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Identification of lice species of water buffaloes in the Marmara Region of Türkiye

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Summary

Water buffaloes are valued for their resilience, efficient feed utilisation, and ability to convert low-quality feeds into meat and milk. In Türkiye, the water buffaloes' population underwent a substantial decline in the 20th century; however, it has since experienced a resurgence, and buffalo and their products have regained popularity. Ectoparasites, such as lice, ticks, and mites, can cause direct harm to their hosts, including weight loss, anemia, and even death. They have also been proven to act as vectors for disease transmission, including zoonotic infections. In this study, 143 water buffaloes from dairy farms in Istanbul, Kırklareli, and Sakarya were examined for lice infestations between February and April 2022. Of the 143 water buffaloes examined, 37 (25.9%) were found to be infested with lice, with a total of 216 lice collected. The mean number of lice per buffalo was 1.38, with 76 males, 121 females, and 19 nymphs. All collected lice identified as *Haematopinus tuberculatus*. This study is the first comprehensive study of lice infestation of water buffaloes in Türkiye. The management of lice is of crucial importance in minimising economic losses in buffalo farming, and regular ectoparasite surveillance and antiparasitic programmes are recommended. Further research is required to enhance our understanding of lice populations and their role in disease transmission.

Keywords: water buffaloes, lice, *Haematopinus tuberculatus*

Water buffaloes have been domesticated and are found in many tropical countries worldwide dating back to their domestication between 3,000 and 6,000 years ago (11). Water buffaloes are primarily domesticated for their meat, milk, and hides, while their horns and manure also serve various purposes in agricultural and industrial sectors (3). Domestic buffaloes, which have over 70 different species under the domestic and wild categories, are divided into two groups as River and Swamp buffaloes. More widespread worldwide, the river buffalo is the dominant species in South Asia, Europe, Egypt and Australia, while the swamp buffalo is found from the western to eastern China (11). The natural habitat of buffaloes includes humid, temperate, and marshy regions, reflecting their physiological adaptation to such environmental conditions. The native Asian water buffalo is an important animal resource in at least 67 countries (29). The characteristics that make the water buffalo important include its resistance to environmental stress and diseases, high feed utilization capacity, ability to convert low quality feeds into meat and milk including lower breeding costs compared to cattle (3, 11). Water buffaloes' milk is a reliable source of high-quality nutrients, as it contains high amounts of leucine, lysine and valine. Moreover, buffalo milk contains considerable amounts of the non-essential amino acids glutamic and aspartic acid, and cheese made from buffalo milk is rich in glutamic acid and tyrosine (5).

The number of water buffaloes in Türkiye decreased from 1,178,000 in the 1970s to 84,705 in 2007 (13). According to data from the Turkish Statistical Institute (TÜIK), the number of water buffaloes in Türkiye as of 2024 was 162,051, with 18,497 of these buffaloes located in the Marmara Region. To date, no comprehensive study has been conducted on the ectoparasites of water buffaloes in Türkiye (27).

Ectoparasitic arthropods, such as lice, ticks, mites, and fleas, cause significant harm to livestock by feeding on or burrowing into the skin, leading to direct damage, immune responses, blood loss, and in some cases, death. The behaviour of ectoparasites can also cause indirect harm, especially when infestation is high, by creating discomfort that results in increased

levels of behaviour like rubbing and reduced grazing or rumination time, and in some cases, self-inflicted injury. Furthermore, they have the ability to transmit a variety of diseases, including parasitic, bacterial, and viral infections, a significant proportion of which are zoonotic. Ectoparasites pose a significant economic challenge for livestock farming, resulting in losses that encompass animal mortality, diminished productivity, and reduced hide quality (7, 15, 20).

Lice infestations can cause significant irritation and itching, leading to annual milk production losses of 15-25%, weight loss of up to 30 kg, and in severe cases, anaemia and skin damage (8, 14, 17). Furthermore, lice infestations have been demonstrated to act as vectors for the transmission of pathogens. *Haematopinus tuberculatus* has been proven to be the vector of *Anaplasma marginale* (4, 8). Anaplasma species cause anaplasmosis and contain six species: *Anaplasma centrale*, *A. marginale*, *A. ovis*, *A. bovis*, *A. phagocytophilum* and *A. platys* (9). Anaplasmosis is widespread among farm animals across Türkiye and occurs throughout the country (1). The clinical signs of anaplasmosis are generally non-specific and include lethargy, anaemia, jaundice, loss of appetite, weight loss, reduced milk yield and miscarriage. *A. marginale* passes transplacentally to the foetus in pregnant animals. The severity of the disease increases with age. Cattle infected with *A. marginale* become reservoir hosts for the bacterium for life after surviving the acute phase. Tetracyclines and imidocarb dipropionate are used in the treatment of anaplasmosis. Furthermore, the provision of supportive fluid replacement therapy, anti-inflammatory medications, and blood transfusions as indicated in cases of severe anaemia, is recommended (16).

In a study conducted in Istanbul in 1997, *H. tuberculatus* was found in one of seven water buffaloes examined (12). To the best of our knowledge, this study is the first of its kind to provide a comprehensive report on the infestation of water buffaloes with lice in Türkiye.

Material and methods

In this study, 143 water buffaloes from eight dairy farms in Istanbul, Kırklareli and Sakarya provinces were examined between February and April 2022 (see Figure 1 and Figure 2). Of the examined farms, one was located in Kırklareli, three in Istanbul, and four in Sakarya. Sampling included 15 animals per farm in Istanbul and Sakarya, and 38 animals from the farm in Kırklareli. The study enrolled all females. The age of animals ranged in age from three to six years. Each water buffalo was subjected to a thorough examination using an electronic comb, extending from the neck to the tail, for a duration of approximately 15 minutes (see Figure 3). The lice were collected from the animals and transferred to tubes containing 70% ethanol. These tubes were then brought to Istanbul University – Cerrahpaşa, Veterinary Faculty, Department of Parasitology Laboratory.

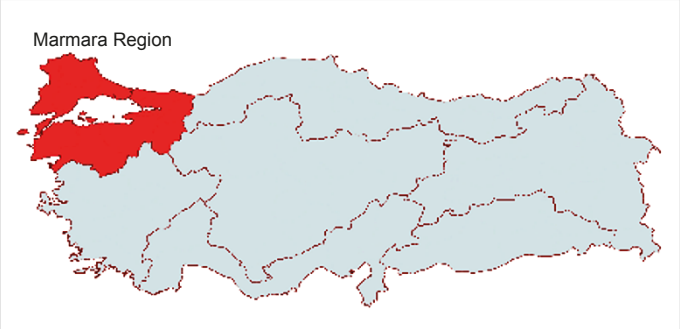

Fig. 1. Marmara Region of Türkiye

Fig. 2. Sample collection area, from west to east; Kırklareli, İstanbul, Sakarya

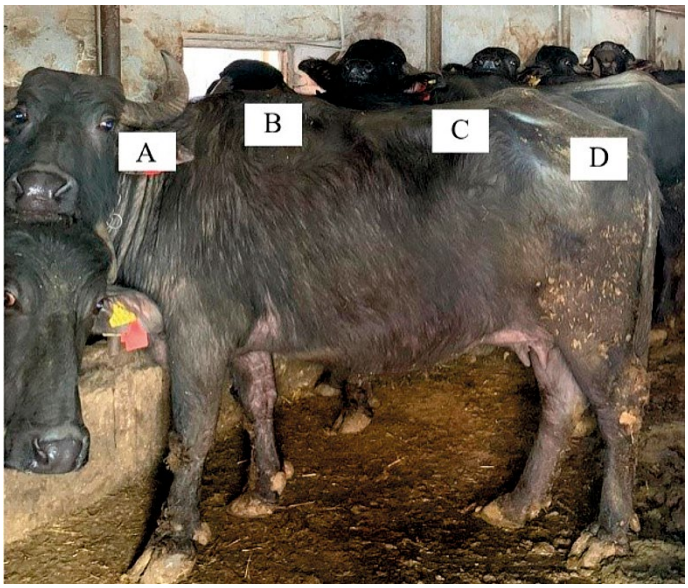

Fig. 3. Areas combed for research
Explanations: A – neck; B – withers; C – loin; D – tail. Original Figure, Şakir Pehlivan

For clearing the specimens each collected louse was pierced with a pin from the abdomen dorso-ventrally. The specimens were then placed in a 20% NaOH solution and left overnight. In the subsequent stage of the procedure, the extracted lice were subjected to a series of rinses in ethanol solutions of increasing concentration. These rinses consisted of 40% ethanol for 30 minutes, followed by 70% ethanol for 30 minutes, and finally, 96% ethanol for

a further 30 minutes. Following this process, each louse was mounted on Canadian balsam (24). The specimens were examined morphologically at the species level under light microscope, and the keys proposed by Chaudhuri and Kumar (1961) and Meleney and Kim (1974) were used to identify the lice species (6, 19, 25).

Results and discussion

Lice infestation was detected in 2 of the 8 farms examined. Farms were located in Sakarya and Kırklareli provinces. The farm in Kırklareli was an intensive establishment, while the farms in Istanbul and Sakarya were extensive establishments. Lice infection was detected in 37 (25.9%) of the 143 buffalo examined. A total of 216 lice were collected from the all examined animals. The number of lice collected from water buffaloes ranged from 1 to 22, with an mean of 1.38 (see Tables 1 and 2). All lice examined were identified as *Haematopinus tuberculatus*. Of the 216 lice collected, 76 were identified as male and 121 as female (see Figure 4 and Figure 5), with 19 identified as nymphs.

Fig. 4. Male louse

Fig. 5. Female louse

Tab. 1. Total collected lice table

Total collected lice	Female lice	Male lice	Nymphs
216	121	76	19

Tab. 2. Max. number, min. number and mean number table

Max. Number	Min. Number	Mean Number
22	1	1.38

This study provides the first comprehensive study of lice infestation of water buffaloes in Türkiye, identifying *Haematopinus tuberculatus* as the sole species, with a prevalence of 25.9% and a mean intensity of 1.38 lice per animal. The infestation rate in this study was lower than those reported in Bangladesh with 51.27% (18), Iraq with 54.06% (2), in Mexico with 79.8% (22) and markedly different from the highly variable rates in Pakistan with 0% to 92% (21), while it was more comparable to those observed in Italy with 4.5% (28), and Hungary with 13.8% (10). These differences may reflect the influence of local climatic zones and management practices. Among these, herd management is likely the primary factor influencing the occurrence of lice. Higher infestation rates reported during winter in Iraq have been associated with intensive housing and increased animal density. Additional contributing factors include the introduction of new animals into herds, high stocking densities, and inadequate hygiene practices (2). Supporting these findings, a 2023 study on 1353 cattle in the provinces of İzmir, Aydın, and Muğla in Türkiye reported a lice infestation rate of 12.57% among 191 insfested animals, with all infestations with lice occurred in February, indicating a strong seasonal pattern linked to winter housing conditions. Regional variations in lice infestation levels suggest differences in herd management practices and environmental exposure across the study areas (23). The relatively low prevalence in our study likely resulted from herd management and control practices, potentially including the intensive or unregulated use of insecticides on some farms. However, the emergence of pyrethroid-resistant *H. tuberculatus* populations in Iran highlights the need for Integrated Pest Management (IPM) to prevent resistance (26). In conclusion, the present study identified *H. tuberculatus* as the sole louse species infesting water buffaloes in Türkiye. Although both prevalence and infestation intensity were relatively low, continued monitoring remain essential. The comparison with international studies highlights that infestation levels are highly variable and strongly influenced by local husbandry and environmental conditions. To improve control, we recommend routine monitoring, quarantine and treatment of newly introduced animals, and implementing of integrated pest management strategies to mitigate the risk of insecticide resistance. Further research is needed to elucidate specific risk factors, including age, sex, seasonal dynamics, and potential resistance mechanisms, while also clarifying the population dynamics and possible vector role of these lice species. Such efforts will provide a scientific basis for the development of targeted, effective, and sustainable ectoparasite control strategies in buffalo farming.

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