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.


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 Anaplasmaphagocytophilum. 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 Mabouly, 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% 171/380), 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**

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

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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 (González 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 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 (2010) and Földvári and Farkas (2005) to tick infection and re-infection.

**CONCLUSION**

The current study highlights the high prevalence of *R. sanguineus* in the Egyptian Delta. Control of tick and tick-born 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.

**REFERENCES**


