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Sabeeh H Al-Mayah

Biology Dept, College of
Education for Pure Sciences,
University of Basrah, Basrah,
Iraq

Alaa N Hatem

Biology Dept, College of
Education for Pure Sciences,
University of Basrah, Basrah,
Iraq

Species diversity, prevalences and some ecological aspects of Ectoparasites of buffalo *Bubalus bubalis* in Basrah Province, Iraq

Sabeeh H Al-Mayah and Alaa N Hatem

Abstract

This study was carried out in Basrah province, south of Iraq, during June 2016 to May 2017. The survey was done with a total of 240 buffaloes, 124 (51.6%) were found infested with one or more of ectoparasites. 10 species of ectoparasites were identified, Six species of ticks, five are hard ticks, namely: *Hyalomma anatolicum* Koch, 1844, *Hyalomma excavatum* Koch, 1844, *Hyalomma asiaticum* Schulze and Schlotzke, 1929, *Rhipicephalis turanicus* Pomerantzev, 1941, *Haemaphysalis sulcata* Canestrini and Fanzago, 1878, and one species of the soft ticks: *Otobius megnini* Duges, 1884. Three species of lice, two are sucking lice: *Haematopinus tuberculatus* Brumeister, 1839, and *Haematopinus eurysternus* Denny, 1842, one of the biting lice: *Damalina Caprae* Gurlt, 1843, One species of mites *Psoroptis ovis* Hering, 1838. The infestation prevalence rate of ticks was 53%, higher compared to lice 45.5%, and to mites 1.5%. The most prevalent of ticks species in the study was *H. anatolicum* with an abundance of 39%, while, *Hae. sulcata* was the lowest abundance with 5%. For lice, *Ha. tuberculatus* recorded the highest abundance with 35.5%. Many variations of the seasonal abundance of osteoporosis were determined during the study period. Ticks were found to be more abundant in the moderate climates (Spring and Autumn) period of the year, while Winter months recorded low rates of abundance. May was recorded the highest prevalence of ticks abundance with 60%, while, January was the lowest with 25%. For lice, the high prevalence rates were noticed in moderate and cold climates, The highest abundance rate of lice was recorded in May with 55%, while, in August the lowest prevalence was recorded with 15%. For mites, the samples were collected in two months only during the study period, May and June.

Keywords: ectoparasites, buffalo, ticks, lice, mites

1. Introduction

An ectoparasite is a small animal living upon or in the superficial tissues of hosts, most of them are arthropods, Ectoparasites feed on body tissue, such as blood, skin and hair ^[41]. Medical and veterinary significance of arthropods is attributed mainly due to their blood sucking habits, and their capacity to transmit pathogens like bacterial, viral or parasitic infection ^[3]. Domestic animals such as cattle, sheep, buffaloes, dogs, goats and cats are living in different places, which are threatened by several arthropods, including ticks, mites, lice, fleas and flies ^[21]. However, ectoparasites, especially in large aggregations may also debilitate domestic animals in other ways. Arthropods pests' causes economic loss by limit production of the livestock industry in many ways, includes weight gains and milk production ^[37]

Most of ectoparasites are classified into two classes of the phylum Arthropoda, namely Arachnida and Insecta ^[6]. Ticks are most important arachnids, there are two families of ticks: Ixodidae the hard ticks, Argasidae the soft ticks. About 850 species of ticks have been described, they have worldwide distribution ^[40]. Ticks are blood sucking ectoparasites of mammals and birds, and have most important to farm livestock. Their heavy rates of infestation causing significant damage to hide and skin ^[3]. Ticks are known to transmit the widest variety of pathogens such as viruses, bacteria, rickettsia, protozoa, and helminthes, and causing diseases like hemorrhagic fever, anaplasmosis, theileriosis, ehrlichiosis, and babesiosis in animals ^[35]. Tick paralysis is the only tick-borne disease that is not caused by an infectious organism; the illness is caused by a neurotoxin produced by the tick's salivary gland, the engorged tick transmits the toxin to its host during a blood meal ^[30].

Correspondence

Sabeeh H Al-Mayah

Biology Dept., College of
Education for Pure Sciences,
University of Basrah, Basrah,
Iraq

Although tick paralysis is of concern in domestic animals and livestock as well, human cases are rare and usually occur in children under 10 years [38].

Mites are colonizing in the skin, the cause of several types of itchy skin rashes, such as grain itch, grocer's itch, and scabies [37]. *Sarcoptes scabiei* is a parasitic mite responsible for scabies, which is one of the three most common skin disorders in human [3]. Lice are important ectoparasites insects, there are two sub orders of lice, namely, Anoplura the sucking lice, and Mallophaga the biting or chewing lice [21]. Lice can attack many domestic mammals, cows, buffaloes, sheep, horses, goats, dogs, camels and many wild mammals [41]. They have been implicated as a vector for several pathogens, such as viruses, bacteria, protozoa, and helminths [12]. Lice infested animals keep poor physical condition and develop an unthrifty, anemic appearance and discolored greasy hair [31]. In addition, lice infestation contributes to huge economic losses due to damage to skin and hide in the form of light flecks and spots followed by secondary bacterial infection or scratching behavior and inflammation of the skin [9].

Buffalo is one of the most important economic animals in Iraq, especially in the southern region. Few studies about ectoparasites of buffalo in Iraq, there were two only in Basrah province, [19] study the lice of the domestic animals, [4] studied about the occurrence of hard ticks in some mammals. In other areas of Iraq, [14] recorded four species of Ixodids ticks in many areas in Wasit province in the of middle of Iraq, and [36] in some areas in the middle of Iraq. This study was conducted to infested buffaloes in Basrah province, the prevalences, monthly abundance and some field observations.

2. Materials and Methods

2.1 Study Area

This study has been conducted in Basrah Province, South of Iraq, including eleven locations: Fao, Abu Al-Khaseeb, Shat Al-Arab, Basrah Center, Zubair, Qarmat Ali, Dair, Nashwa, Qurnah, Mudainah and Slayen Marsh. A large number of farm lands, animal husbandry stations, marshes and slaughter houses were visited.

2.2 Sample Collection

A total of 200 buffalos were examined, During June 2016 to May 2017. Samples of ectoparasites were collected from many parts of buffalo, including: head, ears, eyelids, axilla, perinea, udder, teats in female, and scrotum in male of individual animals, using a fine forceps. The samples were fixed on thick paper and kept in insect box. Date and place of collection were recorded.

2.3 Samples Identification

The study was made using a dissecting and compound microscopes, Image of samples were taken by digital camera. Species were identified based on morphological characteristics. The specimens of ticks were identified to the species level using the taxonomic keys of [15, 30, 20, 40, 5, 6], based on many morphological features, which are shape, size, color, capitulum (mouth parts), scutum (dorsal shield) and festoons (posterior abdominal markings). Lice identified according of [9, 12, 19], based on the volume of the head, optic lobes, antennae, scouting, and abdomen. Mites identified by some features such as, mouth parts, scutum, legs and setae,

according [41, 29]. For more confirmation, the results of the classification were compared with previous studies in Iraq and the specimens in The Iraqi Museum of Natural History in Baghdad University.

2.4 Ecological study

Temperature and relative humidity rates were adopted by Iraqi meteorological organizations and seismology in Basrah Airport (table2). The prevalence rates of ticks, lice and mites were calculated for each month during the study period, the rates of all months were compared. Some field observations of ectoparasites were noticed and recorded.

2.5 Statical analysis

The results were analyzed with t test and chi-square by using a computerized SPSS program (Statistical Program for Social Sciences). $P < 0.05$ was considered to be lest limit of significance [2].

3. Results

3.1 Species diversity

In this study, 10 species of ectoparasites were identified, six species of ticks, three species of lice, and one species of mites, as follows:

1. Class: Arachnida, Order: Parasitiforms

Family: Ixodidae (hard ticks)

Hyalomma anatolicum Kotch, 1844, *Hyalomma excavatum* Koch, 1844, *Hyalomma asiaticum* Schulze and Schlottke, 1929, this record is believed to be a new host of this species, *Rhipicephalis turanicus* Pomerantzev, 1941, and *Haemaphysalis sulcata* Canestrini and Fanzago, 1878.

Family: Argasidae (soft ticks)

Otobius megnini Duges, 1884, this species records for the first time in Iraq.

2. Class: Arachnida, Order: Sarcoptiforms, Family: Psoroptidae

Psoroptis ovis Hering, 1838, (figure1) this record is believed to be a new host of this species.

3. Class: Insecta, Order: Phthiraptera

Family: Haematopinidae (sucking lice)

Haematopinus tuberculatus Brumeister, 1839, and *Haematopinus eurysternus* Denny, 1842.

Family: Trichodictidae (biting lice)

Damalina caprae Gurlt, 1843, this record is believed to be a new host of this species.



Fig 1: the soft tick *Otobius megnini* records for the first time in Iraq.

3.2 Prevalences of ectoparasites infestation of Buffalo

In this study, A total of 240 buffaloes were observed, 20 in each month, 124 were infested with ectoparasites, with total prevalence rate 51.6%. The infestation rate of ticks was 42.5%, higher compared to lice 37.5% and mites 1.25%. Table 1 showed that Ticks belong to genus *Hyalomma* are the dominant in the present study, both in the number of species and individual ticks collected, followed by *Rhipicephalis*, then *Haemaphysalis*. The most prevalent species in the study was *H. anatolicum* with a prevalence of 39%, followed by *R. turanicus* with 31.5%, while, *Ha. Sulcata* was the lowest with 5%. For lice, *Haematopinus tuberculatus* recorded the highest prevalence with 35.5%

Table 1: Infestation prevalence of ectoparasites from buffalo in Basrah province.

| Species of ectoparasites | Infested buffaloes No. | Infestation prevalence % |
|----------------------------------|------------------------|--------------------------|
| <i>Hyalomma anatolicum</i> | 78 | 39 |
| <i>Rhipicephalis turanicus</i> | 63 | 31.5 |
| <i>Hyalomma excavatum</i> | 51 | 25.5 |
| <i>Hyalomma asiaticum</i> | 21 | 10.5 |
| <i>Haemaphysalis sulcata</i> | 10 | 5 |
| <i>Otobius megnini</i> | 7 | 3.5 |
| <i>Haematopinus tuberculatus</i> | 71 | 35.5 |
| <i>Haematopinus eurytenuis</i> | 50 | 25 |
| <i>Damalinea caprae</i> | 10 | 5 |
| <i>Psoroptis ovis</i> | 3 | 1.25 |

3.3 Seasonal abundance of ectoparasites of Buffalo

Many variations of seasonal abundance of ectoparasites were

determined during the study period between June 2016 to May 2017. According to figure 2, ticks were found to be more abundant in the moderate climates (Spring and Autumn) period of the year, followed by Summer months, while Winter months recorded low rates of abundance. May was recorded the highest prevalence of ticks abundance with 60%, while, January was the lowest with 25%. The statically analysis were showed a significant difference ($P \leq 0.05$) among the rates of ticks abundance for the months of period study. For lice, highest prevalence rates were noticed in moderate and cold climates, but the abundance rates were very low in the summer months. The highest abundance rate of lice was recorded in May with 55%, while, in August, the lowest prevalence was recorded with 15%. For mites, the samples were collected in two months only during the study period, May by 10%, and June by 5%.

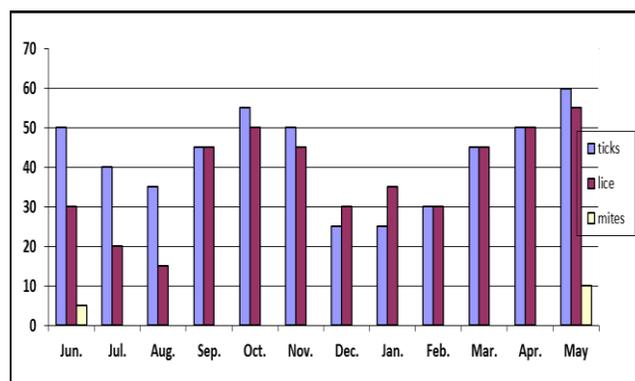


Fig 2: Seasonal abundance of ectoparasites in Basrah province during June 2016 to May 2017.

Table 2: Rates of Temperature degrees and Relative humidity in Basrah province during June 2016 to May 2017.

| Z | Jun. | July | Aug. | Sep. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May |
|-------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Temperature | 40 | 42 | 41 | 38 | 35 | 28 | 21 | 15 | 18 | 29 | 33 | 38 |
| Humidity % | 19.7 | 20 | 20.2 | 24.4 | 24.2 | 45 | 53.4 | 65 | 63.5 | 41 | 33.4 | 29.7 |

3.4 Some field observation of ectoparasites

During the study period, some field observation were noticed, some variations among species of ectoparasites by the site of attachment of the buffalo's body. Table 3 shown *Hyalomma anatolicum* and *Haematopinus tuberculatus* were collected in many sites of the buffalo's body, while, *Otobius megnini*

found in the ears only. From other notes, the differences were observed in terms of variation in stages of the life cycle of ectoparasites. *Hyalomma anatolicum* was collected by adults, nymph and larvae, while *Otobius megnini* found in nymph stage only.

Table 3: Some field observations of ectoparasites from buffalo in Basrah province.

| Species of ectoparasites | Stage of life cycle | Site on host body |
|----------------------------------|----------------------|--|
| <i>Hyalomma anatolicum</i> | adult, nymph, larvae | axilla, genital areas, perineum, udder |
| <i>Hyalomma excavatum</i> | adult, nymph | perineum, udder |
| <i>Hyalomma asiaticum</i> | adult, nymph | axilla, genital areas |
| <i>Rhipicephalis turanicus</i> | adult, nymph, larvae | ears, neck, flank |
| <i>Haemaphysalis sulcata</i> | adult | udder, axilla |
| <i>Otobius megnini</i> | nymph | ears |
| <i>Haematopinus tuberculatus</i> | adult, nymph | head, lower abdomen, axilla, neck |
| <i>Haematopinus eurytenuis</i> | adult, nymph | neck, front |
| <i>Damalinea caprae</i> | adult | tail, lower abdomen |
| <i>Psoroptis ovis</i> | adult | neck |

4. Discussion

Few studies about ectoparasites of buffalo and other economic mammals in Iraq, there were two only in Basrah province. The

present study differs of the other studies in Iraq, in that it has included a survey of all ectoparasites, while the previous reports have specialized in hard ticks or lice only. According

to the current results, five species of Ixodid ticks were isolated, while ^[4] recorded three species only, *Hyalomma excavatum*, *H. turanicum* and *H. detritum*, thus *H. excavatum* is the only similar species between the two studies ^[36]. were recorded six species of Ixodids ticks infested Buffaloes in many areas in the south and middle of Iraq ^[28]. was found two species in the middle of Iraq. Ticks belong to genus *Hyalomma* are the dominant in the present study, both in the number of species and individual ticks collected ^[22]. referred to acclimation of *Hyalomma* sp. to the environment of the area and adaptation for hot or cold ^[35]. noticed that the cattle are mostly infested with *Rhipicephalis (Boophilus)* spp. while buffaloes are mostly infested with *Hyalomma* spp.. Buffaloes have a less dense hair coat and have access to mud for wallowing, which might cause dropping of ticks and hence less infested with *Boophilus* spp ^[20, 36] reported this species distributed among domestic animals in Iraq, buffaloes, cows, sheep, goats and camels.

For the soft ticks Argasids, there was one species only recorded in this study, namely *Otobius megnini*. This is a first record for this species in Iraq, and the second of the family Argasidae, in previous studies *Argas persicus* has been isolated from domestic birds. For mites *Psoroptis ovis*, which recorded from buffalo for the first time in Iraq, in previous reports this parasite was isolated from sheep and goats. As for lice, ^[19] was recorded three species of sucking lice from buffalo, namely *Haematotopinus tuberculatos*, *Ha. eurysternus* and *Ha. quadripertusus*. The present study is different of previous study not to record *Ha. quadripertusus*, and isolated the biting lice *Damalina caprae*, which recorded from buffalo for the first time in Iraq. In previous studies, this louse was isolated from sheep and goats. While, ^[24] were recorded *Ha. tuberculatus* only in Baghdad province, middle of Iraq.

The differences between the results of the present study and previous studies might be due to variation in the geographical locations, climatic conditions, methods of study, selection of sampling animal and breed of animal studied. Distribution of ticks on the hosts in the field influenced by various factors, such as the morphology of the tick (length of the hypostome), the morphology of the host (length of the fur coat) and host immune responses ^[27]. While ^[8] referred to self-grooming of ticks, inter-specific interactions, heat dissipating behavior and length of the feeding phase ^[11]. Referred that nature of the host (susceptibility, breed, age and sex) and management practices including the use of acaricides.

The variation in distribution of ectoparasites in different seasons of the year is derived from a variety of factors such as climatic conditions, lifestyle of host animals, and habitat characterization ^[10]. The abundance and distribution of ticks among the months depend upon many factors such as the climate (temperature, humidity, sunlight, wind speed and dust^[7]). The seasonal dynamics of lice species are the consequence of appropriate environmental conditions, temperature, moisture, light intensity and rainfall ^[25]. Temperature is the principal extrinsic factor of ectoparasites occurrence, because it regulates the metabolic rate and influences both the efficiency of blood-meal utilization, length of oviposition periods and developmental rates ^[11]. In low temperature, ticks try to protect themselves by entering in diapauses leading to delayed morphogenesis and reduced

behavioral activities ^[38]. Dantas-Torres (2010) ^[7] reported that relative humidity is the controlling factor of water balance mechanisms of ticks; Low humidity represents a great stress on the water balance of ticks and seems to adversely affect the efficiency of converting the blood meal into egg biomass. Rony *et al.* (2010) ^[35] reported that age, nutrition and hormonal level of the host can influence natural or acquired immunity of cattle to ticks. Hussain *et al.* (2010) ^[16] found that there are several factors related to the environment and host, which contribute to lice infestation; poor nutrition, intensity of sunlight, temperature, humidity, crowding, management conditions, host-skin reaction, hair condition, hair length and shedding, animal grooming, licking, physiological resistance and breeds.

The abundance and distribution of ticks, lice and mites with limited movements can greatly be affected by the chances of an encounter with a potential host and their population densities ^[39]. The migrating hosts with high population densities and their social activities facilitate the dispersion of ticks that eventually increases the chance of finding a suitable host ^[17]. That may be the reasons of associating immature ticks more with small mammals, which allow the ticks to reach a large host ^[31]. The tick's species differ with the sites of attachment on the buffalo's body ^[8]. Some species were found in the anterior parts of the host, and other species preferred posterior parts of the host. This may be an evolutionary adaptation to reduce the competition with other tick species and at the same time to minimize the host defense mechanisms ^[1]. Preferred attachment sites are influenced by various factors such as the morphology of the tick, length of the hypostome and the length of the fur coat of the host ^[7]. That ticks select an area with a good blood supply, minimal host defense, where predators cannot easily reach and where they can easily penetrate the skin ^[32]. Ectoparasites may avoid sites, which are accessible for grooming and where the host skin is hard to penetrate and prefer the dorsal side of the ear, which has a short fur coat ^[41]. This behavior is more important because it will reduce the competition for attachment sites with the dominating species, which preferred the anterior part.

5. Conclusion

The tick infestation in buffalo poses a serious damage to the livestock industry and it is a challenging task for the workers to control them. The results obtain by the present study shows that ticks have seasonal distribution and preferable host selection. The observations from the present study may contribute to the increased understanding of epidemiology of ticks in Iraq. This may help in adopting tick control strategies. Therefore, further studies on tick prevalence are also suggested in other areas of Iraq to clear the faded knowledge of tick distribution in buffalo and other livestock. Focus should also be given on tick distribution pattern on different attachment sites on host body, tick prevalence in relation to body score and breed of host.

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