Chapter 6

Louse Infestation of Ruminants

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Additional information is available at the end of the chapter

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Abstract

Throughout the world, louse infestation of ruminants is an important problem that impairs the growth and performance parameters of beef, dairy and buffalo stocks. Full details of geographical and taxonomical features of blood sucking and biting louse on ruminants are discussed. The objective of the topic is to demonstrate the occurrence, biological, epidemiological and clinical importance of bovine pediculosis. At the same time, presenting factors determining the severity of infestation with blood-sucking and biting lice include the animals' age and sex and also the season. Important determination of the prevalence and rate of louse infestation among ruminants offer a survey of advances in systemic chemotherapeutic control.

Keywords: sucking and biting louse infestations of ruminants

1. Introduction

Infestations of animals with lice are medically called *pediculosis*. Origin of **pediculosis: 1885–1890; < Latin *pēdicul(us)* louse. Related forms pe·dic·u·lous [p*uh*-dik-y*uh*-l*uh* s]/pəˈdɪk yə ləs/, adjective**[1].

Pediculosis in cattle occurs throughout the world, and is more common in cattle than in any other domestic animal [1, 2].

Lice infecting ruminants are wingless insects and can produce a seasonal chronic dermatitis. The most common sign is pruritus, excoriation and alopecia. The host's rubbing and grooming may not correlate with the extent of infestation. Hairballs can result from overgrooming

[1]Dictionary.com Unabridged Based on the Random House Unabridged Dictionary, © Random House, Inc. 2018

Lice species	Localization of the lice
Chewing lice	
Damalinia bovis/*Bovicola bovis* (cattle biting louse, red louse)	Most commonly found in the dorsum. Infestation may extend cranially to head and caudally to tailhead
Bloodsucking lice	
Linognathus vituli (long-nosed cattle louse)	Most commonly found over withers, lateral shoulders, and dewlap. May have generalized distribution over animal. In early infestations may be found in clusters
Haematopinus eurysternus (short-nosed cattle louse)	In heavy infestations, may be found over most of the body. Often found on front half of the host from ears to dewlap
Solenopotes capillatus (little blue cattle louse)	Infestations tend to be heavier in anterior portions of the body, including the ears, during warm weather. Found in distinct clusters, mainly on head and face
Haematopinus quadripertusus (cattle tail louse)	Heavy infestations may extend to dewlap or surround the eyes. Adults often confined to the tail, eggs commonly noted on tail switch

Table 1. Site predilection of cattle lice [3–5].

in cattle. In severe cases, especially in calves, the organisms can lead to anemia, weight loss, and damaged pelts. Pregnant animals may abort. Lice eggs or nits are attached to hairs near the skin. Three nymphal stages, or instars, occur between egg and adult, and the growth cycle takes about 1 month for all species. Lice cannot survive for more than a few days off the host.

Caused by several species (**Table 1**), five louse species are known to be able to infect cattle: three species of the genus Haematopinus, along with the species *Linognathus vituli* and *Solenopotes capillatus*. *Haematopinus tuberculatus* (**Figure 1**) is a typical parasite of the domesticated Asian buffalo, which is known to infest cattle as well [6] as the young animals may be

Figure 1. *Haematopinus tuberculatus* female with nit (×19.4).

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Figure 2. *Bovicola bovis* male (×26.6).

Figure 3. *Bovicola bovis* female with nymph (over) (×17.5).

infested with multiple species of lice simultaneously. *S. capillatus* and *H. eurysternus* infestations are more often recognized on mature animals, whereas *L. vituli* is more commonly seen on calves and on dairy stock. *Damalinia bovis*/*Bovicola bovis* is the chewing lice of the cattle [7] (**Figures 2** and **3**).

2. Life cycle

Lice undergo an incomplete metamorphosis. The life cycle takes about 4 to 5 weeks to complete. Lice lay eggs that hatch after 6–7 days. Each female deposits 20–50 (30–40) eggs (nits) during

her lifetime. She deposits them one by one to single hairs. Incubation lasts 4–20 days. The eggs hatch and develop through three nymph stages to adults. Nymphs look like adults but are smaller. Adult life lasts for 2–6 weeks. Lice tend to prefer the white areas of black-and-white cattle. Off the host, most lice survive only for a few days. Survival of lice is reduced by warm weather, cattle self-grooming, loss of hair coat and good nutrition of the host [3, 4].

Lice infestations develop mostly in the colder season and peak in late winter and early spring. Skin temperature has also been correlated with the severity of louse infestation. Lice decline during the hotter season. Stabling the animals during the winter season favors overcrowding, which makes contact transmission easier. The poorer diet during winter weakens the natural defense of cattle against the lice infestations. The denser and more humid hair coat in winter offers an excellent environment for lice development as well.

In spring, food improves quickly when the herds start grazing fresh pastures. The shorter hair and the exposure to the sun reduce skin humidity, and free grazing ends overcrowding in the winter quarters, which also diminishes transmission. As a consequence, lice infestation usually recedes spontaneously during the summer season. However, a few lice usually manage to survive in some animals that will re-infest the whole herd when it comes back to the winter quarters for the next winter [3, 4].

3. Epidemiology

Lice spend their whole life on the same hosts: transmission from one host to another one is by contact. Transmission from herd to herd is usually through introduction of an infested animal, but flies or fomites may also occasionally transport lice. Up to 1–2% of the cattle in a herd can carry a high load of lice, even in the summer when high temperatures reduce the number of lice. These carrier animals are the source of reinfestation during the fall. Usually, they are a bull or a cow in poor body condition [8]. Winter housing provides the ideal conditions for the transfer of lice between cattle.

4. Clinical findings

Throughout the world, louse infestation of ruminants is an important problem that impairs the growth and performance parameters among beef, dairy stocks and buffalos. Chewing lice feed on skin and hair debris as well as on skin secretions. The other species have mouthparts adapted for piercing the skin and suck blood.

Louse infestation has been reported to cause blood loss [9], anemia, anorexia, restlessness, weight reduction of as much as 25–30 kg, diminished milk production and development of stress [6, 10–13]. The blood-sucking lice mentioned above may also be carriers of different pathogens [14]. Host animals infested with blood-sucking lice tend to keep scratching, licking and biting their skin, thus causing hair loss and skin injuries to themselves. By rubbing their body against different objects, cattle infested with lice may damage fences or trees. Such stress can reduce weight gains and milk production for up to 10% and makes the animals more

susceptible for other diseases. Cattle with hair loss may be discounted at the saleyards. Skin that has been irritated by lice has a rough surface with complete loss of hair in some areas, which gives the animals an unthrifty appearance and reduces both the slaughter value and the usability of skin and hide for industrial processing [15]. In the UK, analysis of hides in abattoirs resulted in more than 80% showing some degree of lice damage. In recent years, hide or fleece damage caused by lice has been increasingly recognized as a significant effect of lice infestations. The damage is described as areas of grain loss up to 3 mm diameter that are seen on dyed crust leather [16].

For all age classes of cattle, stressors such as high stocking density, poor feed quality, gestational status, and underlying health issues are often contributing factors to susceptibility and degree of infestation.

Factors determining the severity of infestation with blood-sucking lice include the animals' age and sex and also the season. Numerous studies have been conducted to investigate correlations between the distribution of lice and the age of host animals within herds. Occurrences of bovine pediculosis do not show seasonal variation in countries with a warm climate. However, in the temperate zone and in colder regions, the most severe infestations occur in late winter and early spring, when the weather is cold and damp and the animals have the thickest coat of hair. The coat of hair serves as a habitat and shelter for lice, and provides optimum conditions for their propagation. During the year, the highest increase in the louse population occurs when cattle or buffaloes are kept indoors for the winter. In late spring, the number of lice suddenly decreases. It then remains at a low average level during the summer months when the hair coat becomes thinner, which provides a less favorable habitat for lice, because the high temperature of the skin surface and direct exposure to sunlight reduce the intensity of their development [2, 15]. Other authors have also observed seasonal occurrences of pediculosis, reporting that the population of sucking lice starts to grow in late winter, reaches its peak in the spring and its nadir in the summer and autumn months. In India, the highest 'louse index' was found in January and the lowest in June [17]. According to the results obtained by Hussain et al., the louse population reaches its highest level in February, and the environmental conditions continue to be favorable for survival and propagation of lice in March and April [9].

In a survey conducted in Pakistan [18], the prevalence of lice was significantly ($P < 0.05$) higher in cattle than in buffaloes: 144 out of 600 randomly selected cattle (24%) and only 113 out of 600 randomly selected buffaloes (18%), kept under conditions identical to those of the cattle, proved to be infected. The prevalence of louse infestation in cattle has been reported by researchers from different countries [19–21] have reported varying prevalence rates of louse infestation in cattle in association with differences in the ecological, geographic and weather conditions. Animals kept in closed management systems are not exposed to direct sunlight, which favors the survival of lice. When cattle are kept in open barns, houses with outdoor runs or in free range management system, their skin surface is directly exposed to sunlight and consequently becomes drier, which reduces the survival chances of lice and decreases the intensity of their propagation [10]. A total of 762 water buffaloes were examined. *H. tuberculatus* was found in the 11.0% (14/127) of the farms and in the 4.5% (34/762) of the animals. The presence of *H. tuberculatus* should be routinely considered because it is a cause of serious health, production and economic damages in intensive breeding buffaloes [22]. According to

our observations, the female host animals and, among them, the cows showed the most severe louse infestation. Larvae of the parasite accounted for only 0.3% and adult lice represented 3.2% of all the developmental stages recovered, while 96.4% of the stages found were louse eggs. The hair samples from the bulls yielded five adult lice and 83 louse eggs, while those from the cows yielded 78 adult lice, eight larvae and 2348 louse eggs. The hair samples from the buffalo heifers yielded 12 adult lice, two larvae and 641 louse eggs, while from those of young males, seven adult lice and 16 louse eggs were recovered [18].

5. Vector significance

Lice may serve as biological or mechanical vectors for various infectious agents. *Haematopinus tuberculatus* is known to be a vector for the species *Trypanosoma evansi* and *Anaplasma marginale*. *H. tuberculatus* invasion might play a role as a vector in the intensive spreading of mycoplasma infection among buffaloes. The results of the study of Egri et al. draw attention to the importance of preventing the spread of **mycoplasma** infection and implementing control programs against parasitoses of animals [18]. The occurrence of cattle-associated Bartonella species was investigated in the cattle tail louse *Haematopinus quadripertusus* and in dairy cattle blood in the study of Gutiérrez et al. from Israel [23]. The lice were identified morphologically and molecularly using 18S rRNA sequencing. Thereafter, they were screened for Bartonella DNA by conventional and real-time PCR assays using four partial genetic loci (gltA, rpoB, ssrA, and internal transcribed spacer [ITS]). A potentially novel Bartonella variant, closely related to other ruminant bartonellae, was identified in 11 of 13 louse pools collected in summer. In the cattle blood, the prevalence of Bartonella infection was 38%, identified as *B. bovis* and *B. henselae* (24 and 12%, respectively). A third genotype, closely related to *Bartonella melophagi* and *Bartonella chomelii* (based on the ssrA gene) and to *B. bovis* (based on the ITS sequence) was identified in a single cow. The relatively high prevalence of these Bartonella species in cattle and the occurrence of phylogenetically diverse Bartonella variants in both cattle and their lice suggest the potential role of this animal system in the generation of Bartonella species diversity. To investigate louse infestation of ruminants and pathogens potentially transmitted by them, anopluran lice (n = 1182) were collected in Hungary and evaluated for the presence of anaplasma, rickettsia and hemotropic mycoplasma DNA in the study of Hornok et al. [24]. On cattle, the following species were found: *Linognathus vituli* (57%), *Haematopinus eurysternus* (38%) and *Solenopotes capillatus* (5%). *L. vituli* had a lower mean individual count/host when compared to *H. eurysternus*. On calves, only *L. vituli* was observed, with a higher louse burden than on full-grown cattle. *H. eurysternus* and *S. capillatus* were more likely to occur simultaneously with another species on the same host, than *L. vituli*.

6. Diagnosis and monitoring

Sampling involves carefully inspecting sections of skin on a representative sample of animals in the herd, either 10% or 15 animals in each group: mature cows, heifers, and calves. The best regions to inspect are head, neck, shoulders, back, hips, and tail. If sampling indicates that

B. bovis is the dominant species present, assessment of the neck and tailhead alone is sufficient to detect most infestations. If sampling indicates that *Haematopinus tuberculatus* is the dominant species present in the herds, hair samples were taken only from animals which the hair was covered with louse eggs that were easily visible with the naked eye. These hair samples were consistently collected from a 2 cm^2 area on the side of the middle part of the neck.

Although lice normally do not survive away from the host, it is possible to send live specimens by post if a suitably insulated container is used (warmed to 25°C beforehand if possible) and containing a generous quantity of suitable animal hair. Some biting lice can be maintained for at least 8 weeks and a new generation obtained *in vitro* if they are kept on filter papers in Petri dishes at 36–37°C. It is essential to maintain the humidity at 68% RH by the use of an appropriate solution of NaOH, sulfuric acid, or concentrated solution of NH_4NO_3. For short-term tests, a solution of NaCl may be used, giving approximately 75% RH as a food supply, dried yeasts with powered hair and fresh skin scrapings is supplied; it is important that these should be fresh (no more than 6 days old unless deep frozen) and from the correct host species. This maintenance technique makes it possible to test the insecticide susceptibility of strains from the field [18, 25–27].

7. Treatment

Classical concentrates for dipping and spraying with traditional contact insecticides (mainly organophosphates, synthetic pyrethroids and amidines) are quite effective lousicides for cattle. However, such insecticides do not kill lice eggs (nits) and their residual effect is usually not long enough to ensure that immature lice are killed when hatching out of the eggs. A variety of compounds effectively control lice in cattle, including synergized pyrethrins, the synthetic pyrethroids cyfluthrin, permethrin, zeta cypermethrin, and cyhalothrin (including gamma- and lambda-cyhalothrin) (beef cattle only). Many pyrethroids are lyophilic, which assists the development of pour-on formulations with good distribution [28]. Natural pyrethrins are quickly degraded, while synthetic pyrethroids such as flumethrin and deltamethrin have greater stability and a relatively long period of action [29], but they do not affect all developmental stages of the louse life cycle. Organophosphates such as phosmet, chlorpyrifos (beef and nonlactating dairy cattle only), tetrachlorvinphos, coumaphos, and diazinon (beef and nonlactating dairy cattle only) are used against lice. Certain Brahman and Brahman-cross cattle have organophosphate hypersensitivity, which should be considered when selecting a treatment compound. The compounds such as macrocyclic lactones ivermectin, eprinomectin, and doramectin are also used to control lice in cattle. Injectable macrocyclic lactones will also control biting lice, since they reach the parasites through the blood stream of the host. But control of chewing lice is usually incomplete[2]. Pour-on formulations are effective against biting and bloodsucking lice, whereas injectable formulations are primarily effective against bloodsucking lice.

[2]The interesting thing about it is that in the treatment of chewing or biting lice, *Werneckiella equi equi* (Denny, 1842) infestation in a foal stock in Hungary, which was treated with paste Eqvalan (MSD) (and Rintal Plus (Bayer)) at doses of 0.2 mg/kg (and 8.4 g/100 kg) body weight, respectively, after 13 days was not found with the nits of lice [30].

Multiple pour-on formulations of 5% permethrin/5% piperonyl butoxide, 5% diflubenzuron/5% permethrin, and gamma cyhalothrin are labeled for season-long control (~3–4 mo) of lice on beef and dairy cattle. Although both amitraz and spinosad are effective against lice, the last cattle products containing amitraz were removed from the USA market in 2014. Spinosad formulations for use on cattle were officially discontinued in the USA in 2010. In 2016, Bayer Animal Health introduces Clean-Up TM II Pour-On Insecticide with an insect growth regulator (IGR) pour-on for topical application to control lice on dairy and beef cattle and calves.

The compound chosen must be appropriate for the animal's age, reproductive status, and production system. The treatment of meat and dairy animals must be restricted to uses specified on the product label, and all label precautions should be carefully observed. Appropriate meat and milk withdrawal times must be observed. In most countries, regulatory agencies specify tissue residue limits of insecticides and carefully regulate insecticide use on livestock. All regulations are subject to change, and pertinent current local laws and requirements should be determined before treatment [5, 27].

Research on the use of entomopathogenic fungi (*Metarhizium anisopliae*) for the biological control of lice has shown promising results.

By the Parasitipedia.net for the time being, there are vaccines that will protect cattle by making them immune to lice. There are repellents natural or synthetic that will keep lice away from cattle. And there are traps for catching cattle lice. Insecticides must be used properly to achieve satisfactory control of lice. Many louse-control products require two treatments, 10 to 14 days apart. *The second treatment is essential to kill newly hatched lice that were present as eggs at the time of the first treatment and were therefore not killed.* Failure to make the second treatment in a timely manner will create problems requiring many more subsequent treatments [3].

8. Conclusions

Many factors can cause susceptibility for louse infestation (stress, pregnancy, lactation), which is important to produce optimal husbandry conditions as well as optimal animal feeding. Feeding cattle a high energy diet and maintaining uncrowded conditions will reduce the chances of a louse infestation. When the infested animals became asymptomatic, on the hidden surface of the body (anal or pubic region, ridges), the louse can survive. The introducing of new animals in the herd realize necessary only after investigation of these on louse infestation and use of acaricide. Secondary bacterial and viral infections may also occur, resulting in a different (e.g., mange like) lesion. The regular disinfection of infested herds and all articles that infested animals may have come in contact with are essential too, for preventing further lice infestations. Specific lice control products can be more effective than integrated pest management principles, which indicate that it is preferable to use a narrow spectrum or specific product for each pest.

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References

[1] Urquhart GM, Armour J, Duncan JL, Dunn AM, Jennings FW. Veterinary Parasitology. Essex: Longman; 1987

[2] Urquhart GM, Armour J, Duncan JL, Dunn AM, Jennings FW. Veterinary Parasitology. Avon, UK: Longman Scientific and Technical, Bath Press; 1996

[3] parasitipedia.net/index.php?option=com_content&view=article&id=2398&Hemid=2665

[4] phthiraptera.Info/category/lice/animalia/arthropoda/insecta/phthiraptera

[5] https://www.msdvetmanual.com/integumentary-system/lice/lice-in-cattle

[6] Nickel WE. The economical importance of cattle lice in Australia: Advances in systemic control by pour-on method. Revue de Médecine Vétérinaire. 1971;**2/3**:392-404

[7] Durden LA, Musser GG. The Sucking Lice (Insecta, Anoplura) of the World: A Taxonomic Checklist with Records of Mammalian Hosts and Geographical Distributors. Vol. 218. New York: Bulletin of the American Museum of Natural History; 1994

[8] https://www.vetmed.ucdavis.edu/vmth/local_resources/pdf/misc_pdfs/ varga_article-Nov13.pdf

[9] Hussain MA, Khan MN, Iqbal Z, Sajid MS, Arshad M. Bovine pediculosis: Prevalence and chemotherapeutic control in Pakistan. Livestock Research for Rural Development. 2006;**18**:10-17. For author's personal use

[10] Fadok VA. Parasitic skin diseases of large animals. Veterinary Clinics of North America: Large Animal Practice. 1984;**6**:3-26

[11] Gibney VJ, Campbell JB, Boxler DJ, Clanton DC, Deutscher GH. Effects of various infestation levels of cattle lice (Mallophaga: *Trichodectidae and Anoplura: Haematopinidae*) on feed efficiency and weight gains of beef heifers. Journal of Economic Entomology. 1985; **78**:1304-1307. DOI: 10.1093/jee/78.6.1304

[12] Loomis EC. Ectoparasites of cattle. The Veterinary Clinics of North America. 1986;**2**:299-321. DOI: 10.1016/s0749-0720(15)31240-8

[13] Scharff DK. An investigation of the cattle louse problem. Journal of Economic Entomology. 1962;**55**:684-688. DOI: 10.1093/jee/55.5.684

[14] Eissa SI. Some studies on Mycoplasma mastitis in cattle and buffalos in Egypt [Ph.D. thesis]. Alexandria, Egypt: Alexandria University; 1986

[15] Walker B. Cattle lice. Prime Fact. 2007;**337**:1-4

[16] Bugby A, Webster RM, Tichener RN. Light Spot and Fleck—Part 2: Animal infestation studies. Laboratory Report 186. Northampton: British Leather Confederation; 1990

[17] Rawat BS, Trivedi MC, Saxena AK, Kumar A. Incidence of phthirapteran infestation upon the buffaloes of Dehradun (India). Angewandte Parasitologie. 1992;**33**:17-22

[18] Egri B, Stipkovits L, Piszmán R. Haematopinus infestations and mycoplasma infections of water buffalo (*Bubalus bubalis*) herds in National Parks of Hungary. Journal of Buffalo Science. 2016;**5**:53-59

[19] Colwell DD, Clymer B, Booker CW, Guichon PT, Jim GK, Schunicht OC, Wildman BK. Prevalence of sucking and chewing lice on cattle entering feedlots in southern Alberta. The Canadian Veterinary Journal. 2001;**42**:281-285

[20] Nafstad O, Grřnstřl H. Eradication of lice in cattle. Acta Veterinaria Scandinavica. 2001;**42**: 81-89. DOI: 10.1186/1751-0147-42-81

[21] Topgu A. Lice (Anoplura and Mallophaga) species on cattle in the Nigde region. Veteriner Fakultesi Dergisi, Ankara Universitesi. 1999;**16**:51-55

[22] Veneziano V, Santaniello M, et al. Lice (*Haematopinus tuberculatus*) in water buffalo farms from Central Italy. Italian Journal of Animal Science. 2007;**6**(Suppl.2):926-927

[23] Gutiérrez R, Cohen L, Morick D, Mumcuoglu KY, Harrus S, Gottlieb Y. Identification of different Bartonella species in the cattle tail louse (*Haematopinus quadripertusus*) and in cattle blood. Applied and Environmental Microbiology. 2014 Sep;**80**(17):5477-5483

[24] Hornok S, Hofmann-Lehmann R, Fernández de Merac IG, et al. Survey on blood-sucking lice (Phthiraptera: Anoplura) of ruminants and pigs with molecular detection of Anaplasma and *Rickettsia* spp. Veterinary Parasitology. 2010;**174**:355-358

[25] Egri B, Nagy E. A szarvasmarha bovicolosisának kezeléséről (in Hungarian). Magyar Állatorvosok Lapja. 1995;**50**:170-171

[26] Manual of Veterinary Parasitological Laboratory Techniques. London: MAFF; 1990

[27] https://vet.entomology.cals.cornell.edu/arthropod-identification/cow-recommendations/cattle-lice

[28] Losson BJ. Chemical control of lice on cattle and other animals. Pesticide Outlook. 1990;**1**:26-29

[29] Zerba E. Insecticidal activity of pyrethroids on insects of medical importance. Parasite Today. 1988;**4**:53-57

[30] Egri B. Occurence and treatment of biting louse (*Werneckiella equi equi* Denny, 1842) infestation in a foal stock in Hungary (in Hungarian). Parasitologia Hungarica. 1990;**23**:109-113