Haematopinus
(insect: louse)

Overview

Arthropods are coelomate metameric invertebrate animals with a chitinous exoskeleton and jointed limbs. They undergo protostomial embryonic development and grow by cuticular moulting (ecdysis). Three main subphyla are recognized: Chelicerata, Crustacea and Hexapoda. Insects are hexapods with three pairs of uniramous legs, three tagmata (head, thorax, abdomen), ectognathous mouthparts with whole-limb mandibles, and one pair of antennae. Lice (Phthiraptera) are small wingless dorsoventrally-flattened hemipterodeans which are permanent obligate ectoparasites on other animals. All lice undergo gradual metamorphosis and there are no free-living stages. Eggs are cemented to host hairs whereas nymphs and adults cling to hairs using enlarged tarsal claws. Lice do not survive long off their hosts so transmission is usually by direct contact. Anopluran (sucking) lice have narrow pointed heads adapted to piercing the skin and feeding on tissue fluids (solenophage mode of feeding). Sucking lice are ectoparasitic on mammals and most species are highly host specific and even site-specific, being found predominantly in areas with coarse hairs. Haematopinids are short-nosed lice whose tarsal claws are equal in size. *Haematopinus* spp. are commonly found on the skin/hair of domestic animals and infestations have been associated with dermatitis, anaemia, pruritus, alopecia, excoriation and self-wounding, especially in cattle.

Classification:

Domain:	Eukaryota (membrane-bound nucleus)
Supergroup:	Amorphea (unikonts with single flagellum, or nonflagellated amoebae)
Kingdom:	Metazoa (multicellular eukaryotes, heterotrophs, notably animals)
Group:	Protostomia (triploblastic, spiral cleavage)
Subgroup:	Ecdysozoa (cuticle moulted = ecdysis)
Phylum:	Arthropoda (chitinous exoskeleton, segmented body, jointed limbs, haemocoel)
Subphylum:	Hexapoda (three tagmata, three pairs uniramous legs, whole-limb mandibles, Malpighian tubules)
Class:	Insecta (ectognathous mouthparts (bases lie outside head capsule), single pair antennae, many with wings)
Superorder:	Hemipterodea (Exopterygota) (young resemble adults, externally developing wings)
Order:	Phthiraptera (lice, wingless, ectoparasites, dorsoventrally flattened, stout legs, claws, eggs, nymphs, adults)
Suborder:	Anoplura (sucking lice, narrow pointed head, pierce skin and feed on fluids (solenophagy))
Family:	Haematopinidae (short-nosed lice, ectoparasites of domestic animals, claws on ends of legs of similar size)
Genus:	*Haematopinus* (parasitic on skin/hair of horses/cattle/pigs)
Species:	various species cause skin lesions/anaemia in domestic livestock

Parasite biodiversity and host range: Most Metazoa are multicellular triploblastic animals with differentiated tissues, many being bilaterally symmetrical with a body cavity. Most invertebrate animals are protostomes as their embryonic development involves spiral determinate cleavage. Those that moult their external cuticles during their life-cycles (process known as ecdysis) are grouped together in the unique clade Ecdysozoa, including the nematodes (roundworms), onychophorans (velvet worms), tardigrades (water bears) and arthropods (myriapods, chelicerates, crustaceans and hexapods). Arthropods have small segmented bodies encased in chitinous exoskeletons with articulated limbs. Most species are free-living in terrestrial and aquatic habitats, although a small range are ectoparasitic on other animals, some feeding on the blood or skin of vertebrates. Five subphyla are recognized: Chelicerata, Crustacea, Hexapoda, Myriapoda and Trilobita. Insects are hexapods with six legs, three distinct body parts, two antennae and mouthparts with whole-limb mandibles. Insects are the most biodiverse group on the planet, with millions of species described in numerous taxa. Notorious ectoparasitic species belong to four orders in two superorders: the Hemipterodea (Exopterygota) containing the orders Hemiptera (bugs) and Phthiraptera (lice); and the Holometabola (Endopterygota) containing the orders Siphonaptera (fleas) and Diptera ('true' flies). Lice are small wingless hemipterodeans that undergo gradual (hemimetabolous) metamorphosis and are permanent obligate ectoparasites on other animals. Four suborders are recognized: the Anoplura containing the haematophagous sucking lice of placental mammals; the Ischnocera and Amblycera (previously classified together as Mallophaga) comprising the chewing or biting lice of birds, marsupials and placental mammals; and the Rhynchophthirina confined to elephants and warthogs in Africa.

Major parasitic phthirapteran families	Biodiversity	Hosts	Parasitic stages	Patho-genesis	Disease transmission
Suborder: Anoplura (sucking lice of placental mammals) (narrow pointed head, pierce skin and feed on fluids (solenophagy)) [16 families, 51 genera, 694 species]					
Haematopinidae (ungulate lice, short-nosed lice)	1 genus, 21 spp.	mammals (equids, bovids, suids)	nymphs, adults	blood-sucking	viral, bacterial
Linognathidae (pale lice, long-nosed lice)	3 genera, 73 spp.	mammals (bovids, canids)	nymphs, adults	blood-sucking	-
Pediculidae (head & body lice)	1 genus, 4 spp.	mammals (hominids, New World primates)	nymphs, adults	blood-sucking	bacterial
Pthiridae (pubic lice)	1 genus, 2 spp.	mammals (hominids)	nymphs, adults	blood-sucking	-
Suborder: Rhynchophthirina (sucking lice of African wildlife) [1 family, 1 genus, 4 species]					
Haematomyzidae (elephant & warthog lice)	1 genus, 4 spp.	mammals (elephants, warthogs)	nymphs, adults	blood-sucking	-
Suborder: Ischnocera [Mallophaga p.p.] (chewing lice of mammals and birds, broad rounded head, without maxillary palps, prominent filiform antennae, keratin feeders) [2 families, 158 genera, 3,371 species]					
Trichodectidae (fur lice)	20 genera, 413 spp.	mammals (bovids, equids, carnivores)	nymphs, adults	biting	helminth
Philopteridae (bird lice)	138 genera, 2,958 spp.	birds	nymphs, adults	biting, chewing	-
Suborder: Amblycera [Mallophaga p.p.] (chewing lice of mammals and birds, large rounded head, with maxillary palps, 4-segmented antennae in antennal grooves, keratin feeders) [6 families, 96 genera, 1,550 species]					
Menoponidae (bird lice)	68 genera, 1,150 spp.	birds	nymphs, adults	biting, chewing	-
Boopiidae (marsupial chewing lice)	8 genera, 57 spp.	mammals (incl. marsupials)	nymphs, adults	biting	helminth

Some 700 species of anopluran sucking lice have been described in 51 genera in 16 families, namely: Echinophthiriidae (*Antarctophthirus*, *Echinophthirius*, *Latagophthirus*, *Lepidophthirus*, *Proechinophthirus*); Enderleinellidae (*Atopophthirus*, *Enderleinellus*, *Microphthirus*, *Phthirunculus*, *Werneckia*); Haematopinidae (*Haematopinus*); Hamophthiriidae (*Hamophthirius*); Hoplopleuridae (*Ancistroplax*, *Ferrisella*, *Haematopinoides*, *Hoplopleura*, *Paradoxophthirus*, *Pterophthirus*, *Schizophthirus*, *Typhlomyophthirus*); Hybophthiridae (*Hybophthirus*); Linognathidae (*Linognathus*, *Prolinognathus*, *Solenopotes*); Microthoraciidae (*Microthoracius*); Mirophthiridae (*Mirophthirus*); Neolinognathidae (*Neolinognathus*); Pecaroecidae (*Pecaroecus*); Pedicinidae (*Pedicinus*); Pediculidae (*Pediculus*); Polyplacidae (*Abrocomaphthirus*, *Ctenophthirus*, *Cuyana*, *Docophthirus*, *Eulinognathus*, *Fahrenholzia*, *Galeophthirus*, *Haemodipsus*, *Johnsonpthirus*, *Lagidiophthirus*, *Lemurpediculus*, *Lemurphthirus*, *Linognathoides*, *Neohaematopinus*, *Phthirpediculus*, *Polyplax*, *Proenderleinellus*, *Sathrax*, *Scipio*); Pthiridae (*Pthirus*); and Ratemiidae (*Ratemia*). Those of medical significance are found in the families Pediculidae (hominids, New World primates) and Pthiridae (hominids), while those of particular veterinary significance occur in the families Haematopinidae (equids, bovids, suids), Linognathidae (bovids, canids), Hoplopleuridae (rodents), Pedicinidae (Old World primates) and Polyplacidae (rabbits, rodents). Haematopinids are commonly known as ungulate lice or short-nosed lice. The tarsal claws at the ends of their legs are similar in size and used to grip host hairs. Over 20 *Haematopinus* spp. have been described from ungulates, both domestic and sylvatic. These species are mostly host-specific and their geographic distribution generally mirrors that of their hosts, with lice of domestic livestock being cosmopolitan due to frequent translocations, while those of wild animals are more restricted to their native host ranges (e.g. African antelope, zebra, etc.).

***Haematopinus* species**	Hosts	Location	Clinical signs	Distribution
H. acuticeps	Perissodactyla: equid (plains zebra)	skin		Africa
H. apri (syn. *H. aperis, urius p.p.*)	Artiodactyla: suid (pig)	skin		Eurasia
H. asini (syn. *H. elegans, equi, macrocephalus, minor*) (horse sucking louse)	Perissodactyla: equid (horses, donkeys)	skin (head, neck, back, brisket, upper legs, belly)	dermatitis, irritation, excoriation, alopecia, anaemia	worldwide
H. breviculus	Artiodactyla: bovid (eland)	skin		Africa
H. bufali (syn. *H. neumanni, papillosus, phthiropsis*)	Artiodactyla: bovid (buffalo)	skin		Africa

H. channabasavannai	Artiodactyla: bovid (cattle)	skin		India
H. eurysternus (syn. *H. brevipes, palpebrae*) (short-nosed cattle louse)	Artiodactyla: bovid (cattle)	skin (around poll, horns, ears, eyes, nostrils, tail switch)	dermatitis, pruritus, rubbing, licking	worldwide
H. gorgonis	Artiodactyla: bovid (wildebeest)	skin		Africa
H. jeannereti	Artiodactyla: bovid (giant eland)	skin		Africa
H. latus (syn. *H. incisus, peristictus p.p.*)	Artiodactyla: suid (river hog, bushpig)	skin		Africa
H. longus	Artiodactyla: cervid (sambar)	skin		Indo-China
H. ludwigi	Artiodactyla: suid (Philippine pig, bearded pig)	skin		South-East Asia
H. meinertzhageni	Artiodactyla: suid (giant forest hog)	skin		Africa
H. nigricantis	Artiodactyla: cervid (Philippine brown deer)	skin		South-East Asia
H. oliveri	Artiodactyla: suid (pygmy hog)	skin		India
H. oryx	Artiodactyla: bovid (gemsbok)	skin		Africa
H. phacochoeri (syn. *H. peristictus p.p.*)	Artiodactyla: suid (warthog)	skin		Africa
H. quadripertusus (syn. *H. parviprocursus*) (cattle tail louse)	Artiodactyla: bovid (cattle)	skin (tail, perineum)	dermatitis, pruritus	worldwide
H. suis (syn. *H. adventicus, chinensis, irritans*) (swine/hog louse)	Artiodactyla: suid (pig)	skin (neck, jowls, flanks, legs)	irritation, scratching, weight loss [plus vector for swine pox virus]	worldwide
H. taurotragi	Artiodactyla: bovid (kudu, eland)	skin		Africa
H. tuberculatus (syn. *H. punctatus*) (buffalo louse)	Artiodactyla: bovid (buffalo, cattle)	skin (tail, dorsal mid-line)	dermatitis	worldwide

Parasite morphology: Lice form three different types of developmental stages: eggs; nymphs (3 instars); and adults. Eggs are ovoid-ellipsoidal stages (0.9-1.1 x 0.4-0.5 mm) that are glued onto host hairs by their bases, sometimes on a short peduncle or stalk, and generally lay almost parallel to the hair. The eggs are translucent and white-beige in colour, the surface covering is pitted with numerous aeropyle pores, the apical end is bluntly rounded and contains an opercular lid, and they contain developing embryos. The eggs, and the empty eggshells, are commonly called nits. Newly-hatched nymphs moult through another two nymphal stages (instars) before developing into adult lice (imagoes). Developing stages undergo gradual (incomplete) metamorphosis (hemimetabolous) whereby the nymphs appear morphologically similar to adults but are smaller, less sclerotized, have fewer body setae, and lack genitalia. Haematopinids are the largest lice found on domestic animals, with adults ranging in length from 2-8 mm depending on species. They are usually grey to brown in colour and are dorso-ventrally flattened (dorsal tergum, ventral sternum) with three distinct body parts (head, thorax, abdomen). The head is long and narrow (longer than wide, narrower than thorax) with an anterior point containing the mouthparts, two antennae extending laterally (each comprised of five segments) and two lateral ocular points (eyeless projections) behind the antennae. The long thin mouthparts are modified for piercing and sucking and are located in a snout-like proboscis (labrum) containing a tubular haustellum which is eversible, armed with prostomal teeth (for attachment) and supports four retractable stylets (two supported by maxillae to form a food channel, one derived from the hypophyarnx and connected to the salivary gland, and one derived from the labium which is flattened with a serrated tip and guides the other stylets). The mouthparts are retracted into a pocket in the head when not used for feeding. Sucking lice lack maxillary palps (present in amblyceran chewing lice), and they lack mandibles and pulvinus pads (present in other chewing/biting lice). Although some early texts suggested that *Haematopinus* lice retained rudimentary mandibles, subsequent embryological studies revealed them only in developing eggs and they never became sclerotized and had disappeared before adults were formed. The alimentary tract consists of a foregut (with buccal funnel, cibarial pump, pharynx and oesophagus), a large midgut (with ventriculus, anterior caeca and round mycetome (special organ, sometimes called bacteriome or stomach disc, harbouring bacterial/fungal symbionts)), and a hindgut (with pylorus, papillae and rectum). The thorax is relatively small and consists of 3 fused segments without obvious divisions although a notal pit is present in the tergum and the sternal plate is large and dark. The thorax contains three pairs of legs, all similar in size. Each leg contains five sections (proximal coxa, trochanter, femur, tibia and distal tarsus), the latter bearing a large specialized claw that closes onto a thumb-like tibial spur next to a tibial pad. These modified tibiotarsal claws are similar in size and well adapted for grasping host hairs (the claw diameter closely corresponds to the diameter of host hairs). The elongate elliptoid abdomen consists of nine segments with well-sclerotized dorsal tergal plates, ventral sternal plates and paratergal plates bulging laterally and associated with respiratory spiracles (openings in the body wall connected to the tracheal system).

Mature female lice are slightly larger than males (2-6 cf. 2-4 mm long). The female reproductive tract lacks a spermatheca but has ovaries with polytrophic ovarioles, tubular oviducts, and a globular uterus with accessory glands (produce eggshells and glue). The posterior abdominal segment is distinctly bifurcated (with apical lobes) and the genital opening (vagina) is supported by a sclerotized genital plate and well-developed gonopods armed with setae. Males have a more rounded abdomen containing compact bilobed testes, tubular vas deferens which coalesce to form the seminal vesicle, and then a prominent posterior genital sac containing a well-sclerotized asymmetrical aedeagus (copulatory intromittent organ comprising a penis-like tube with dorsal gonopore and terminal V-shaped pseudopenis) supported by a thick basal apodeme (plate-like sclerite) and small lateral parameres (rod-like sclerites). [Note that some texts refer to the whole aedeagus as the pseudo-penis, while others reserve the latter term for the terminal portion of the aedeagus]. *Haematopinus* spp. are differentiated by variations in their morphological characteristics, particularly their heads, ocular points, thoracic sternites, sternal pits and genital plates.

Site of infection: Haematopinid lice are obligate ectoparasites of ungulates, parasitizing even-toed artiodactyls (pigs, cattle, buffalo, antelopes, deer) and odd-toed perissodactyls (horses, donkeys, zebras). Nymphal stages and adult lice are found crawling around on the skin and hair of their hosts. Most species are remarkably host specific and are found on individual host species, occasionally on several closely-related hosts. Many species exhibit some site specificity and are found preferentially on particular body parts, although they may be more widespread in heavy infestations. *H. eurysternus* (short-nosed cattle louse) is commonly found on the neck, dewlap and brisket, sometimes around the eyes, horns, tail and withers. During the summer, lice have been observed to shelter around the ears, horns and under the tail. *H. quadripertusus* (cattle tail louse) normally infests the tail, although nymphs may also be found on the perineum and vulva. *H. asini* (horse sucking louse) is found on the coarse hairs of the mane, forelock, brisket, back, tail and on the legs above the hooves. *H. suis* (hog louse) is found under scurf of the skin usually in protected areas such as neck folds, jowls, around the ears and eyes, the inner flanks and between the legs.

Pathogenesis: These sucking lice are haematophagous and all nymph and adult stages feed by piercing the skin with their slender mouthparts, injecting saliva and sucking blood. Light infestations are often well tolerated by their hosts and may go unnoticed, but heavier infestations may cause mild to severe disease characterized by dermatitis, anaemia, allergic reactions and reduced productivity. Bite sites may become irritated and inflamed due to physical trauma and local reactions to louse antigens/allergens (in saliva and/or faeces). Skin lesions may be conspicuous as red pruritic spots with inflammatory cellular infiltrates (polymorphonuclear leucocytes and eosinophils) sometimes progressing to dermal granulomas due to hypersensitivity responses. Infested animals become restless and endeavour to relieve the itching by grooming (licking, biting, scratching or rubbing) afflicted body parts which can become unsightly and unthrifty in appearance. Animals may develop rough coats (matted, dry, broken fibres, pulled appearance) and alopecia (loss of hair) with thickened areas of skin, superficial flecks, cracks, scales or crusts, and local scarification due to self-trauma. They may exhibit impaired thermoregulation and damaged hides are prone to secondary infections by bacteria or fly larvae. Over time, heavily or chronically infested animals lose body condition due to inappetence or anorexia, with production losses due to suboptimal meat, milk or fibre production. Heavy infestations by sucking lice may also cause significant blood loss with anaemia and compromised nutrition contributing to further weight loss, deteriorating health and sometimes reproductive losses (through abortion), shortened life-spans and death (particularly in pigs). Young, old, sick or stressed animals are more susceptible to severe infestations due to their compromised immunological and/or physiological states, with heavy infestations often developing in association with some underlying condition such as malnutrition or concurrent infection. Animals in good body condition with good nutrition generally keep louse populations in check by regular self-grooming. Studies have shown that individuals unable to groom themselves develop heavier and more persistent infestations, shed their winter coats later and may act as chronic carriers between seasons, locations and herds.

Some haematopinid species have been shown to act as vectors for several infectious microbial diseases of livestock: notably *H. suis* transmitting the virus causing swine pox and the bacterium *Eperythrozoon suis* causing eperythrozoonosis in pigs. Recent molecular screening studies have used polymerase chain reaction (PCR) techniques to detect DNA sequences from a range of potential microbial pathogens in lice; including the bacteria *Anaplasma marginale* in *H. tuberculatus* from cattle and in *H. suis* from pigs, *Mycoplasma* sp. in *H. tuberculatus* from buffalo, *Bartonella* spp. in *H. quadripertusus* and *H. tuberculatus* from cattle, *Rickettsia africae* in *H. quadripertusus* from cattle, *Rickettsia* sp. in *H. eurysternus* from cattle, and the haemoprotozoans *Trypanosoma evansi* in *H. tuberculatus* from cattle, and *Theileria orientalis* in *H. eurysternus* from cattle; but their roles in disease transmission are uncertain. Both sucking and chewing lice of cattle have also been shown to act as mechanical vectors for the skin fungus *Trichophyton verrucosum* which causes dermatomycosis (ringworm).

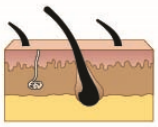
Developmental cycle and mode of transmission: Sucking lice are permanent obligate ectoparasites whose entire life-cycle occurs on the host with transmission between hosts occurring by direct contact or via fomites. Mature female lice attach their eggs (nits) to hairs close to the skin surface. The eggs hatch in 11-14 days releasing first-stage nymphs (N1) which crawl over the skin and begin to suck blood within hours. The nymphs resemble adult lice and undergo simple (incomplete) metamorphosis, moulting through another two nymphal stages (N2 and N3) before moulting to adults after 9-22 days. After feeding and mating, female lice lay 1-5 eggs each day for 2-4 weeks and may live for up to 8 weeks. The whole life cycle may be completed in 3-5 weeks, particularly in cool moist conditions. Transmission to other animals occurs by direct contact when lice (nymphs or adults) crawl from one host to another, although it may also occur by contamination of the immediate environment, notably when lice infest fomites, such as

shared bedding, grooming equipment, harnesses, saddles, blankets or rugs. Lice do not survive for long off the host (maximum of 3-4 days), so infestations are generally transmitted during periods of high contact between hosts, such as mothers suckling young, commercial milking times, or crowding in feed-lots, yards, barns, stalls or pens. Occasional examples of phoresis or phoretic transfer have been reported whereby lice have become temporarily attached to insects (muscids) which act as paratenic (transport) hosts; e.g. *H. eurysternus* nymphs from cattle attached to horn flies (*Haematobia irritans*). Many infestations exhibit seasonal patterns, being most prevalent during cooler winter months when lower temperatures, rain and less daylight favour louse development, and hosts generally have poorer nutrition, longer hair, and crowd together for warmth. Infestations decline prevalence and intensity approaching summer with warmer drier conditions, loss of winter coats, better nutrition and less crowding or gregarious behaviour. The exception is the cattle tail louse *H. quadripertusus* which is most abundant during summer months due to delayed hatching of their eggs.

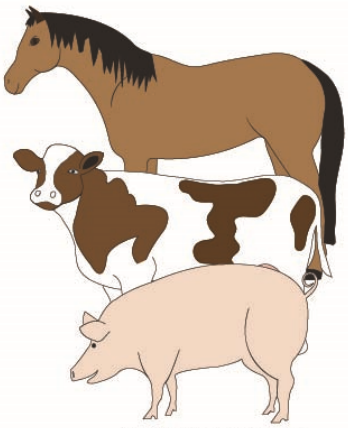
Differential diagnosis: Most infestations are diagnosed by direct detection of lice (nymphs and adults) on the skin of their hosts. Sucking lice move slowly and are often found with their mouthparts embedded in the skin. Occasionally, their eggs or egg cases (nits) may be observed attached to hairs near the skin surface. Macroscopic inspections of livestock are best conducted by parting the coat (if necessary, breaking apart matted hairs) particularly on the face, neck, back, legs, scrotum and tail. Lice may be collected and examined microscopically for positive identification. Recent studies have used molecular biological techniques to characterize several species following the polymerase chain reaction (PCR) amplification of nuclear DNA (ribosomal RNA gene) and mitochondrial DNA (revealing fragmented mitochondrial genomes with 37 genes arranged on 9 minichromosomes).

Treatment and control: Clinical infestations may be effectively controlled by combining chemotherapy with preventive management strategies. A range of insecticides have demonstrated good activity against haematopinid lice on domestic livestock and performance animals: including organochlorides (dichloro-diphenyl-trichloroethane (DDT), lindane, methoxychlor); organophosphates (tetrachlorvinphos, chlorpyrifos, diazinon, famphur, fenthion, malathion); carbamates (carbaryl, propoxur); synthetic pyrethroids (permethrin, fenvalerate, deltamethrin, flumethrin, cypermethrin); macrocyclic lactones (abamectin, doramectin, eprinomectin, ivermectin, moxidectin); amidines (amitraz); spinosyns (spinosad); and several insect growth regulators such as benzoylphenylureas (diflubenzuron). Most chemicals were not very effective against egg stages so treatments needed to be repeated, although some formulations had residual activity long enough to act against newly-emergent nymphs. Domestic animals may be treated using topical formulations (showers/baths/dips, shampoos/rinses, sprays/aerosols, powders/dusts, neck collars, ear/tail tags) or systemic chemicals (oral, spot-ons, injectable, gut boluses), while wild or feral animals may be treated using self-application devices (back rubbers, oilers, dust bags). Careful attention should be paid to regulations governing chemical usage (including with-holding periods, residues, contra-indications, environmental toxicity). It is also important to differentiate between infestations by sucking and chewing lice as not all chemicals are effective against both types of lice. Generally, injectable macrocyclic lactones are less efficient against chewing lice while pour-on formulations are active against both. Matted coats may need clipping prior to treatment, and a range of grooming devices (brushes and combs) may assist in easing tangles and exposing lice. Preventive measures revolve around minimizing contact between susceptible and infested individuals (through isolation, quarantine, treating new livestock) or decontaminating shared facilities and equipment (by cleaning, washing or chemical treatment). Insecticides may be used on absorbent materials (saddlery, harnesses, rugs, bedding, clothing, grooming equipment) while impervious materials (brushes, combs, stalls/pens) may be subject to heat sterilization (steam-cleaning). Animals should be kept well-nourished and healthy, as infestations are worse in sick or stressed hosts. Husbandry practices should avoid over-crowded unsanitary conditions and animals should be pre-emptively treated in autumn to prevent louse populations from escalating during the colder months, particularly in animals housed indoors.

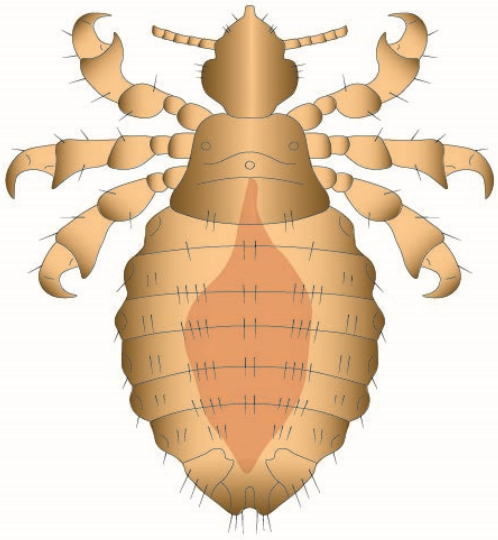
Haematopinus



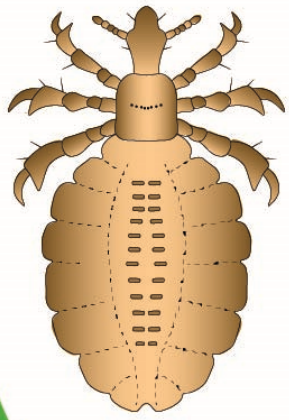
skin/pelage
(dermatitis,
anaemia,
allergy,
reduced
productivity)



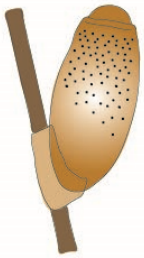
Definitive Hosts
(ungulates)



adult (dorsal)
(~ 5 mm)



nymph (dorsal)
(~ 3 mm)



egg
(~ 1 mm)

all stages ectozoic on host
(motile stages feed on blood)

transmission between hosts
through transfer of motile stages
by direct contact or via fomites

Haematopinus adult on pig skin

Haematopinus adult

Haematopinus egg

Haematopinus nymph