

**PREVALENCE AND ECOLOGY OF THE BROWN DOG TICK
RHIPICEPHALUS SANGUINEUS IN DOMESTIC MAMMALS IN BASRAH
PROVINCE, IRAQ, WITH THE ACARICIDAL EFFECT OF QUERCUS
BRANTTI ACORNS EXTRACT IN ADULTS.**

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ABSTRACT

This study was aimed to detect the infestation of *Rhipicephalus sanguineus* of some mammals in Basrah province from January to June 2019. A total 75 of 210 (35.71%) of studied mammals were been infested. This species was isolated from horses in Iraq for the first time. The highest prevalence was recorded in dogs while the lowest in buffaloes. Mean of intensity was recorded mostly in sheep, and the lowest in horses. Highest relative density was recorded in dogs, whereas the lowest was in horses. The highest occurrence was recorded in April, whereas the lowest was in January. The acaricidal effect of ethanolic extract of acorns *Quercus brantti* in adults was shown the rates of mortality increases with the rise of extract concentrations. Mortality percentages were increased according to the time of the exposure. Females were more sensitive than males in the treatment with extract.

Keyword words: hard ticks, ectoparasites, acorns, plant extracts.

حاتم

مجلة العلوم الزراعية العراقية - 2020: 51(6): 1670-1677

انتشار وبيئة قراد الكلب البني *Rhipicephalus sanguineus* في اللبائن الداجنة بمحافظة البصرة وتأثير مستخلص ثمار

البلوط *Quercus brantti* في الدور البالغ

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مدرس

قسم علوم الحياة - كلية التربية للعلوم الصرفة - جامعة البصرة

المستخلص

أجريت هذه الدراسة لتحديد نسب إصابة اللبائن الداجنة بقراد الكلب البني *R. sanguineus* في محافظة البصرة خلال الفترة من كانون الثاني إلى حزيران 2019 ، سجل إصابة ما مجموعه 75 من 210 (35.71 %) من اللبائن المدروسة وعزل هذا النوع من الخيول لأول مرة في العراق، وسجلت أعلى نسبة إصابة في الكلاب، والأدنى كانت في الجاموس، تم تسجيل أعلى شدة إصابة في الأغنام ، بينما الأقل كانت في الخيول، وسجلت أعلى كثافة نسبية في الكلاب، في حين كانت أدنى نسبة في الخيول ، وسجل أعلى معدل للإصابات في شهر نيسان ، بينما الأقل سجل في كانون الثاني، وأظهر المستخلص الايثانولي لقسور ثمار البلوط *Quercus brantti* تأثير كبير في هلاك البالغات، أن معدلات الهلاكات تزداد مع زيادة التراكيز، وكذلك وفقاً لزيادة وقت التعرض للمستخلص، كما كانت الإناث أكثر حساسية من الذكور في التأثير بالمستخلص.

كلمات مفتاحية: الطفيليات الخارجية، القراد الصلب، الجفت، المستخلصات النباتية.

INTRODUCTION

Ticks are obligate ectoparasites of mammals and birds, livestock and wild animals. Ticks are arachnids classified in the subclass Acari, closely related to mites (31). They have four pairs of legs, and the body is divided into two sections, the gnathosoma which bears the mouthparts, and the idiosoma which bears legs (29). There are 840 tick species have been described worldwide. The ticks are classified into two families, namely the hard ticks Ixodidae, according to their hard dorsal shield, and the soft ticks Argasidae, due to their leathery cuticle (17). The family Ixodidae comprises approximately 80% of all tick species, ranging between 2-20 mm. At length, including the species of highest economic importance (30). There are four stages in the life history of ticks: egg, larvae, nymph and adult (16). All stages take a blood meal from hosts only once, twice or long periods (21). Most ticks require one or two hosts to complete the life cycle, but some needs three. Ixodid ticks sucking blood from domestic and wild animals such as cattle, sheep, goats and dogs (9). Ticks are veterinary importance because they are vectors of variety of pathogens such as viruses, bacteria, rickettsia, protozoa, and nematodes (13). The pathogens typically transmit to hosts while the ticks feeding or defecating, includes anemia, hemorrhage, dermatitis and skin necrosis (4). Some important diseases transmitted by ticks to economic animals are as follows, Rocky Mountain spotted fever, Bovine anaplasmosis, Lyme borreliosis, theileriosis, Tick borne fever, ehrlichiosis, and babesiosis (5). Ticks pests' causes economic effects as limit production in the livestock industry. Ticks are second to the mosquito as a means of disease transmission in humans and the most important vector of vector borne disease in dogs and dogs (19). The control of ticks is crucial in the prevention of various vector borne diseases that cause high morbidity and in some cases of mortality in domestic animals (27). Many vector borne diseases cross borders causing diseases atypical of their traditional geographic distribution with the result that many ticks borne diseases are recognized as emerging disease threats (28). The brown dog tick *Rhipicephalus sanguineus* is one of the

important ixodid ticks in the world, especially in Iraq. It infested many livestock and other mammals. This study was conducted to diagnose *R. sanguineus* that infested domestic mammals in Basrah province, and determine its prevalence, some parasitism measures, some ecological aspects and spatial distribution. Then, study the acaricidal effect of ethanolic extract of *Quercus brantii* acorns in the adults of this tick.

MATERIALS AND METHODS

Study area

This study has been conducted in Basrah Province, South of Iraq (fig. 1). This area is confined approximately within 45°- 48° longitude and 30°-32° latitude. The lands of this region are agricultural plains, residential lands, semi-desert and deserts lands. The survey was done in nine locations distributed all Basrah Province, as following: Fao, Abu Al-Khaseeb, Shat Al-Arab, Basrah Center, Zubair, Qarmat Ali, Dair, Qurnah, and Mudainah. A large number of farm lands, animal husbandry stations, and slaughterhouses were visited.

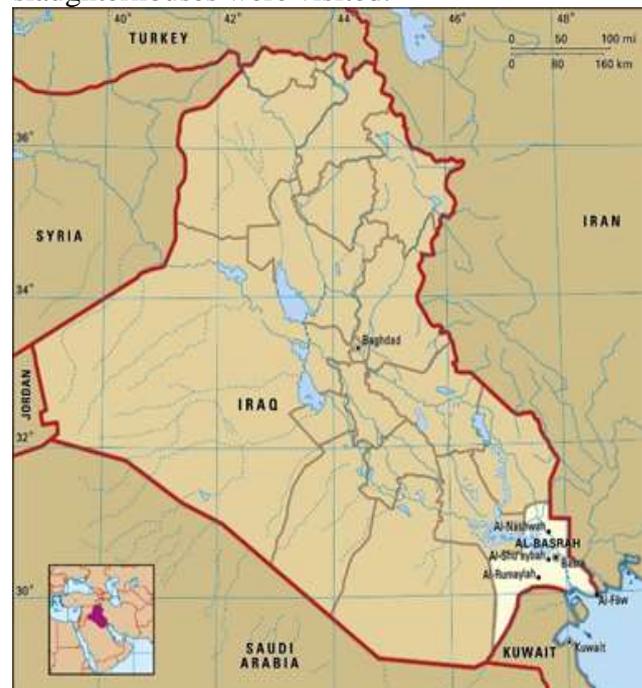


Fig. 1. Iraq map showing the location of Basrah province



Fig. 2. Collection of ticks from dogs

Ticks collection

A total of 200 individuals from different mammals, cattle, sheep, goats, buffaloes, dogs, horses and donkeys were examined for ticks' infestation (fig. 2). The survey was done during January to June 2019. This time period was chosen because it is almost similar with the second half of the year in terms of climatic conditions in Iraq. Samples of ticks were collected by using a fine forceps, cotton, and ethanol. The samples were kept in insect box and recorded the date and place of collection.

Ticks identification

Samples of ticks were identified to the species based on morphological characteristics, using the taxonomic keys of (30), (2) and (16). The diagnosis was depending on several phenotypic features, which are size, coloration, capitulum, scutum, legs, spiracles, anal plates and festoons.

Measures of the parasitism on mammals

Some important measures of parasitism prevalence, abundance, mean intensity and relative density were calculated. Some important measures of parasitism were calculated according to the following equations.

1. Prevalence of infestation = number of animals infested with ticks \div number of all examined animals \times 100.
2. Mean of intensity of tick = total number of collected ticks \div number of infested animals in the sample.
3. Relative density of ticks = total number of collected ticks \div total number of all animals (infested + uninfested) in the sample.

Some field observations

Some field observations of the ecology of *R. sanguineus* infesting mammals were also recorded. Sex ratio between male and female was calculated. The sites of infestation in host bodies were determined. The age composition of ticks' population was recorded.

Determine the temporal distribution

Temperature means and relative humidity rates for the months in the study period were adopted by Iraqi meteorological organization and seismology in Basrah Airport. The occurrences of ticks' infestations during the months of the study periods (from January to June 2019) were recorded. Then, observed the relationship between the presence of infestations and the variations in the climatic factors temperature and relative humidity.

Study the acaricidal effect of *Quercus brantii* acorns in adults

Samples of oak husks *Q. brantii* were brought up from markets in Basrah city. Preparation of the ethanolic extracts was done according to (32). A stock solution of the ethanolic extracts was prepared. A prior each experiment, the stock solution was diluted in distilled water. In order to study the effect activity of on ticks adults, three concentrations were prepared (0.5%, 1%, 2% and 4%). The acaricidal activity of ticks was studied according to (13). This method was carried out by fitting the impregnated filter paper to bottom of glass petri dish which contain 20 ml of the extract for 1 minute only. 10 of adult ticks were immersed in the oil, and then placed on filter paper in big petri dish. The mortality rate of ticks computed after 24 and 48 hours. This procedure was repeated 3 times. Control samples was prepared for each method by impregnated it with distill water only. All tests were carried out at laboratory conditions (in vitro).

Statistical analysis

The results of study were analyzed with t test and chi-square analysis by using computerized Statistical Program for Social Sciences (SPSS). P value <0.05 was considered to be lest limit of significance.

RESULTS AND DISCUSSION

Prevalence of *R. sanguineus* in domestic mammals: The results of the survey were recorded that 75 of 210 mammals were

infested with the brown dog tick *R. sanguineus* in Basrah province during January to June 2019. The species *R. sanguineus* was isolated from buffaloes and horses (new host) in Iraq for the first time. Table 1 showed the total prevalence rate of infestations was 35.71%. The most prevalent host of *R. sanguineus* was dogs with 68.75%, followed by sheep 48.39%, then goats 33.33%. The lowest prevalence was in buffaloes with 13.04%. The statistical analysis showed some significant differences between these hosts. The data in table 1 showed also the highest mean of intensity of *R. sanguineus* was recorded in sheep with 6.37, whereas the lowest was in horses 2.33 with significant differences. Highest relative density of *R. sanguineus* was being recorded in dogs 4.0, while the lowest was 0.44 in horses. The statistical analysis showed a significant differences between the relative densities of ticks' infestations. There are very limited taxonomic, ecological and epidemiological information's about the ticks of Iraq, even though Iraq has very suitable climate and

hosts for ticks. There were few studies about ixodid ticks in Basrah province Southern Iraq. *R. sanguineus* isolated from dogs only by (6) among some domestic animals which they studied. For the wild mammals, (20) recorded it from that. The present study and others in Iraq were showed that genus *Rhipicephalus* are one of the dominant ticks both in the number of species and specimens collected. Species belonging to this genus are most prevalent in the regions of North Africa and the Middle East (31). There are an acclimation of *Hyalomma* and *Rhipicephalus* to the environment of the Afrotropical area and adaptation for hot or cold (22). The diversity of ixodid ticks' species varied between the locations of studies might be due to the difference in the geographical locations, and climatic factors. The variation in tick diversity are due to climate change, geographic location and hosts (11). Ecological and climate changes impacts on tick's biodiversity, the changes alter tick population dynamics (12).

Table 1. The prevalence of mammals' infestation with *R. sanguineus* in Basrah province for the period from January to June 2019

mammals	examined	infested	prevalence%	Mean of intensity	relative density
dogs	16	11	68.75	5.82	4.0
sheep	62	30	48.39	6.37	3.08
goats	42	14	33.33	5.71	1.90
cattle	51	14	27.45	6.29	1.73
horses	16	3	25.00	2.33	0.44
buffaloes	23	3	13.04	3.67	0.48
total	210	75	35.71	5.88	2.10

Some aspects of *R. sanguineus* ecology

The data in figure 3 showed the variation according to gender. The number of collecting females was higher than that male with 53.96% to 46.04%, and the sex ratio was 0.85. Figure 4 revealed that the total number of ticks collected was mostly engorged female with 32.18%, followed by feeding males 28.22%. The larvae were the lowest collected number by 5.45%. The statistical analysis of the data were recorded some significant differences among the numbers of life cycle stages, fed stages from unfed and un adult stages. The observations during the ticks' collections were recorded the sites of attacks of *R. sanguineus*

on the infested host body. The numbers of ticks were isolated from ear, face, axilla and groin (fig. 5). There are some biological conditions influenced of ticks' occurrence, such as morphology of the host, host immune responses, inter-specific interactions, and length of the feeding phase (14). There were some differences in density, attachment site and proportion of tick life stages depending on the body parts. Factors that affect ticks feeding include ticks density, host defenses, and ages of the host and tick (25). The different stages of ticks select different body parts for attachment, the attachment site selection reflected the life stages differing ability to

move (27). Population of ticks differ in a given region depending on climatic fluctuations, land structure and vegetation (7). The larvae were mainly found on legs and ears, with nymphs mainly on ears and some on the legs, while adult ticks are moving long distances to the neck and groin (18).

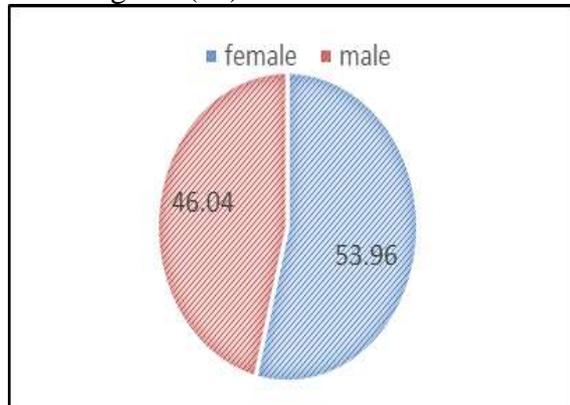


Fig. 3. Sex ratio between females and males in *R. sanguineus* collected in Basrah province

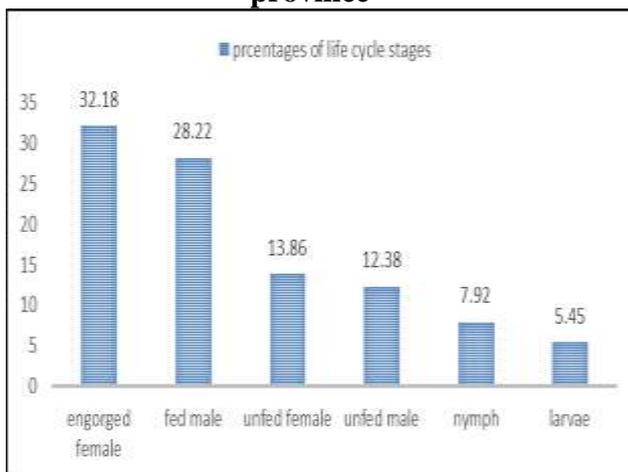


Fig. 4. Age composition of *R. sanguineus* collected from livestock in Basrah province during the period January to June 2019

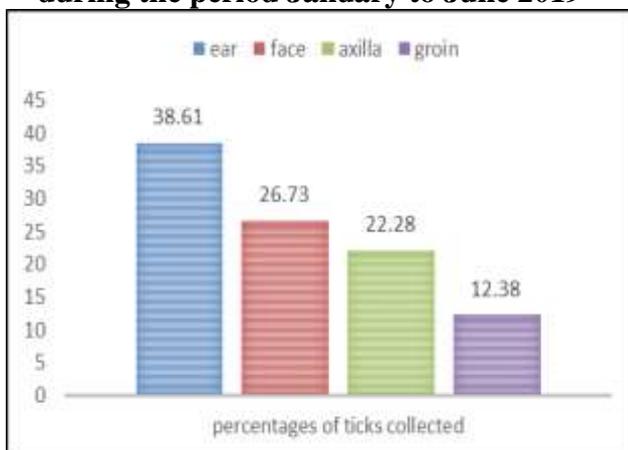


Fig. 5. The attachment site of *R. sanguineus* in the host bodies

The temporal distribution of prevalence of *R. sanguineus* in Basrah province

The results of the present study showed some differences in the monthly occurrence of *R. sanguineus* infesting some mammals during January to June 2019. Figure 6 revealed the prevalence of studied mammals with *R. sanguineus* according the months of the year. The distribution according to months showed that it was highest in April with 28.33% followed by May 21.67%. The lowest prevalence was recorded in January with 6.67%. The statistical analysis of the results was referred to some significant differences between the prevalence rates in the months of the study periods. For the temporal distribution of *R. sanguineus* on mammals, the results showed statistically different numbers of tick's collection among the months during January to June. The abundance of ticks was being affected with climatic factors such as temperature, humidity, sunlight, wind speed and dust. In the temperate areas, long periods of high temperatures may encourage a boost of the mortality of molting stages, but long winters may induce high mortalities in the ticks (3). The effect of the climate on the tick abundance concentrate in two essential parameters: the composition and the numbers of the hosts (15). Human actions changed and modified the habitats of the vectors and hosts, may have deeper effects on the epidemiology of tick than climate change (10). The composite ecological systems, defining many epidemiological effects of ticks, the abiotic and biotic factors influencing the constitution and continuity of tick populations and their associated pathogens (26).

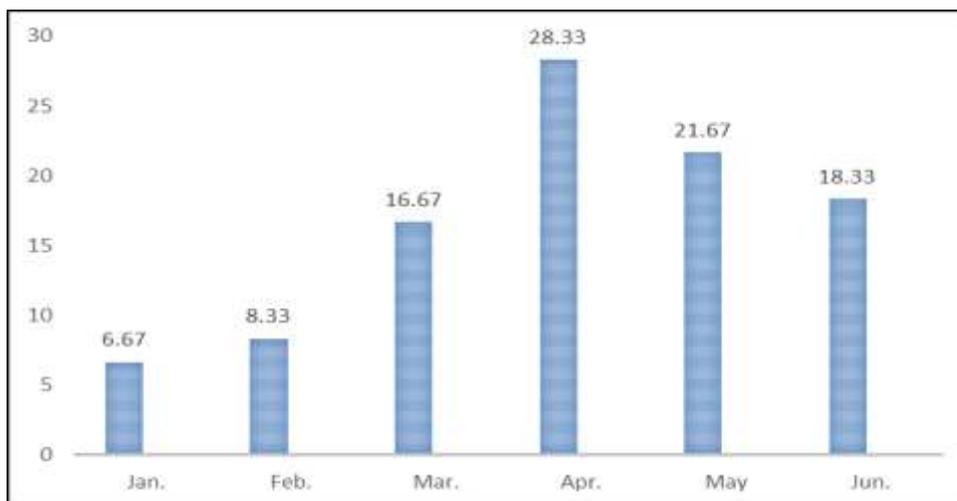


Fig. 6. Temporal distribution of *R. sanguineus* on some domestic mammals in Basrah province during the study period from January to June 2019.

The acaricidal effect of *Quercus brantii* acorns in *R. sanguineus* adults

The results of *R. sanguineus* adults' immersion test with the ethanolic extract of *Q. brantii* acorns were shown in the Fig. 7 and 8. High mortality percentages were recorded in females treated with the extract compared to the control after exposure 24 and 48 hours. These percentages recorded 16.67%, 26.67%, 60%, 46.67% and 70% at the concentrations 0.5%, 1%, 2% and 4% respectively, with significant differences. The mortality percentages increased significantly in the all concentrations after 48 hours of the treatment. They recorded 23.33%, 33.33%, 60% and 86.67% at the same concentrations respectively (fig.7). Figure 8 shows the mortality percentage of *R. sanguineus* adult males which ranged between 10%, 23.33%, 43.33% and 63.33% at the concentrations 0.5%, 1%, 2% and 4% respectively, after 24 hours of the exposure. The mortality percentage increased significantly at the all

concentrations after 48 hours of the immersion test. They recorded 26.67%, 30%, 56.67% and 76.67% in the same concentrations respectively. For the acaricidal effect of *Quercus brantii* acorns extracts in the adults' mortality of *R. sanguineus*, the ethanol extract revealed good results. High mortalities may be caused by toxic substances that affect in the central nervous system or damage the cellular enzymes in the body (24). The toxic potential of the extract was higher on fed individuals than unfed (1); this may be due to the opening of the dorsal plates and the expansion of the body, thus, toxic compounds penetrate into the body coelom (18). The high effect of *Q. brantii* extracts on adult ticks may be attributed due to the chemical structure. The phytochemical content of acorn *Q. aegilops* products contains phenols, fatty acids, gallic acid oleic and linoleic (23). The chemical activity of acorns may be due to the phenolic compounds found in the oak peel (8).

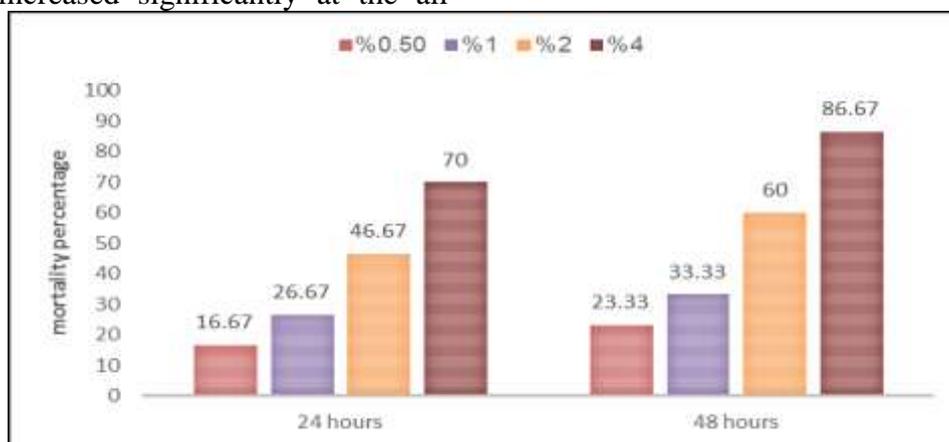


Fig. 7. Mortality percentage of *R. sanguineus* female treated with ethanol extract of *Q. brantii* acorns

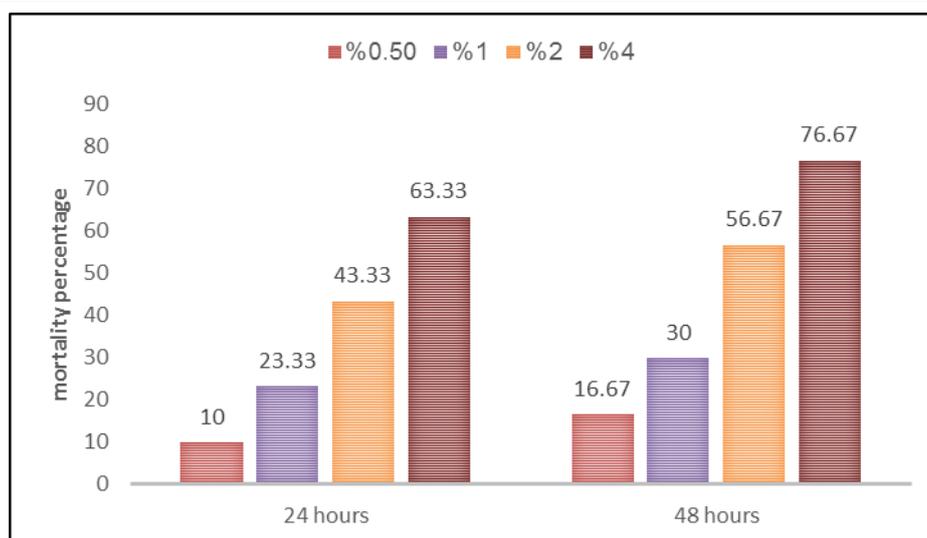


Fig. 8. Mortality percentage of *R. sanguineus* male treated with ethanol extract of *Q. brantti* acorns

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