

Felicola
(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. Mallophagan (chewing) lice have blunt rounded heads with mouthparts adapted for feeding on keratin in superficial skin layers. Chewing lice are ectoparasitic on mammals and birds, most species being highly host specific and even site-specific. Ischnoceran lice have prominent filiform antennae but lack maxillary palps. Trichodectids have three antennal segments, single tarsal claws and are found on mammals. Infestations by *Felicola subrostrata* have been associated with dermatitis in cats.

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: Hemipteroidea (Exopterygota) (young resemble adults, externally developing wings)
Order: Phthiraptera (lice, wingless, ectoparasites, dorsoventrally flattened, stout legs, claws, eggs, nymphs, adults)
Suborder: Mallophaga (= wool-eating) (chewing lice, broad rounded head, feed on keratin, host/site specific)
Superfamily: Ischnocera (without maxillary palps, prominent filiform antennae, keratin feeders (hairs/feathers))
Family: Trichodectidae (parasitize mammals, 3-segmented antennae, single claw on tarsi)
Genus: *Felicola* (parasitic on skin/hair of cats)
Species: *Felicola subrostrata* (causes dermatitis in cats)

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 Hemipteroidea (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	Pathogenesis	Disease transmission
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
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: 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	-

Over 4,900 species of biting/chewing lice have been described in 253 genera in 8 families, around 4,400 species associated with birds and 500 species with mammals. Members of the suborder Ischnocera have broad rounded heads with conspicuous filiform antennae but lacking maxillary palps, while members of the suborder Amblycera have large rounded heads with maxillary palps and inconspicuous antennae hidden in grooves. Some 158 ischnoceran genera have been assigned to 2 families (Trichodectidae and Philopteridae), while 96 amblyceran genera have been classified in 6 families (Boopiidae; Gyropidae, Laemobothriidae, Menoponidae, Ricinidae, Trimenoponidae). Species of veterinary importance include members of the ischnoceran families Trichodectidae (bovids, canids, equids) and Philopteridae (poultry), and the amblyceran families Menoponidae (poultry) and Boopiidae (carnivores). Most ischnoceran lice are parasitic on birds but the trichodectids are found on mammals and are commonly known as fur lice. Members of the family Trichodectidae possess antennae with 3 segments and their legs terminate in tarsi with single claws (in contrast to members of the family Philopteridae which have 5-segmented antennae and paired tarsal claws). Over 400 trichodectid species have been described from 20 genera, namely *Bisonicola*, *Bovicola*, *Cebidicola*, *Damalinia*, *Dasyonyx*, *Eurytrichodectes*, *Eutrichophilus*, *Felicola*, *Geomydoecus*, *Lorisicola*, *Lutridia*, *Neotrichodectes*, *Procavicola*, *Procaviphilus*, *Protelicola*, *Thomomydoecus*, *Tragulicola*, *Trichodectes*, *Werneckiella* and *Werneckodectes*. The subfamily Trichodectinae (subgenital lobes present on females, often with serrate margins, six or fewer abdominal spiracles, carnivora/primate hosts) contains the genus *Felicola* (head triangular or broadly rounded, variable number of abdominal spiracles, setae sparse, subgenital lobe without scales or spines, parameres narrow and rod-like) and 2 subgenera are recognized: *F. (Felicola)* (gonopod with rounded lobe, terminal endophallus thinly sclerotized) and *F. (Suricatoecus)* (gonopod with rectangular-round lobe and spur, terminal endophallus not sclerotized). All *Felicola* spp. have been reported from carnivores, mostly felids (cats and allies), herpestids (mongooses) and viverrids (civets and genets), although a small number have been found on canids (foxes). Most species are considered to be host-specific and their distribution mirrors that of their hosts.

<i>Felicola</i> species	Hosts	Location	Clinical signs	Distribution
Subgenus <i>F. (Felicola)</i> [gonopod with rounded lobe, terminal endophallus thinly sclerotized]				
<i>F. calogaleus</i>	Carnivora: herpestid (slender mongoose, Cape gray mongoose)	skin		South Africa
<i>F. congoensis</i>	Carnivora: herpestid (kusimanse)	skin		West Africa
<i>F. cynictis</i>	Carnivora: herpestid (yellow mongoose)	skin		South Africa
<i>F. genetiae</i>	Carnivora: viverrid (genet)	skin		Africa
<i>F. helogale</i>	Carnivora: herpestid (dwarf mongoose)	skin		Africa
<i>F. helogaloidis</i>	Carnivora: herpestid (dwarf mongoose)	skin		Africa
<i>F. hopkinsi</i>	Carnivora: nandiniid (palm civet)	skin		Africa
<i>F. inaequalis</i> (syn. <i>F. rammei</i>)	Carnivora: herpestid (Egyptian mongoose)	skin		North Africa
<i>F. liberiae</i>	Carnivora: herpestid (Liberian mongoose)	skin		Liberia
<i>F. minimus</i>	Carnivora: herpestid (marsh mongoose)	skin		Africa
<i>F. occidentalis</i>	Carnivora: herpestid (long-nosed kusimanse)	skin		Africa
<i>F. rahmi</i>	Carnivora: herpestid (water mongoose)	skin		Africa
<i>F. robertsi</i>	Carnivora: herpestid (Meller's mongoose)	skin		Africa
<i>F. rohani</i>	Carnivora: herpestid (crab-eating mongoose)	skin		Indo-Asia
<i>F. setosus</i>	Carnivora: herpestid (Selous's mongoose)	skin		South Africa
<i>F. subrostratus</i> (syn. <i>F. rostratus</i> , <i>Trichodectes</i> , <i>Felicina</i> , <i>Bedfordia helogale</i>) (cat biting louse)	Carnivora: felid (cat, civet, bobcat), herpestid (brown-tailed mongoose)	skin (face, pinnae, back)	dull ruffled coat, scaling, crusts, alopecia	worldwide
<i>F. viverriculae</i>	Carnivora: viverrid (small Indian civet)	skin		India
<i>F. zeylonicus</i>	Carnivora: herpestid (stripe-necked mongoose)	skin		Africa
Subgenus <i>F. (Suricatoecus)</i> [gonopod with rectangular-round lobe and spur, terminal endophallus not sclerotized, herpestid/canid hosts]				
<i>F. acutirostris</i>	Carnivora: herpestid (marsh mongoose)	skin		Africa
<i>F. bedfordi</i>	Carnivora: herpestid (Jackson's mongoose, bushy-tailed mongoose, black-footed mongoose)	skin		Africa
<i>F. cooleyi</i>	Carnivora: herpestid (meerkat)	skin		Africa
<i>F. decipiens</i>	Carnivora: herpestid (banded mongoose)	skin		Africa
<i>F. fahrenheitzi</i>	Carnivora: canid (crab-eating fox, Patagonian fox)	skin		South America
<i>F. fennecus</i>	Carnivora: canid (fennec fox)	skin		Egypt
<i>F. guinlei</i>	Carnivora: canid (bat-eared fox)	skin		Africa
<i>F. macrurus</i>	Carnivora: herpestid (water mongoose)	skin		Africa
<i>F. pygidialis</i>	Carnivora: herpestid (water mongoose)	skin		Africa
<i>F. quadraticeps</i>	Carnivora: canid (gray fox, swift fox)	skin		North and Central America
<i>F. vulpis</i> (syn. <i>F. abnormis</i> , <i>micropus</i>)	Carnivora: canid (red fox), Primates: cheirogaleid (brown mouse lemur?)	skin		Africa

A range of species formerly recognized as *Felicola* spp. have now been reclassified into the sister genus *Loricicola* (gonopore with spicular patch, gonopod lobes comprising two fused tubercles, subgenital lobe with scales or spines, parameres broad) with two subgenera: *L. (Loricicola)* (male antennal flagellum with teeth on projection) and *L. (Paradoxuroecus)* (male antennal flagellum with teeth not on projection).

<i>Loricicola species</i>	Hosts	Location	Clinical signs	Distribution
Subgenus <i>L. (Loricicola)</i> [male antennal flagellum with teeth on projection]				
<i>L. americanus</i>	Carnivora: felid (bobcat)	skin		North America
<i>L. braziliensis</i>	Carnivora: felid (pampas cat)	skin		South America
<i>L. caffra</i>	Carnivora: felid (cat)	skin		Africa
<i>L. felis</i>	Carnivora: felid (ocelot, pampas cat, puma)	skin		Americas
<i>L. hercynianus</i>	Carnivora: felid (cat)	skin		Europe
<i>L. isidoroi</i>	Carnivora: felid (Spanish lynx)	skin		Europe
<i>L. malaysianus</i>	Carnivora: felid (otter civet)	skin		South-East Asia
<i>L. mjoebergi</i> (syn. <i>F. brachycephalus</i>)	Primates: lorid (slow loris)	skin		South-East Asia
<i>L. neofelis</i>	Carnivora: felid (Geoffrey's cat)	skin		South America
<i>L. oncae</i>	Carnivora: felid (jaguar)	skin		Americas
<i>L. siamensis</i>	Carnivora: felid (leopard cat)	skin		Asia
<i>L. similis</i>	Carnivora: felid (jaguarundi)	skin		Americas
<i>L. spenceri</i>	Carnivora: felid (Eurasian lynx, Canadian lynx)	skin		Eurasia, North America
<i>L. sudamericanus</i>	Carnivora: felid (tigrillo)	skin		Central America
Subgenus <i>L. (Paradoxuroecus)</i> [male antennal flagellum with teeth not on projection]				
<i>L. acuticeps</i> (syn. <i>F. genetta</i>)	Carnivora: viverrid (large-spotted genet, Abyssinian genet)	skin		Africa
<i>L. africanus</i>	Carnivora: viverrid (small-spotted genet)	skin		Africa
<i>L. aspidorhynchus</i>	Carnivora: prionodontid (banded linsag)	skin		South-East Asia
<i>L. bengalensis</i>	Carnivora: viverrid (Asian palm civet)	skin		South-East Asia
<i>L. juccii</i>	Carnivora: viverrid (masked palm civet)	skin		Indo-Asia
<i>L. laticeps</i>	Carnivora: herpestid (marsh mongoose)	skin		Africa
<i>L. lenicornis</i>	Carnivora: viverrid (giant genet, large-spotted genet)	skin		Africa
<i>L. mungos</i>	Carnivora: herpestid (slender mongoose)	skin		Africa
<i>L. neoaffricanus</i>	Carnivora: viverrid (large-spotted genet)	skin		Africa
<i>L. paralaticeps</i>	Carnivora: herpestid (water mongoose)	skin		Africa
<i>L. philippinensis</i>	Carnivora: viverrid (Asian palm civet)	skin		Philippines
<i>L. sumatrensis</i>	Carnivora: prionodontid (banded linsag)	skin		South-East Asia
<i>L. wernecki</i>	Carnivora: viverrid (Hausa genet, large-spotted genet)	skin		Africa

Parasite morphology: *Felicola* spp. form 3 different types of stages during their development: eggs (sometimes called nits); nymphs (3 consecutive instars); and adult lice (male and female). The eggs are white-cream in colouration and elongate-oval in shape measuring 0.8-1.0 x 0.2-0.4 mm. They have an anterior operculum (lid) and are attached (glued) to host hairs by their bases sometimes on a short stalk. They contain a developing embryo which hatches as a first-stage nymph (N1) and then moults through another 2 nymphal stages (N2, N3) before moulting to adult lice. All nymphs are similar in morphology to adults but are smaller, less sclerotized, contain fewer body setae, and lack genitalia. Adult lice are elongate measuring 1.0-1.5 mm in length, dorso-ventrally flattened, pale in colour (often pale yellow sometimes with tan bands) and they have 3 body parts (broad head, small thorax, and oval abdomen). Members of the genus *Felicola* are characterized by a large triangular head notched at the apex rather than having broad rounded heads like other members of family Trichodectidae. The notch is continuous with a median longitudinal groove in the ventral surface of the head which fits a host hair shaft. The biting/chewing mouthparts comprise large ventral opposing sclerotized mandibles used to sever small pieces of food which are guided to the preoral cavity by a posterior plate-like labrum (often with an anterior hyaline pad-like protrusion (pulvinus)), 2 lateral maxillae and an anterior labium with salivary secretions provided through a central hypopharynx. In ischnoceran lice, the mandibles are inserted at right angles to the head (such that the condyles are posterior and the gingivum is anterior), the maxillae and labium are reduced in size (compared to anopluran lice) with single-lobed maxillae attached to the sides of the tripartite labium. The mandibles and pulvinus assist in anchoring the louse to the host. The head lacks maxillary palps (present in amblyceran lice) but possesses stout filiform antennae that extend laterally (not in grooves) and consist of three short segments (rather than 5 segments as occurs in the family Philopteridae in birds). The alimentary tract comprises a foregut (pharynx, oesophagus, crop), midgut (ventriculus, caeca, mycetome (sometimes called bacteriome or stomach disc, harbouring bacterial/fungal symbionts)), and hindgut (pylorus, papillae, rectum). The thorax is small and trapezoidal and composed of segments fused together with indistinct boundaries. The ventral surface gives rise to 3 pairs of legs, each composed of 5 segments (coxa, trochanter, femur, tibia, tarsus). The hind-legs are slightly smaller than the fore- and mid-legs, and all legs terminate in a single tarsal claw (whereas those of philopterid lice from birds terminate in pairs of claws). The abdomen is oval-shaped and smooth in appearance with a few short setae and a variable number of dorsal spiracles (openings to tracheal (breathing) system) but numbering 6 or fewer in the subfamily Trichodectinae. Adult lice possess conspicuous genitalia, and male lice are slightly smaller than female lice. Males have 2 pairs of compact testes (3 pairs in amblyceran lice) connected to tubular vas deferens which coalesce to form a seminal vesicle opening into a large spinous genital sac equipped with a tubular intromittent organ (aedeagus with terminal endophallus and dorsal gonopore surrounded by a spicular patch) supported by basal plate-like apodeme and narrow rod-like lateral parameres. In males belonging to the subgenus *F. (Felicola)*, the endophallus is thinly sclerotized whereas that in males of the subgenus *F. (Suricatoecus)* is not sclerotized. Females possess ovaries with polytrophic ovarioles, tubular oviducts, a globular uterus with accessory glands (produce glue) and a spermatheca (sperm storage vesicle), a genital opening (vagina) with a lobular genital plate and the posterior segment is bifurcated forming lateral gonopods with subgenital lobes (often with serrate margins, but without scales or spines). In females belonging to the subgenus *F. (Felicola)*, the gonopods have rounded lobes while those in females of the subgenus *F. (Suricatoecus)* are rectangular and bear lateral spurs.

Site of infection: These chewing lice (also known as fur lice) are ectoparasitic on the skin and hair of carnivorous hosts, especially felids but also including some herpestids, viverrids and a few canids. Most species are relatively sedentary and tend to congregate in their predilection sites, particularly on the face, pinnae, along the back and tail, and in areas of higher moisture (near body openings or skin abrasions).

Pathogenesis: Light infestations may be asymptomatic and go unnoticed by their hosts, but heavier infestations may cause mild-severe disease characterized by intense skin irritation, hyperkeratosis and inflammation (dermatitis), often exacerbated by allergic responses to louse antigens. Lice feed using their mandibles to bite or scrape hairs and epidermal debris, and probably opportunistically on body fluids and blood from scabs and lesions. Their feeding behaviour results in skin inflammation with pruritus (itching), alopecia (hair loss) and epidermal sloughing (dandruff). Infested animals endeavour to relieve the pruritus by repetitive grooming (licking, scratching, rubbing) of afflicted body parts, which can lead to lesions due to self-excoriation, seborrhoea, unsightly coat, impaired thermoregulation, and secondary infections. Animals that are able to groom themselves properly appear to be able to control the clinical consequences of infestations, but old, poorly-nourished, sick, neglected or stray felids, especially long-haired breeds, may develop severe disease.

Several trichodectid species, possibly including *Felicola subrostratus*, have been implicated in the transmission of the double-pored tapeworm *Dipylidium caninum* by acting as an intermediate host for cysticercoid stages that may infect humans or dogs and cats when they ingest infected lice.

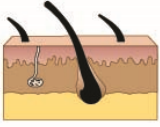
Developmental cycle and mode of transmission: All stages occur as ectoparasites in the fur of individual hosts: eggs being attached to hair shafts, and motile nymphs and adults using their claws and mouthparts to hold onto hairs. Transmission between hosts occurs when motile stages become dislodged from one host and crawl onto new hosts in direct/close contact or are transferred via contaminated grooming equipment or bedding. Gravid female lice glue their eggs onto hairs using an adhesive cement-like substance. The eggs hatch 10-12 days later releasing first-stage nymphs (N1) which commence feeding and undergo simple/incomplete (hemimetabolous) metamorphosis moulting through another 2 nymphal stages before forming adult lice in 2-3

weeks. After mating, female lice begin laying eggs several days later. Any developmental stages dislodged from hosts do not survive long in the external environment, dying within hours in warm dry conditions, but also within days in cool moist conditions. Transmission relies on close contact between hosts, as occurs during breeding, nursing, nesting or gregarious hosts. Some lice (mostly ischnoceran chewing lice) have also been observed to be transmitted between hosts by phoresy: i.e. temporary attachment to the external surfaces of larger insects that move between hosts (usually hippoboscids or muscid flies). Louse populations tend to increase in the cooler months of the year, when conditions are more favourable for louse development and survival and when hosts congregate for breeding or shared thermoregulation.

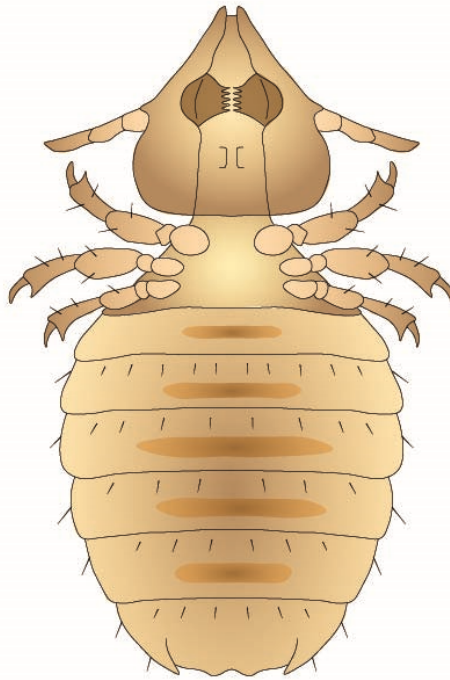
Differential diagnosis: While infestations may be suspected on clinical grounds (dermatitis and pruritus), diagnosis is made by direct demonstration of lice and/or their eggs upon clinical examination (visual examination of parted fur, sometimes aided by using magnifying glasses or grooming equipment). Sticky-tape impression smears may assist in the collection of eggs or lice for microscopic examination. Alternatively, infestations may sometimes be detected fortuitously when the undigested cuticular remains of lice are found upon routine coprological examination of host faecal samples (smears, sediments or floats). Molecular biological techniques have been used to characterize species and examine phylogenetic relationships between lice following polymerase chain reaction (PCR) amplification of nuclear (18S ribosomal RNA, elongation factor-1 α) and mitochondrial (16S rRNA, cytochrome oxidase 1) gene sequences.

Treatment and control: A range of insecticidal chemicals have been used to treat clinical infestations, including organophosphates (dichlorvos, fenitrothion, fenthion), pyrethrins, pyrethroids (permethrin), macrocyclic lactones (ivermectin, selamectin), arylpyrazoles (fipronil), and chloronicotinylns (imidacloprid). Most chemicals are applied topically as shampoos/foams, rinses/sprays, aerosols or powders, although some recent formulations are given systemically as injectables, orals or spot-ons. Careful attention should be paid to product information regarding usage (side-effects, contra-indications) as well as to government regulation (concerning with-holding periods, environmental toxicity). Most chemicals have little residual activity and do not work effectively against egg stages, so treatments are best repeated 7-14 days later to kill any emergent nymphs before they mature to adults. A variety of fine-toothed combs have been designed to assist grooming in the removal of lice, but adherent nits (eggs and egg cases) are difficult to dislodge without using lubricants (conditioners) to ease tangles. Heavy infestations in long-haired animals may sometimes result in matted coats which are best clipped prior to treatment. Preventive control measures are based around minimizing contact with infested individuals (through quarantine, isolation or exclusion), decontaminating shared facilities and items (clothing, bedding, cages, pens and grooming equipment by washing with insecticidal chemicals), avoiding over-crowded unsanitary conditions, and maintaining healthy, well-nourished and well-groomed hosts (as they are better able to resist clinical infestations).

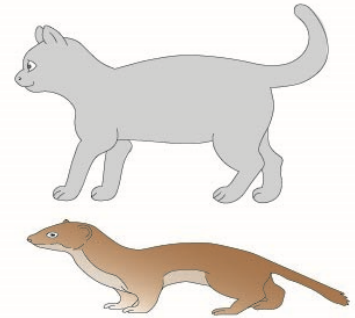
Felicola



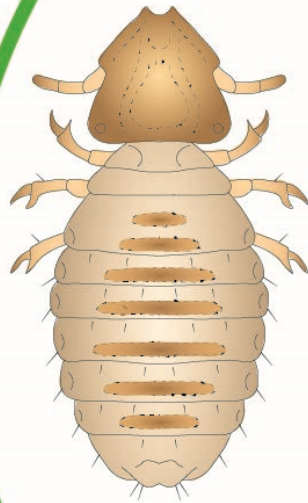
skin/pelage
(dermatitis, pruritus,
alopecia, dandruff)
(some vector infectious
microbial diseases)



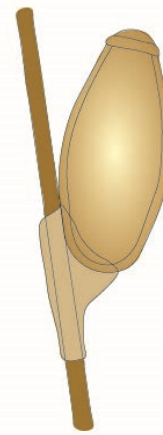
adult (ventral)
(~ 1.5 mm)



Definitive Hosts
(carnivores)



nymph (dorsal)
(~ 1.2 mm)



egg
(~ 1 mm)

all stages ectozoic on host
(motile stages feed on skin/scurf/hairs)

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



Felicola adult



Felicola egg