenshine, 1979; Solusby, 1982; Walker *et al.*, 2000; Estrada- Peña *et al.*, 2004; Dantas-Torres., 2008; Dantas-Torres, 2010; Lord, 2011).

Statistical analysis

Data obtained was tabulated using Microsoft Excel (MS Excel 2010, Microsoft Corporation). SPSS version

16.0 statistical software (SPSS, Chicago, IL) was used for statistical analysis following Chi-square test.

RESULTS

The results of the current study showed that; 89.4 % (340/380) dogs were infected with one species of hard tick "*Rhipicephalus sanguineus*" (Table 1, Figure 1). The most affected group was-animal guard dogs (56.1%) followed by stray dogs (34.2%) and lastly household dogs (10%). There was no significant variation% ($p>0.01$) between the dog breeds, or sex of dogs and the percent of infection at significance level of 99, but obvious significant difference was found between age and infection rate and site on the body and infection rate ($p<0.01$), the percent of infection was highest in young ages less than 6 months, and the highly condensed area with infection was the external ear.

The most infected dog breed was Baladi 74.1% (89/120); then Dalmatian 61.9% (26/42); German Shepherd 64.55% (102/158) and lastly Black Jack 58.33% (35/60). Females were more infected 53.1% (110/207) than males 47.4% (82/173). While dogs aged 0-6 months old were more infected 46% (39/85) than those with age ranged 6-12 months 35% (48/136) and those 12-36 months old 19% (31/159). Ticks were concentrated in different areas of the body such as external ears 45% (171/380), perineum and lateral abdomen 32.1% (122/380) and lastly chest and shoulder region 23.1% (88/380), (Table 1, Figure 1).

The seasonal dynamics of *R. sanguineus* infection revealed that; it was more prevalent during summer (45% 63/140), than in spring (34% 55/162), in autumn (13% 5/43) and lowest prevalent detected in winter (8% 3/35) (Table 1, Figure 2).

Table 1. *Rhipicephalus sanguineus* prevalence in-relation to the habitat, breed, age, and sex of examined dogs in Sadat district, Egypt

Dog		Number examined	Number infected	%age
Habitat	Household	60	6	10
	Stray dogs	190	65	34.21
	Guard dogs	130	73	56.15
	Black jack	60	35	58.33
Breed	German Shepherd	158	102	64.55
	Dalmatian	42	26	61.90
	Baladi "local"	120	89	74.16
Age (months)	0-6	85	39	45.88
	6-12	136	48	35.29
	12-36	159	31	19.49
Sex	Male	173	82	47.7
	Female	207	110	53.10

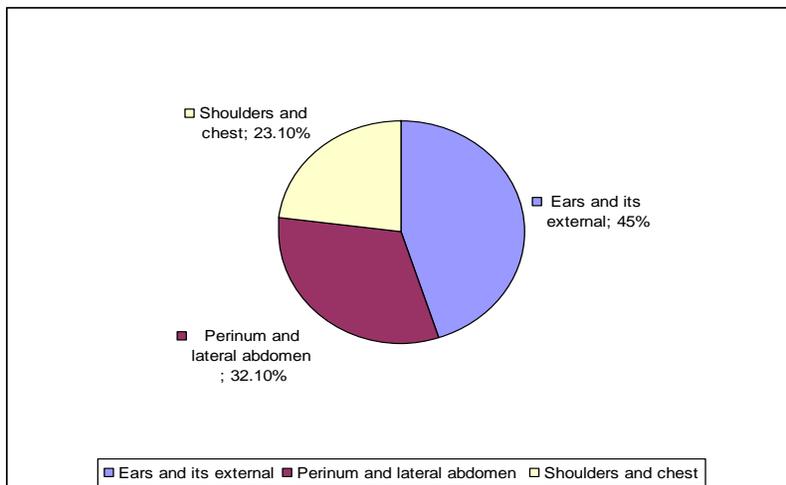


Fig. 1. Prevalent infection sites of *Rhipicephalus sanguineus* on different body regions in infected dogs in Sadat district, Egypt

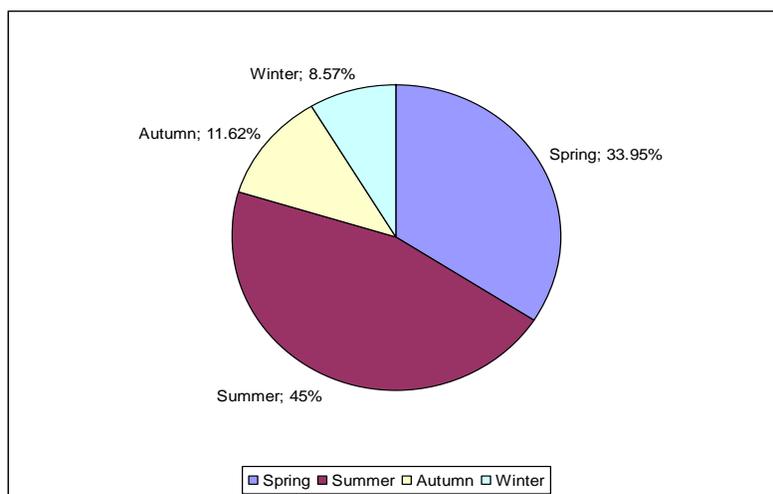


Fig. 2. Seasonal dynamics of *Rhipicephalus sanguineus* infection in dogs at Sadat district, Egypt

DISCUSSION

To apply any control measures for hard tick infection in dogs, it is advisable to characterize the species of tick and the risk factors of this infection. In the current study *R. sanguineus* was the only tick species identified, this goes in line with investigations in Egypt (Amin and Madbouly, 1973; Ramadan and Abd-El- Mageid 2010; Sultan and Khalfallah, 2014) as they did not identify any other hard tick species rather than *R. sanguineus*. Also, it agreed with results from similar climatic areas of the world (Gonzalez *et al.*, 2004; Mosallanejad *et al.*, 2011). These results support the hypothesis of Amin and Madbouly (1973) that *R. sanguineus* is the main and seems to be the sole ixodid tick-infecting dogs in Egypt. The overall prevalence of *R. sanguineus* was 89.4%, this was much higher than recorded earlier in Egypt (56% by Amin and Madbouly, 1973; 24.87% by Ramadan and Abd-El- Mageid, 2010), in

Mexico (20% by Vazquez *et al.*, 1998), in Argentina (73.0% by González *et al.*, 2004), in Nigeria (80% by Abah and Audu 2013). There are a large number of parasites which infect the domesticated animals (Iqbal *et al.*, 2014; Muhammad *et al.*, 2015; Abdel-Aziz and El-Meghanawy, 2016).

The most affected group was animal guard dogs, followed by stray dogs and lastly, household dogs. This is in-agreement with results of Papazahariadou *et al.* (2003) in Thessaloniki, northern Greece, who found that dogs living outdoors, in rural areas and in close proximity to farm animals, were infested with higher numbers of ticks than dogs living indoors. The most infected dog breed was Baladi (local breed); then Dalmatian; German shepherd and lastly Black Jack. This result agrees with those of Abah and Audu (2013) in Nigeria, they found that local dogs were more infected than the exotic breeds. This can be attributed

to that Black Jack and German Shepherd are reared primarily as household dogs having some attention and care than Baladi breed which constitutes the main stray and animal guard dogs population in Egypt.

In the current study, a significant difference was observed in tick burden between females and males ($p < 0.01$), females were more infected than males. This is in agreement with other studies on ectoparasites of dogs (Agbolade *et al.*, 2008); Ramadan and Abd-El- Mageid, 2010). It may be related to hormonal changes, pregnancy, and lactation in females, which results in lower resistance to tick infection and re-infection.

A higher prevalence of ticks in younger animals in comparison with older ones was observed in our study; dogs aged 0-6 months old were more infected than those with age ranging 6-12 months and those 12-36 months old. These results disagree with those obtained by Abah and Audu (2013) as they reported that adolescent dogs were highly infected than the adult hosts and young dogs. Also, Tinoco-Gracia *et al.* (2009) recorded similar results, as dogs up to one-year-old had a significantly ($p < 0.05$) higher tick prevalence than older dogs. This is may be due to the regular washing and dipping with acaricides with increase in age, host specificity could also account for no other species detected in our study.

The preferable predilection sites of ticks on examined dogs in the current study were as follows; external ears, then perineum and lateral abdomen then chest and shoulder region was the lowest. This is in-line with results of Papazahariadou *et al.* (2003), Tinoco-Gracia *et al.* (2009); Abah and Audu (2013), and Földvári and Farkas (2005), they found that; the most preferred sites of ixodid ticks attachment in dogs were in decreasing order; the head, neck and legs. The possible reason that ticks are often found on the ears is probably self-grooming is difficult in this area and the skin is thinner which permit better feeding of the ticks.

R. sanguineus is a three-host ixodid tick, which requires three blood meals to complete its life cycle. Within the favorable conditions of temperature and relative humidity and availability of host, the life cycle can be completed within two months (Lord, 2011). In the current study; the seasonal fluctuations of *R. sanguineus* showed that in summer and spring seasons it was more prevalent, followed by in autumn and the lowest in winter. This is in-much agreement with results of Amin and Madbouly (1973), who suggested a pattern of two successive generations in a year due to the two oviposition following the two feeding peaks of the female in March (related to the increase in atmosphere temperature) and June (due to increasing moisture). Another study in Brazil, also suggested another pattern four generations per year (Louly *et al.*, 2007). Also, our results on seasonal dynamics of *R. sanguineus* agree with those by Vazquez and Vazquez, (1999) as they found *R. sanguineus* infection throughout the year with more prevalent (20% or more) in summer,

spring and autumn than in winter and suggested that 2.5 tick generations can be completed per year. Thus, it is true that *R. sanguineus* is more prevalent in tropical and subtropical areas, but not in cold regions and can be prevalent all over the year seasons (Inokuma *et al.*, 1996). The high prevalence of *R. sanguineus* in the present study and its presence all over the year can be attributed to the suitable climatic conditions in the Egyptian Delta region which allow at least two successive tick generations per year, also the primitive and limited strategies that employed to control stray dogs creates availability of hosts all over the year in both strategic or individual level (Amin and Madbouly 1973).

CONCLUSION

The current study highlights the high prevalence of *R. sanguineus* in the Egyptian Delta. Control of tick and tick-borne disease in dogs remain a great challenge, so applying of adequate control measures for dog ectoparasites in Egypt is required. Further epidemiological surveys on *R. sanguineus* and other dog parasites in Egypt are extremely encouraged.

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CONFLICT OF INTEREST

There is no conflict of interest.

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