ECTOPARASITE INFESTATION OF GOATS (CAPRA HIRCUS) IN NORTHERN IRAQ: PREVALENCE AND SPECIES IDENTIFICATION

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ABSTRACT

The study was carried out for eight months from May to December 2020 to identify the main ectoparasite species that infest goats; for this purpose, a total of 150 local goats (Capra hircus) were thoroughly examined for the investigation of ectoparasites from ten small ruminant flocks belonging to five districts of the Sulaymaniyah governorate in northern Iraq. The goats included in the study were determined for preimaginal and adult ectoparasite stages. The observed ectoparasites were collected and preserved separately in containers with 70% ethanol and then brought to the laboratory for identification. The ectoparasite collection was done from the following regions: the ear, shoulder, neck, back, flank, thigh, and groin region. The overall prevalence rate of ectoparasite infestation was 57.33% counting 86 animals. Three different types of ectoparasites including ticks (n = 42; 48.84%), lice (n = 37; 43.02%), and fleas (n = 7; 8.14%), were identified. The higher infestation rate was due to hard ticks (Ixodidae). The identified ticks belonged to five species and Rhipicephalus spp. were widely distributed with the highest reported numbers as follows: Rhipicephalus sanguinaus 14 (16.28%), R. turanicus 11 (12.79%), R. bursa 7 (8.14%), Rhipicephalus (Boophilus) annulatus 4 (4.65%), and Hyalomma anatolicum 6 (6.98%). Two species of lice belonging to sucking lice, Linognathus stenopsis 22 (25.58%) and chewing lice of Bovicola caprae 15 (17.44%), were reported. The only identified flea species from the study was Ctenocephalides canis which was reported in 7 (8.14%). Recognized ectoparasites affect the health status and productivity of goats.

Keywords: - goat, tick, lice, flea, Sulaimani

INTRODUCTION

Ectoparasites cause a significant decline in growth rate and production resulting in reduced income from livestock rearing (Milne et al., 2008). Ectoparasitism is one of the most common problems among livestock; however, it was underestimated in goat farming (Cornall and Wall, 2015). The phylum Arthropoda comprises over 80% of known animal species and exists in almost all habitats. As a consequence of their activity, ecto-parasites may have a variety of direct and indirect effects on their hosts (Wall and Shearer, 2001).

Among the ectoparasites of terrestrial vertebrates, ticks, mites, lice and fleas are more abundant with greater veterinary and zoonotic significance (Durden, 2006, Yakhchali and Hosseine, 2006).
Phthirapterosis (lice infestation) in goats is a precise entomosis. Lice are considered as permanent ectoparasites with great specificity towards the host. They can be sucking or biting (Nizamov and Prelezov, 2019). Substantial infestations among goat herds with lice species have been reported from various parts of the world, predominantly during the winter months (Iqbal et al., 2014). Itching and alopecia are the main consequences related to the clinical lice infestation as a result of hypersensitivity reaction of the skin (Ajith et al., 2019). Numerous factors enhance the flaring up of lice infestation in animals, increased herd density, lack of hygiene, low temperature, and high humid weather were among the important factors (Taylor et al., 2007). Moreover, they become vectors, and are capable of transmitting several pathogens, such as viruses, bacteria, protozoa, and fungi to susceptible hosts (Otter et al., 2003).

Fleas (Siphonaptera) are another type of blood-sucking arthropods that infest different hosts including mammals, poultry, reptiles as well as humans (Halos et al., 2014).

Various species of fleas have been stated infesting goats including Ctenocephalides canis, C. felis, C. felis orientis, C. felis strongylus and Pulex irritans (Soundararajan et al., 2018).

Flea infestation is associated with extreme annoyance, irritation, loss of hair, and loss of body weight. As a result, the infested animals become weak and debilitated, with rough coats and lusterless skin. In heavy infestation conditions, there was discoloration of the hairs which become dark brown or reddish colour as a result of blood oozing from the flea’s bite injuries (Christodoulopoulos et al., 2006). The consequence was severe anemia and even death in children (Soundararajan et al., 2018). Additionally, sings of restlessness, rubbing, chewing, cutting hairs, excoriations, and lichenification have also been observed (Kaal et al., 2006).

Ticks are the further most nonpermanent ectoparasites (Durden, 2006; Yakhchali and Hosseine, 2006). Hard ticks are a group of arthropods that have a harmful effect on domesticated animals, as well as they transmit some pathogenic agents of serious zoonotic diseases (Kumar et al., 2013). The premature and adult stages of ticks attack different animal hosts. They feed on their blood and interstitial fluids (Davari et al., 2017), resulting in direct injuries due to their feeding behavior (Ghashghaei et al., 2016). In spite of this, about 10% of the currently known tick species are act as vectors for pathogens of animals and humans (De la Fuente et al., 2008). Since ticks have one or more hosts during their life cycle, they may transmit infections from wild to domestic hosts during their feeding, as they remain infected for their lifetime and transfer the infection through trans-ovarial or trans-stadial transmission (Davari et al., 2017). As a result, they considered as a serious threat to animal and public health in several parts of the world (De la Fuente et al., 2008).

Ixodidae family is one of the largest families of parasitic ticks that infest domestic ruminants. At least 13 genera and 650 species of Ixodidae ticks have been identified and reported (Horak et al., 2002).

Deficient prophylactic and therapeutic programmes for controlling of ectoparasitic invasions, low skill, and bad awareness from the owners of the animals have led to the wide spread of the ectoparasitic infestation among livestock in some regions (Nizamov and Prelezov, 2019). Furthermore, control of ticks and tick-borne diseases is important to protect livestock health and their products (Mullen and Durden, 2009).

Ectoparasite infestations have been reported from different parts of Iraq affecting the health, condition of farm animals and production, while periodic investigations of ectoparasite prevalence and associated risk factors are required, so the study was aimed to find out and identify different types
of ectoparasites infesting goats in Sulaymaniyah governorate northern Iraq.

MATERIALS AND METHODES

Study areas and sampling
The study was conducted from May to December 2020 to identify the main ectoparasite species infesting goats. A total of 150 adult local breed goats (Capra hircus) of both sexes were randomly selected from ten small flocks of ruminants belonging to five districts of the Sulaymaniyah governorate, and thoroughly examined for infestation of ectoparasites. The goats included in the study were determined for preimaginal and adult ectoparasite stages.

Ectoparasites Collection and Identification
The lice, fleas and ticks that were found, collected individually with forceps, preserved in containers with 70% ethanol (Urquhart et al., 1996), and brought to the laboratory for identification. Ectoparasite collection was performed from the following regions: ears, shoulder, neck, back, flank, thigh, and groin region.

Species differentiation and identification of collected ectoparasites was conducted microscopically based on the morphological traits for each parasite as described by (Joseph, 1981; Walker et al., 2003) for ticks, (Soulsby, 1982; Wall and Shearer, 2001) for fleas and lice. Based on reference identification keys, ectoparasites were identified to the genus, species, and gender.

RESULTS
The overall prevalence rate of ectoparasite infestation was 57.33% (n= 86) cases. The encountered ectoparasites infesting goats belonged to three different types, including: ticks, lice, and fleas. Among the reported ectoparasites, hard ticks (Ixodidae) were found as the predominant one, and recovered in 42 (48.84%), compared to lice 37 (43.02%) and fleas 7 (8.14%).

The identified hard ticks belonged to five species. The highest number of recognized and widely distributed tick species were Rhipicephalus spp., including: R. sanguinaus (14; 16.28%), R. turanicus (11; 12.79%), R. bursa (7; 8.14%) and R. (Boophilus) annulatus (4; 4.65%). Furthermore, Hyalomma anatolicum was recovered in (6; 6.98%).

Two species of lice were reported, including sucking lice Linognathus stenopsis (22; 25.58%) and chewing lice Bovicola caprae (15; 17.44%), and also, a flea species Ctenocephalides canis was identified with a prevalence rate of (7; 8.14%) as shown in Table 1.
FIGURE LEGENDS

Figure 1. Photomicrographs of lice and flea species: Linognathus stenopsis female, (A) Bovicola caprae female (B), Ctenocephalides canis male (C) (40 X).

Figure 2. Photomicrographs of tick species Rhipicephalus bursa male (A1, A2), female (A3, A4), Rhipicephalus turanicus male (B1, B2), female (B3, B4), Rhipicephalus sanguineus male (C1, C2), female (C3, C4), Rhipicephalus (Boophilus) microplus female (D1, D2), Hayaloma anatolicum female (E1, E2) with dorsal and ventral view, respectively.
DISCUSSION

Diseases caused by ectoparasites are among the important aspects that influence the production and productivity of small ruminants (Zewdu et al., 2015). The overall prevalence rate of goat ectoparasites in the study area was 57.33% (86/150). As compatible with the current study, higher ectoparasites infestation rates of 72.8% and 79.9% were reported by Puvarajan, (2017) and Tulu and Urge, (2018), respectively.

The ectoparasites encountered that infested goats were ticks, lice, and fleas. Among the various reported ectoparasites in the current study, ticks were found to be predominant as ecoparasites, which recovered in 42 (48.84%) compared to in lice 37 (43.02%) and in fleas 7(8.14%).

In accordance with the study findings by Iqbal et al., (2014) in Pakistan, who reported a higher prevalence rate of ticks (33.58%) compared to lice (9.58%) and fleas (6.84%). The highest infestation rate of ectoparasites due to tick was also reported (37.8%), followed by fleas (34.4%) and lice (31.2%) by (Tulu and Urge, 2018) from Ethiopia. Furthermore, in another study (Monfared et al., 2015) a higher tick infestation rate was (49.6 %). The ixodid tick species are the most abundant tick parasite that infest ruminants (Sajid et al., 2008).

The ectoparasites identified with Ixodidae from the current study belong to five species, including the following: *Rhipicephalus sanguinaus* (14, 16.28%), *R. turanicus* (11, 12.79%), *R. bursa* (7, 8.14%), *Rhipicephalus (Boophilus) microplus* (4, 4.65%) and *Hyalomma anatolicum* (6, 6.98%). Other authors have also identified similar species.
of hard ticks in goats with various prevalence rates. In a previous study from northern Iraq, Mustafa, (2019) reported that R. sanguineus 28.63%, R. turanicus 15.96%. Rhipicephalus (Boophilus) spp. 14.16% and Hy. anatolicum 31.30%. Also, (Banafshi et al., 2018) reported R. sanguineus 60.05%, R. bursa 0.08%, and Hy. anatolicum 12.33% from the borderline of Iran-Iraq. Furthermore, the common identified tick species reported by Davari et al., (2017) were R. sanguineus 43.63.1%, R. bursa 28.1% and R. annulatus 0.18% from Iran. In agreement with our study, high prevalence rates of R. sanguineus 43.2 % and R. bursa 41.5 % from Iran were reported (Monfared et al., 2015).

In agreement with our study, Rhipicephalus spp. was more prevalent than Hyalomma spp. in goats from the middle and southern borders of Iraq (Mohammad, 2016). Similar findings were also reported by (Shemshad et al., 2012; Semu et al., 2012) from Iran and Ethiopia, respectively. This can be attributed to the fact that this genus is considerably resistant to adverse climatic conditions (Shemshad et al., 2012).

In accordance with the current study, both R. sanguinaus and R. turanicus were also reported with high prevalence rates of 39.93% and 49.54%, respectively compared to Hy. anatolicum 13.5% (Zangana et al., 2013). While contrary to the current study findings, higher infestation rates were reported due to Hy. anatolicum 28.45% and 20.39% in Iran and Pakistan (Yakhchali et al., 2012; Iqbal et al., 2014), respectively. Moreover, in contrast to our study data, higher infestation rate due to Boophilus microplus 27.2% than R. sanguineus 7.2% was reported (Puvarajan, 2017).

Rhipicephalus sanguineus is considered as a global tick and is capable of transmitting pathogens such as Rickettsia rickettsii, Coxiella burnetii, Ehrlichia spp. and Anaplasma spp. (Sarih et al., 2005; Dantas-Torres, 2008), as its activities were extended all over the seasons, although the activity of R. bursa was confined during the autumn months (Davari et al., 2017). The present results about identifying different tick species agree with previous reports that goats act as alternative hosts for cattle ticks (Nyangiwe and Horak, 2007; Puvarajan, 2017). Both R. sanguineus and R. bursa, were among the reported tick species that parasitized cows and goats (Shemshad et al., 2012).

Variation in prevalence levels from different studies may be associated with difference in the study season, grazing system, method for applying of chemicals, and animal management, also age, sex, and flock type are considered risk factors (Leul et al., 2020).

Lice were the second identified ectoparasites, which noted in 37 animals (43.02%). High prevalence rate of lice infestation 53% was also reported in Algeria (Meguini et al., 2018). Both sucking lice Linognathus stenopsis and chewing lice Bovicola capriae were detected with prevalence rates of 22 (25.58%) and 15 (17.44%), respectively. L. stenopsis was also found to be the second most prevalent ectoparasite of 25.92% (Leul et al., 2020).

Concerning lice infestation, in contrast to the study findings, higher prevalence rates of chewing lice than sucking lice were reported, including both B. capriae and L. stenopsis, 80.74% and 19.2%, respectively (Zangana et al., 2013), and 10.97% and 6.22%, respectively, in Iraq (Mustafa, 2019). Similarly, higher prevalence rates of chewing lice than sucking lice were reported in many countries. Yakhchali and Hosseine, (2006) reported B. capriae in 71.4% and L. stenopsis in 36.1% in Iran. Sarkar et al., (2010) identified B. capriae in 20.8% and L. stenopsis in 18.4% of infested goats in Bangladesh. As well as Prelezov and Nizamov, (2020) reported 46.6 % and 40% for sucking lice (L. stenopsis) and biting lice (B. capriae), respectively, in Bulgaria. Such variation in prevalence rates might attributed to various epidemiological risk factors.

Factors such as differences in chemical intervention, stress conditions, feeding and
housing conditions, and quarantine of newly introduced animals may contribute to the fluctuation of lice infestations (Shibeshi et al., 2013). Intestinal parasitism and malnutrition were among the stress factors that enhancing the lice infestation (Pugh, 2002), poor body condition was another predisposing risk factor (Tulu and Urge, 2018) reported that goats being at risk four times to be infested with ectoparasites compared to good body condition goats. Age and sex of infested animals also considered as another risk factor (Sarkar et al., 2010).

Lice have been considered one of the responsible parasites for skin rejection in tanneries due to a skin defect as a result of itching leading to scratching and rubbing due to the feeding behavior of lice (Mulugeta et al., 2010, Mersha, 2013).

Flea was another reported ectoparasite, *Ctenocephalides canis* was the only identified species with an infestation rate of 7 goats (8.14%). The study result represented a higher prevalence rate of lice 37 (43.02%) than fleas 7 (8.14%). A similar finding was also reported by (Zangana et al., 2013), however, Semu et al., (2012) noticed a higher prevalence rate of fleas 11.3% in comparison to lice 9.7%.

Previously, flea infestations were recognized, and a high abundance rate of 30.79% was reported by (Soundararajan et al., 2018). Among the current study’s inspected animals, only *Ctenocephalides canis* was reported with a prevalence rate of 7 (8.14%). However, higher infestation rates of 47.2% and 18.52% for both flea species; *C. canis* and *C. felis* were reported by Zangana et al., (2013) and Leul et al., (2020) in Iraq and Ethiopia, respectively. However, both *C. felis* and *C. canis* were reported with low prevalence rates of 4.35% and 2.48%, respectively, in Pakistan (Iqbal et al., 2014).

Incompatibility in the prevalence rates of *Ctenocephalides* spp. reported by different authors may be due to differences in management, agroecological, and climatic conditions (Leul et al., 2020). Variation in ectoparasitic prevalence rates depends on several environmental, host, and parasite-related factors like, climate, hygiene, age, sex, host immune status, parasite biology, etc. (Taylor et al., 2007). Differences in the chemical application method, geographical differences, season, grazing system, and animal management were other related factors (Leul et al., 2020). According to the reports of Madeira et al., (2000) and Mulugeta et al., (2010), the prevalence of ectoparasites was higher in large flock size than in small flock size, because in large flock sizes there is an overcrowding and constant contact between small ruminants for prolonged times which enhances ectoparasites’ spread from infected to uninfected animals.

**CONCLUSIONS**

In view of the results of the present study, it has been confirmed that goats became infested with different ectoparasite species in spite of conducting the ectoparasite control programme under traditional husbandry practices. Ticks were the predominant ectoparasites affecting goats. *R. sanguinaus, R. turanicus, R. bursa, Rhipicephalus (Boophilus) microplus* and *Hv. anatolicum* were the important tick species identified in this study, lice belong to *L. stenopsis* and *B. capre* were the second most important reported ectoparasite, followed by *C. canis* flea.

**REFERENCES**


الإصابة بالطفيليات الخارجية للماعز (hircus Capra) في شمال العراق: الانتشار وتحديد الأنواع

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أجريت هذه الدراسة خلال ثمانية أشهر من مارس إلى كانون الأول 2020 لتحديد أنواع الطفيليات الخارجية الرئيسية التي تصيب الماعز. وللتحقيق من هذا الغرض تم فحص ما مجموعه 150 ماعزًا محليًا (Capra hircus) بدقة للتحري عن الخمج بالطفيليات الخارجية في عشرة قطعان من المحاجر الصغيرة التالية: جنوب من محافظة السليمانية شمال العراق. حيث تم تحديد الماعز المشمولة في الدراسة لمراحل مختلفة من الطفيليات الخارجية قبل البلوغ والمراحل البالغة. كما تم جمع القمل والبراغيث والقراد التي تم العثور عليها بشكل فردي بالمقطع وحفظت في عبوات تحتوي على 70% من الإيثانول وإحضارها إلى المختبر لتشخيصها. وقد تم جمع الطفيليات الخارجية من المناطق التالية: الأذن والكتف والرقبة والظهر والجناح والقدم والمنطقة الطفيلة. حيث كان معدل انتشار الخمج الكلي بالطفيليات الخارجية 50.5%.

وتم تصوير ثلاثة أنواع مختلفة من الطفيليات الخارجية بما في ذلك القراد (26.62% 20) والقمل (25.20% 50) والبراغيث (6.02% 7). وجدت أن أعلى معدل للخمج كان بسبب القراد الصلب (Ixodidae) حيث كان القراد الذي تم تشخيصها ينتمي إلى خمسة أنواع وكان نوع القراد Rhipicephalus ؛ R. sanguinus (16.28%) و R. turanicus (12.82%) و R. sanguinaus (16.28%) و R. bursa (8.14%) و R. annulatus (6.98%) و R. anatolicum (6.98%). وجدت أن أنواع القراد المستخدمة في المنطقة من نوع Ctenocephalides cati والمهدمة في منطقة الدراسة هي Ctenocephalides canis (6.02%) حيث تأثر الطفيليات الخارجية المعروفة على الحالة الصحية وناتجة الماعز.