

LOUSE INFESTATION IN PRODUCTION ANIMALS

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INTRODUCTION

Lice infestations, or pediculosis, is common throughout the world affecting humans, fish, reptiles, birds and most mammalian species. Many of these parasites are host very host specific, and in these hosts they may also show preference to parasitize certain areas on the body. Lice are very broadly divided into two groups namely sucking lice (suborder *Anoplura*) and biting lice (suborder *Mallophaga*). Lice may in many cases be found in animals concurrently parasitized by other ectoparasites such as ticks and mites. In some instances lice may be potential vectors for viral or parasitic diseases. The prevalence and distribution patterns of lice, as with all other ectoparasites, may be influenced by a number of different factors such as changing climate, changes in husbandry systems, animal movement and changes or failures in ectoparasite control and biosecurity measures in place.

Lice infestation is of particular importance in the poultry industry, salmon farming industry and in humans. This article will focus mainly on production animals in which lice infestation may be of lesser clinical significance.

SPECIES OF MITES

There are a number of species of lice which are of clinical importance in domestic animals.

In cattle the **sucking lice** are *Linognathus vituli* (long nose sucking louse), *Solenopotes capillatus* (small blue sucking louse), *Haematopinus eurysternus* (short-nosed sucking louse), *Haematopinus quadripertusus* (tail louse) and *Haematopinus tuberculatus* (buffalo louse); and the **chewing louse** is *Bovicola bovis*. All these species of lice are found throughout the world, from the arctic to the tropics with *Haematopinus quadripertusus* (tail louse) confined the warmer climates of Australia and Africa.

In sheep the important **sucking lice** are *Linognathus ovillus* (sucking face louse), *Linognathus africanus* (African blue louse), *Linognathus stenopsis* (sucking goat louse) and *Linognathus pedalis* (sucking foot louse) whilst the **chewing louse** is *Bovicola ovis*.

In goats the important sucking lice are *Linognathus setosus* (sucking blue louse), *Linognathus africanus* (African blue louse) and the **chewing lice** are *Bovicola caprae*, *Bovicola limbat* and *Bovicola crassiceps*.

In pigs the **sucking louse** *Haematopinus suis* is the only louse of any clinical importance. This louse is highly host-specific and wild pigs are not infested by it.

In horses the **sucking louse** is *Haematopinus asini* and the **chewing louse** is *Bovicola equi* are of clinical significance.

In birds more than 40 louse species, all belonging to the suborder *Mallophaga*, has been reported in domestic birds. The genera of major importance include *Lipeurus* (wing louse), *Cuclotogaster* (head louse) and *Menacanthus* (body louse) in domestic fowls. The genera of minor importance include *Goniocotes* (fluff louse) and *Menopon* (shaft louse) in domestic fowls; *Goniodes* and *Columbicola* in pigeons and doves; and *Holomenopon* in ducks.

In humans the clinical important species are *Pediculus humanus capitis* (head louse), *Pediculus humanus corporis* (body louse) and *Phthirus pubis* (pubic louse).

LIFE CYCLE

All stages of the life cycle, of both sucking and chewing lice, are found on the host. The average life span seems to be one month and a female may lay 200-3300 eggs during this period. Eggs are visible as whitish “nits” on the host and attached to the hair or fleace. Lice have three nymphal stages and each of these stages will take 2-4 days to complete. These nymphal stages looks morphologically very similar to the sexually mature adult stage. The entire cycle from egg to adult takes approximately 2-3 weeks. Lice do not in general survive off the host for very long. However some species, usually the chewing lice such as the foot louse of sheep, may survive away from the host for up to 2 weeks. Some species such as *Bovicola* is known to reproduce asexually by parthogenesis and can increase their population numbers rapidly in this manner and their sex ratios are highly female biased.

Sucking lice are obligate blood feeders, acquiring small bloodmeals from superficial capillaries in the skin. Both sexes feed in this manner. **Chewing lice**, in contrast, feed on dead skin cells, hair, and oily secretions which they obtain from the surface using their chewing mouthparts. This may result in mild abrasion of the upper skin layers and it has been demonstrated that sheep develop antibodies to salivary secretions of *Bovicola bovis*.

EPIDEMIOLOGY

Transmission of both types of lice occurs by direct contact between infested animals but blankets, grooming tools and harnesses may remain infective for several days. Sheep may become infested with foot lice from the pasture. Young pigs may become infected some 10 hours after birth. Newborn calves also rapidly acquire infestations from their dams.

The development of all the stages of lice is highly temperature dependent requiring a fairly narrow temperature range with the optimum between 33° C to 37° C. Temperatures above 41° C and 46° C is lethal for eggs and adults respectively. Very low numbers of lice are therefore seen in summer and population numbers begin to increase with cooler temperatures in autumn, reaching maximum levels in late winter. The thinness of hair coats in the summer months coupled with high surface temperatures and increased exposure to sunlight is not favourable for survival of lice during this period.

The effects of climate change and other factor such as changes in animal management and husbandry systems, over-reliance on antiparasitics and development of resistance and increase in animal trafficking or movements may also contribute to changes in the prevalence, or emergence, of lice infestation in certain localities.

In a recent review article Taylor (2012) reports that legislation enforcing changes in pesticide usage have resulted in increased reports, and the spread of ectoparasitic infections in sheep and particularly mite, lice and tick infestations. Product availability have led to a move away from the more traditional methods of pesticide application, and more specifically dipping, to injectable pesticides being more commonly used. This has coincided with increased reports of sheep scab and lice infestations in some countries. Other issues such as disposal of dips and its associated environmental concerns have also contributed to this phenomenon. In Australia it was found that poor application techniques and the misuse of backline products resulted in the development of resistance and breakdown in control. As a consequence, the use of synthetic pyrethroid chemicals is no longer recommended for the treatment of sheep in Australia.

Of some epidemiological concern may be the fact that lice may serve as biological or mechanical vectors for various infectious agents. *Haematopinus suis* is suspected to be able to transmit swinepox mechanically, to aggravate the severity of clinical disease and to enhance viral spread by damaging the skin. It seems that they are able to remain infectious for weeks but vertical transmission has not been proven. *Haematopinus suis* has also been reported to be able to transmit *Eperythrozoon parvum* in pigs. There has been conflicting reports on the ability of *Haematopinus suis* to transmit African swine fever virus and some claims that it has not been proven beyond doubt to occur. *Linognathus vituli* and *Bovicola bovis* is suspected of being able to transmit *Eperythrozoon* spp in stabled animals.

An investigation into louse infestation of ruminants and pigs, and pathogens potentially transmitted by them, was conducted in Hungary by Hornok *et al* (2010). During this study the possible transmission of *Anaplasma*, *Rickettsia* and haemotropic mycoplasma DNA were investigated. In cattle infestation with *Linognathus vituli* (57%), *Haematopinus eurysternus* (38%) and *Solenopotes capillatus* (5%) was recorded. It was found that *Linognathus vituli* had a lower mean individual count per individual host when compared to *Haematopinus eurysternus*. On calves only *Linognathus vituli* was identified, and these animals had a higher louse burden compared to the adult animals. It was also observed that *Haematopinus eurysternus* and *Solenopotes capillatus* were more likely to occur simultaneously with another species on the same host, than *Linognathus vituli*. Goats were infested with *Linognathus stenopsis* and had the highest overall prevalence (68%). In contrast pigs infested with *Haematopinus suis* had the lowest (<1%) prevalence.

The DNA of *Anaplasma* spp. was detected in 50% of pooled samples screened. *Anaplasma ovis* (or a closely related novel *Anaplasma marginale* genotype) was identified in *Linognathus vituli* samples. *Anaplasma* sp positivity was also determined in *Haematopinus suis* and *Linognathus stenopsis*. *Rickettsia* spp. were demonstrated from *Linognathus* spp. and *Haematopinus eurysternus* samples. No haemotropic mycoplasmas were detected in any of the samples screened.

In human lice are the vectors for some life-threatening diseases which includes epidemic typhus, relapsing fever, trench fever and pathogens, such as *Acinetobacter baumannii* and

Yersinia pestis. This poses major public health concerns in populations living in poor hygienic conditions brought about by war (social disruption and refugee camps), severe poverty, or inadequate public health management systems.

In the salmon farming industry lice is of major clinical concern which also poses a serious threat to the ecosystem and the wild salmon populations.

There are not many recent reports on surveys into the occurrence of different species of lice published in domestic animals. In a fairly recent survey in Thailand the following ectoparasites were seen in different domestic animal species sampled: in cattle the tick *Rhipicephalus (Boophilus) microplus* (72.7%) and two lice *Linognathus vituli* (27.3%), and *Solenopotes capillatus* (9.1%). This is the first report on the latter louse in Thailand.

A larger number of reports have been published on lice infestations in a variety of birds, and different small and large mammal species, either free ranging or in captivity.

CLINICAL FINDINGS AND SIGNIFANCE

Lice may prefer certain areas of the body to parasitize but can be found over the entire body in heavy infestations. Infestation by more than one species of louse, and concurrent infestations with other ectoparasites may occur.

In cattle *Bovicola bovis* prefers the top of the head, curly hair of the poll and forehead, neck, shoulder, back, rump and the tail switch. *Linognathus vituli* and *Solenopotes capillatus* prefers the dewlap, neck and head. *Haematopinus eurysternus* may be seen on the poll, base of the horns, in the ears, around the nostrils and eyes, and tail switch. *Haematopinus quadripertusus* are mostly found on the tail only. *Haematopinus eurysternus* and *Linognathus vituli* may form dense isolated clusters exhibiting a gregarious nature. Antagonism between species had been reported and in infestations with both *Bovicola bovis* and *Linognathus vituli* the former may be seen on the dorsal half of the body whilst the latter will be found ventrally.

In sheep the sucking lice *Linognathus ovillus*, *Linognathus africanus*, *Linognathus stenopsis* and *Linognathus pedalis* are not very active, and may feed in gregarious swarms in most haired regions of the body. *Linognathus ovillus* may be seen on the face and ears, from where it may spread to the cheeks, neck and body in heavily woolled breeds. *Linognathus pedalis* found on the lower hind limb, from the feet to below the hocks from where it may spread to the crutch, scrotal and belly regions *Bovicola ovis* is active can be found in wool all over the body.

In pigs *Haematopinus suis* may be found in the skin folds of the neck and jowl, the flanks and the inside of the legs on thin coated animals.

In horses *Haematopinus asini* and *Bovicola equi* both prefers the dense mane hair, the tail base, submaxillary space and the fetlocks in rough-legged breeds. In heavy infestations the may spread over the entire body.

In many animals pediculosis may not be of great clinical significance but more severe infestations may cause severe irritation and pruritis of the skin, resulting in increased or excessive scratching, rubbing and licking with alopecia, papules and crusts as consequence. Hair loss has been associated with lice infestation, but it is a controversial, as it may not be the direct cause of the hair loss. Direct damage to the hair coat, fleece, skin, feathers and hides may be seen which is probably the most important direct clinical manifestation. Plant and Lewis (2011) reports loss in production from lice-infested sheep in Australia and found that sheep showing signs of rubbing and biting may experience a reduction in fleece value of around 40%, which includes lower clean fleece and reduced yields. In sheep the wool may show loss in brightness and become cotted and more yellow in colour. There is evidence that a pelt defect called cockle is associated with infestation with body lice. Secondary myiasis has been described in sheep with lice infestation.

Agitation and restlessness may lead to production losses such as milk in dairy cattle and reduced feed efficiency in feedlot cattle. Hairballs may be present in infested calves due to continual licking. Keratoconjunctivitis and periorbital papillomatosis has been reported in heifers suffering from severe periorbital *Haematopinus quadripertusus* infestation. In horses it has been reported that lice may be one of the predisposing causes of tail pyoderma, which is the result of *Staphylococcus aureus* infection. In pigs it has been reported that some animals may develop an allergic dermatitis as a secondary consequence.

Bovicola ovis infestation in sheep is reported to cause an allergic dermatitis referred to as 'scatter cockle'. In a study by Pfeffer (2010) et al they described the identification of allergen identified from the louse designated Bov o 1 in accordance with the criteria of the World Health Organization/International Union of Immunological Societies Allergen Nomenclature Subcommittee.

Infestation is generally not believed to effect weight gain and /or haematological parameters. However, a synergistic effect between louse infestations and infestation with gastrointestinal nematodes has been reported to have an impact on weight gain. Anaemia is rare but has been described with heavy infestations of *Haematopinus eurysternus* in cattle and in horses with *Haematopinus asini*.

Clinicians should also be aware of the fact that heavy louse infestation may itself be a secondary consequence to an underlying condition such as malnutrition or chronic disease. Debilitated animal may not be grooming themselves and the shedding of the winter coat may be delayed for many weeks, retaining large numbers of lice on the animal. Lice may also act as vector for other infectious diseases as discussed under epidemiology.

In many instances the indirect losses may be the more important and attributed mostly to the costs involved in the treatment of animals, loss of man hours and the repair of damaged fences due to animals constantly rubbing against it.

DIAGNOSIS

The diagnosis of lice infestation requires close inspection with particular attention being paid to the known predilection sites of the lice. For the best possible visual inspection a good external light source must be used and the animal should be properly restrained to allow for the hair to be parted and the skin examined at multiple locations. Chewing lice of cattle, sheep, and horses have a rounded head and is light brown in colour, are highly mobile and will move away from inspection sites. Their eggs may be difficult to spot if not dark haired

cattle or horses. Sucking lice in contrast have a gray or blue-gray colour and a pointed head, are less mobile and usually remains fixed to the skin. Cattle with white faces and necks may show a dark, greasy appearance if lice populations are heavy.

CONTROL

Control measures may be aimed at contact, chemical and biological control.

Contact control measures hinges of the fact that lice are spread from animal to animal when in close contact with one another such as during feeding, breeding, or transporting. Lice and louse eggs dropping off onto bedding or being rubbed off, along with hair, onto fences and facilities may also be responsible for transmission. In horses, blankets, tack and grooming equipment may also be responsible for transmission. Sucking lice die within a few hours when off the host but some biting lice may live for several days if not exposed to direct sunlight or cold weather, and some eggs may hatch and infect other animals in contact. For this reason, premises vacated by infested stock should either be treated with insecticide, or should stand empty for 10 days before being used by clean stock. In Australia a lot of emphasis is placed on trying to determine if lice infestation in sheep is due to inadequate treatment, resistance, a combination of the two, or the introduction of new infestation. Enhanced biosecurity measures with regards to fencing and animal movement (quarantine) is therefore strongly advocated.

Chemicals registered for chemical control of cattle lice (as example) include organophosphates and carbamates, macrocyclic lactones, pyrethrins and pyrethroids, fomamidines, chitin synthesis inhibitors and combinations thereof. Chemical application methods for louse control include dipping, spraying, pour-ons, spot-ons, and injectables, as well as dusts and self-applicators.

Regardless of the application method, most insecticides have little effect on louse eggs and a second treatment 2 or 3 weeks after the first is important to kill the newly-hatched lice before they can mature and lay eggs. High louse populations coincide with periods of cold winter stress, vitamin, mineral or other nutritional deficiencies and when management stresses are most prevalent. Control measures should be initiated in winter months before the lice become numerous.

Dipping or spraying can provide thorough coverage but should be carried out according to recognised methods. Pour-on, spot-on, and injectable treatments can be highly effective but self-applicators apply little or no insecticide to the brisket, ventral thorax, belly, and legs and therefore may not adequately control high lice challenges. Thorough hand dusting can provide control but this is time consuming and better suited to individual animals.

All insecticides should be used strictly according to manufactures specifications and conform to withdrawal times and exclusions where appropriate. Injectable treatments are very effective for the blood-feeding lice species, but may not control the chewing louse. Thus pour on formulations may be necessary in controlling these species. Treated animals should be examined after about 14 days, regardless of treatment method, to determine if a second or continued treatment is necessary. For the treatment of sheep, in Australia, it is recommended to reduce wool damage until the next shearing by method such as hand jetting and backline products. It is reported that this will not eradicate lice. Therefore after shearing wet dipping or backline products are recommended to eradicate the lice.

L.L. Briggs *et al* (2006) described the use of a fungal pathogen, *Metarhizium anisopliae*, for the biological control of the cattle louse *Bovicola bovis*. They concluded that the strategic seasonal use of this fungal pathogen on cattle, applied in early winter, may be of value in suppressing the winter increase in lice populations and preventing them from increasing to clinically significant levels.

The effective control of sheep lice with conventional pesticides can be hampered in some cases by the dense water repellent fleeces of sheep preventing contact between lice and the pesticide. This has prompted some interesting research into the use of entomopathogenic nematodes. These are motile parasites able to actively seek out insect hosts such as lice in the fleece of sheep. A study by James *et al* (2010) investigated whether the nematodes, *Steinernema carpocapsae*, *Steinernema riobrave*, *Steinernema feltiae* and *Heterorhabditis bacteriophora* were able to infect and kill *Bovicola ovis*. All were shown to infect and kill lice in Petri dish assays at 30 °C. It was concluded that *Steinernema riobrave* may likely be the most effective against *Bovicola ovis* when applied to live sheep due to its greater tolerance to high temperatures and its foraging strategy.

In Australia resistance to the synthetic pyrethroids and increasingly with the insect growth regulators (triflumuron and diflubenzuron) has been reported in the treatment of lice infestations in sheep.

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CPD Questionnaire

1. Which statement is true:
 - a) The sucking louse *Haematopinus suis* does not affect pigs.
 - b) Wild pigs are particularly susceptible *Haematopinus suis*.
 - c) The chewing louse *Haematopinus suis* affect pigs.
 - d) There are multiple other species of lice in pigs of clinical importance.
 - e) *Haematopinus suis* prefers the skin folds of the neck and jowls.

2. Which statement is false:
 - a) Both sexes of lice occur on the host.
 - b) They are all short living off the host.
 - c) The life cycle takes approximately 2-3 weeks.
 - d) The life span of an adult louse is 7 days.
 - e) Parthogenesis is seen with *Bovicola sp*.

3. Which statement is false:

Haematopinus asini and *Bovicola equi* both prefers

 - a) The dense mane hair.
 - b) The tail base.
 - c) Submaxillary space.
 - d) Fetlocks in rough-legged breeds.
 - e) In heavy infestations they may spread over the ears.

4. Lice may be a vector in the transmission of:
 - a) Heartwater
 - b) *Eperythrozoon spp*
 - c) Swinepox
 - d) Both b and c
 - e) None of the above

5. Resistance in lice was described against:
 - a) Organophosphates
 - b) Dieldrin
 - c) Carbamate
 - d) Arsenic
 - e) Pyrethroids

6. The most possibly effective entomopathogenic nematode may be

- a) *Steinernema carpocapsae*,
- b) *Steinernema riobrave*,
- c) *Steinernema feltiae*
- d) *Heterorhabditis bacteriophora*
- e) *Metarhizium anisopliae*

7. In humans lice may be vectors for the following disease/s:

- a) epidemic typhus
- b) relapsing fever
- c) trench fever
- d) *Yersinia pestis*
- e) All of the above

8. Anaemia has been described in infestation by:

- a) *Haematopinus asini*
- b) *Bovicola ovis*
- c) *Bovicola bovis*
- d) *Linognathus vituli*
- e) *Haematopinus quadripertusus*

9. After treating animals against lice infestation it is advised:

- a) not to treat animals for a second time.
- b) to treat a second time at 6 months.
- c) to treat again at 2-3 weeks.
- d) to only monitor animals for lice reinfestation.
- e) to treat 3 more times at 2 weekly intervals.

10. Chemical control methods would include

- a) dipping
- b) spraying
- c) pour-ons
- d) injectable preparations.
- e) all of the above.