Ectoparasites (Arthropod parasites)

Arthropoda: The word arthropoda is derived from the Greek words arthros- a joint, and podos-a foot. The phylum has therefore, members with jointed legs. The body of arthropods is metamerically segmented. The anterior group of segments is called as head, the middle group the thorax, and the posterior group the abdomen. The appendages on the body are typically paired. The sexes are separate.

Effects of ecto-parasites on the hosts

As a result of their activity, arthropod ecto-parasite may have a variety of direct and indirect effects on their hosts.

1) Direct harm
   a) Blood loss- although each individual ectoparasite removes a small volume of blood, in large numbers the blood removed by feeding may be directly debilitating and anemia is common in heavily infested hosts.
   b) Myiasis- larva of the ectoparasites cause direct damage to the carcasses and the skin
   c) Skin inflammation and pruritus- various skin infestations by arthropods cause itching often accompanied by hair or wool loss, and skin thickening.
   d) Causes toxic and allergic responses due to antigens and anticoagulants present in the saliva.
   e) Annoyance

2) Indirect harm
   The behavior of the ectoparasites also causes harm indirectly, particularly when they are present at high density causing:
   a) Disturbances- causes irritation as they attempt to feed or oviposit. Causes head shaking, stamping, skin twitching, and scratching. Cattle under attack from flies congregate in a group with their head facing the center. Sheep under attack from nasal bot flies may be seen pressing their nose to the ground before they run a short distance and repeating the same action. These activities may results in reduced growth and loss of condition because the time spent in avoidance behavior is lost from grazing or resting.
   b) Self wounding- the activity of particular parasites such as warble flies may cause dramatic avoidance responses in the intended hosts known as gadding. The madly panicking animal may cause serious self injury following collision with fence sand other objects.
   c) Social nuisance- reduces the aesthetic appearance and value of the farm produced. Also cause irritation and annoyance.
   d) They act as the vectors of pathogens

Class: Insecta

The members of the class Insecta is characterized by segmentation of body into head, thorax and abdomen. All members have three pairs of legs

Class: Arachnida

Life cycle may simple or complex life cycle. The juvenile stage broadly resembles the adult except that the genitalia and the wings are not developed. Body is divided into 2 parts, the cephalothorax and the abdomen. There are four stages in its life cycle: six-legged larva, eight-legged nymph, and eight-legged adult.
Flea infestation (siphonaptera)

Fleas are small, wingless, obligate blood feeding parasites of mammals and birds. Adult fleas live in temporary association with their host. In temperate climates, the problems with fleas are usually restricted to warm weather months. In warmer climates, flea problems may occur year round.

Aetiology

Only two families contain species of veterinary importance: the Ceratophyllidae and the Pulicidae.

<table>
<thead>
<tr>
<th>Host</th>
<th>Fleas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cats</td>
<td><em>Ctenocephalides felis</em> (Cat flea)</td>
</tr>
<tr>
<td>Dog</td>
<td><em>C.canis</em> (dog flea)</td>
</tr>
<tr>
<td>Rabbit</td>
<td><em>Spylopsyllus cuniculi</em> (Rabbit flea)</td>
</tr>
<tr>
<td>Domestic poultry</td>
<td><em>Echidnophaga gallinacea</em></td>
</tr>
<tr>
<td>Human, pigs</td>
<td><em>Pulex irritans</em> (human flea)</td>
</tr>
<tr>
<td>Rats</td>
<td><em>Xenopsylla cheopis</em> (Oriental rat flea)</td>
</tr>
<tr>
<td>Chicken</td>
<td><em>Ceratophyllum gallinacae</em></td>
</tr>
</tbody>
</table>

Life cycle

The life cycle involves four stages: egg → larva → pupa → adult.

Morphology

The adults are highly modified for an ectoparasitic life and are structurally very different from most other insects. The body is laterally compressed. Adults are wingless and usually between 1-6mm in length, with females being larger than males. Body color varies from light brown to black. The body is armed with spines, which are directed backward.

The body is divided into head, thorax and abdomen. The head is immobile and shape highly variable. Both males and females are obligate blood-feeders. Most species of flea are not host specific and will try to feed on any available animal.

Pathology

The feeding behavior of fleas causes significant veterinary problems worldwide.

- Blood loss and fatal iron-deficiency anemia in very young animals. Although blood meal size is small, repeated feedings and high infestations can cause significant blood loss, and heavy infestations may cause fatal iron-deficiency anemia in very young animals.
• Inflammation and pruritus may occur at the site of a flea-bite, leading to self-wounding from scratching or biting by the host animal. Cat fleas, dog fleas and human fleas can act as intermediate host of *Dipylidium caninum*.

• Fleas are also vectors of viral and bacterial infections, particularly of diseases as plague and tularemia.

**Diagnosis**

1. History and clinical findings. Response to aggressive flea control therapy
2. Visualization of flea or flea excreta on body
3. Visualization of tapeworm segments (*Dipylidium* spp) on body or in fecal flotation
4. Response to flea treatment: symptoms resolve on treatment with products like fipronil, imidocloprid and selamectin.

**Differential diagnosis**

- Atopy
- Food hypersensitivity
- Scabies
- Dermatophytosis

**Treatment and control programmes**

1. Strict flea eradication is the only effective treatment.
2. Affected and all in-contact animals should be treated with adulticidal flea sprays, spot-on solutions, or dips every 7 to 30 days. Products that contain Fipronil, imidocloprid and selamectin are especially effective when used topically every 3-4 weeks.
3. In heavily flea infested environments, areas where the animal spend the most time should be treated with insecticides and insect growth regulators (methoprene, piriproxyfen)
4. In severe pruritus,
   a. Prednisolone @0.5 mg/kg (dogs) or 1.0 mg/kg (cats) every 12 hours x 3-7 days
   b. Antibiotics for secondary pyoderma x 3-4 weeks
Lice infestation (Phthiraptera)

General characteristics of lice

- In contrast to most fleas or ticks, lice spend their entire lives on their host and are highly host specific, many species even preferring specific parts of their host’s body.
- They feed on epidermal tissue debris, parts of feathers, sebaceous secretions and blood.
- The body is divided into head, thorax and abdomen. The thoracic segments are fused.
- Dorso-ventrally flattened
- They have three pairs of jointed-legs.
- Wings are absent
- Life cycle with incomplete metamorphosis.
- Egg (nits) → larva → nymph → adult.
- Lice are obligate parasites and they can’t survive without host for more than 2 days
- Possess stout legs and claws for clinging tightly to fir, hair and feathers. All bird lice have two claws while all mammalian lice have four claws except Heterodoxus.
- Highly host specific.

Aetiology

<table>
<thead>
<tr>
<th>Lice</th>
<th>Host</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Suborder: Mallophaga</strong></td>
<td></td>
</tr>
<tr>
<td>Amblycera</td>
<td></td>
</tr>
<tr>
<td><em>Manapon gallinae</em> (shaft louse)</td>
<td>Birds</td>
</tr>
<tr>
<td><em>Mesocanthus stramineus</em> (body louse)</td>
<td>Birds</td>
</tr>
<tr>
<td><em>Heterodoxus spinigera</em></td>
<td>Dog</td>
</tr>
<tr>
<td>Ischnocera</td>
<td></td>
</tr>
<tr>
<td><em>Lipeurus caponis</em> (wing louse)</td>
<td>Poultry</td>
</tr>
<tr>
<td><em>Trichodectus canis</em></td>
<td>Dog</td>
</tr>
<tr>
<td><strong>Suborder: Siphonculata</strong></td>
<td></td>
</tr>
<tr>
<td><em>Hamatopinus asini</em></td>
<td>Horses, donkey</td>
</tr>
<tr>
<td><em>H.suis</em></td>
<td>Pigs</td>
</tr>
<tr>
<td><em>H.eurysternus</em></td>
<td>Exotic cattle</td>
</tr>
<tr>
<td><em>Lignognathus vituli</em></td>
<td>Cattle</td>
</tr>
<tr>
<td><em>L.pedalis</em></td>
<td>Sheep</td>
</tr>
<tr>
<td><em>L.stenopsis</em></td>
<td>Goat</td>
</tr>
<tr>
<td><em>L.setosus</em></td>
<td>Dogs</td>
</tr>
<tr>
<td><em>Solenoptes capillatus</em></td>
<td>Cattle</td>
</tr>
<tr>
<td><em>Pediculus humanus capitus</em></td>
<td>Human</td>
</tr>
<tr>
<td><em>P.humanus humanus</em></td>
<td>Human</td>
</tr>
</tbody>
</table>

Pathology

Heavy louse infestation is known as pediculosis. Heavy louse infestation may cause pruritus, alopecia, excoriation and self-wounding. The disturbance caused may result in lethargy and reduced weight gain or reduced egg production. Severe infestation with sucking lice cause anemia. Some lice act as intermediate host to the tapeworm *Dipylidium caninum* and the pig louse *Haematopinus suis*, may spread swine pox.

Louse infestation is more common in cattle than other domestic animals. In temperate seasonal habitats, heaviest louse infestation occur in late winter and early spring when the coat is thickest, forming a protective humid environment. Louse infestation in pigs is very common condition occurring most often in the folds of the neck and jowl and around the ears. Pediculosis in pigs lead to scratching and skin damage.

Diagnosis

1. Direct visualization of lice
2. Microscopy (acetate tape impressions and hairs): detection of lice and nits

**Treatment and control**

**In dogs and cats**

1. Affected and all in-contact same species animals should be treated.
2. Matted hair should be clipped away.
3. Topical treatment of entire body with 2 % lime sulphur, pyrethrin and organophosphorus compound shampoo, powder, spray or dip twice 2 weeks apart.
4. Alternative treatments
   
   a. Ivermectin @ 0.2 mg/kg twice 2 weeks apart
   b. Selamectin spot-on topically once or twice 1 month apart
   c. 0.25% fipronil pump spray 6 ml/kg, topically, twice 2 weeks apart
   d. 10 % fipronil spot-on
   e. Imidocloprid spot-on topically twice 2-4 weeks apart
5. Blood transfusion in severely anaemic animals
6. Bedding, grooming tools and environment should be cleaned
7. Insecticidal flea collars

**In cattle and pigs**

1. Ivermectin
2. Cypermethrin in a concentration of 1mL of cypermethrin/200mL of water.
Fly infestation and Myiasis

Myiasis is the infestation of tissue with fly larvae, commonly referred to as maggots.

Aetiology

<table>
<thead>
<tr>
<th>Name of the fly</th>
<th>Animals affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Musca domestica (House fly)</td>
<td>Cattle, sheep, goat, pig, dog</td>
</tr>
<tr>
<td>Hippobosca maculata</td>
<td>Cattle, dog</td>
</tr>
<tr>
<td>Mellophagus ovinus (sheep ked)</td>
<td>Sheep</td>
</tr>
<tr>
<td>Hypoderma bovis (bot fly)</td>
<td>Cattle</td>
</tr>
<tr>
<td>Hypoderma lineatum</td>
<td>Cattle, horse</td>
</tr>
<tr>
<td>Oestrus ovis</td>
<td>Sheep</td>
</tr>
<tr>
<td>Sarcophaga species (Flesh fly)</td>
<td>Cattle, sheep, goat</td>
</tr>
</tbody>
</table>

Clinical signs

- Irritation by larva may produce septic wound and holes in the skin
- Painful cutaneous wound filled with larva (maggot wound-myiasis)
- Fly creates annoyance and worry and thus there is drop in milk yield

Diagnosis

Detection of larva within the wound

Treatment and control

Fly repellents should be use to minimize the fly infestations

- Oil of turpentine
- Oil eucalyptus
- BHC or OPCs to destroy the maggots
- Topical antiseptics and antibiotics solutions to check secondary bacterial infection
Mite infestation (mange)

The ectoparasitic mites inhabit the skin where they feed on blood, lymph, skin debris or sebaceous secretions, which they ingest by puncturing the skin, scavenge from the skin surface or imbibe from epidermal lesions. Most ectoparasitic mites spend their entire lives in intimate contact with their host, so that transmission from host-to-host is primarily by physical contact. Infestation by mites is called acariasis and can result in severe dermatitis, known as mange, which may cause significant economic loss and welfare problems.

Morphology of mites
- All mites are small, usually less than 1mm in length.
- Body shows no segmentation but they have sutures and grooves
- The body is divided into 2 sections- Gnathostoma and the idiosoma.
- The adults and the nymphs have four pairs of legs while the larva has 3 pairs.
- Sexual differentiation is not observed in the larva and the nymph.
- Eyes are usually absent.

Aetiology

<table>
<thead>
<tr>
<th>Cause</th>
<th>Animals affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dermanyssus gallinae (red mite of poultry)</td>
<td>Fowl, pigeon, cage birds and wild birds</td>
</tr>
<tr>
<td>Ornithonyssus bursa (tropical fowl mite)</td>
<td>Fowl, pigeon, sparrows and others in warmer parts of the world</td>
</tr>
<tr>
<td>Ornithonyssus bacoti (tropical rat mite)</td>
<td>Rat and man</td>
</tr>
<tr>
<td>Ornithonyssus sylvarium (northern mite fowl)</td>
<td>Birds in temperate climate</td>
</tr>
<tr>
<td>Demodex folliculorum</td>
<td>Man</td>
</tr>
<tr>
<td>Demodex canis</td>
<td>Dog</td>
</tr>
<tr>
<td>Demodex bovis</td>
<td>Bovine</td>
</tr>
<tr>
<td>Demodex caprae</td>
<td>Goat</td>
</tr>
<tr>
<td>Demodex phylloydies</td>
<td>Pigs</td>
</tr>
<tr>
<td>Sarcoptes scabiei</td>
<td>Cattle, buffalo, sheep, goat, dog, horse, man</td>
</tr>
<tr>
<td>Notoedres cati</td>
<td>Cat</td>
</tr>
<tr>
<td>Psoroptes ovis</td>
<td>Sheep, cattle, horse</td>
</tr>
<tr>
<td>Psoroptes bovis</td>
<td>Cattle</td>
</tr>
<tr>
<td>Psoroptes caprae</td>
<td>Goat</td>
</tr>
<tr>
<td>Psoroptes equi</td>
<td>Horse</td>
</tr>
<tr>
<td>Psoroptes natalensis</td>
<td>Cattle and buffalo</td>
</tr>
<tr>
<td>Psoroptes cuniculi</td>
<td>Goat, sheep, horse</td>
</tr>
<tr>
<td>Chorioptes ovis</td>
<td>Sheep and goat</td>
</tr>
<tr>
<td>Chorioptes caprae</td>
<td>Goat</td>
</tr>
<tr>
<td>Chorioptes bovis</td>
<td>Cattle</td>
</tr>
<tr>
<td>Chorioptes equi</td>
<td>Horse</td>
</tr>
<tr>
<td>Otodectes cynotis</td>
<td>Dog and cat</td>
</tr>
</tbody>
</table>

Pathology

In many cases the activity of the mites has no obvious effect on the host. Some species of mites as Demodex may be considered to be a normal part of the skin fauna. Problems with mite infestation and dramatic increase in mite population occur more commonly in animals in poor condition and are more often seen at the end of the winter or in early spring. Some forms of the mange such as Demodectic mange are the result of underlying disease or immunosupression. The clinical signs (erythema, pruritus, and scale or crust formation) are due to the inflammatory response of the skin and resulting excoriation. Feeding, burrowing, or production of antigenic material by the mite stimulates this response.
Mite infestation can result in:
- Direct epidermal damage leading to inflammation. This results in erythema, pruritus, scale formation, lichenification and crust (inflammatory exudates) formation.
- They produce cutaneous hypersensitivity
- Loss of blood or other tissue fluids.
- Mechanical or biological transmission of pathogens.

**Sarcoptidae**
- These are burrowing mites,
- Parasitic throughout their lives
- Circular body,
- Coxae sunk into the body. Short-legged appearance from a dorsal view.

**Sarcoptes scabiei** (Itch mite)

Sarcoptic mange may affect dogs, pigs, sheep, goats, humans and cattle, but it is relatively rare in cats and horses. This usually occurs in housed farm animals or those in poor condition, usually at the end of winter or early spring. The site of infestation is generally in the sparsely haired parts of the body such as the ears, face, elbow or muzzle in the dogs, the ears and the back in the pigs, and the neck and the tail of the cattle.

**Clinical signs**
The burrowing and feeding activity of the *S. scabiei* causes intense itching, inflammation, hair loss and formation of the crust of the dried exudates and even haemorrhage on the skin surface. Sarcoptic mange is a highly contagious and the spread is usually by close physical contact.

**Diagnosis**
- Based on history of itching and clinical signs
- Recovery of mites from deep skin scrapings digested with 10% KOH solution.

**Treatment**
Ivermectin

**Significance**
Severely infested animals show distinct signs of poor health. Sarcoptic mange mites are known to transfer from animal hosts to people, so persons handling mangy animals should take reasonable precautions.

**Psoroptidae**
The Psoroptidae are oval-bodied, non-burrowing mites. They feed superficially and do not need to burrow in to the skin. They are usually larger than the Sarcoptic mites. The legs are longer.

*Psoroptis ovis*- causes sheep scab  
*Psoroptis natalensis*- cattle buffalo and horses
Pathology

Mites are found on the moist skin at the edge of the lesion, which extends rapidly and may take as little as 6-8 weeks to cover three-quarters of the hosts’ skin. Infestation in sheep leads to severe pruritus, wool loss, restlessness, biting and scratching of the infested areas, weight loss and, in growing animals, reduced weight gain. They produce lesions on all parts of the body. *Psoroptes ovis* infestation in cattle causes lesions initially on the withers, neck and around the root of the tail, which spread all over the body in cases of severe infestation.

**Chorioptes bovis**

*Chorioptes* mange is the most common form of mange in cattle and horses. It is also found in other herbivore animals as sheep and goat. In horses the mites are found largely on the lower legs. On cattle the mite causes lesions on the base of the tail, perineum and the udder.

**Otodectes cynotis (ear mite)**

This is a very common mite of dogs, cats and other carnivores found in the ear leading to otitis in these animals.
**Demodecidae**

**Morphology**
These have elongated crocodile-like tapered body, 100-400 micron in length.

**Pathology and clinical signs**
For the most part they are nonpathogenic and form a normal part of the skin fauna. They are important mainly in dogs. This cause host immunosuppression.
This often present as non-pruritic areas of focal alopecia on head, forelimbs and trunk. It can be localized or generalized and the clinical features seen are erythema, pustules, crusts and pruritus. The skin often becomes hyperpigmented in chronic cases.

**Diagnosis**
- Clinical signs
- Skin scrapping examination for mites

**Treatment**
- Amitraz
- Ivermectin

**General control measures for mange**
- Hair should be clipped before acaricidal treatment.
- A course of antibiotic should be given to inhibit bacterial infection
- Preparations of benzyl benzoate @ 0.2-0.5% in large animals and 0.5% in small animals
- Ivermectin @0.2 mg/kg BW s/c
- Psoroptes mange can be treated with 0.02 percent benzene hexachloride dips
Tick Infestation

Ticks are obligate, blood feeding ectoparasites of vertebrates, particularly mammals and birds. They are usually large compared to mites. Ticks are found in most parts of the world but are generally limited to those habitats frequented by their hosts—namely, woods, tall grass, and shrubby vegetations where they climb onto plants and wait to jump on a passing host.

Aetiology

<table>
<thead>
<tr>
<th>Name of the ticks</th>
<th>Animals affected</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Ixodes ricinus</em></td>
<td>Cattle, sheep, goat, and dog</td>
</tr>
<tr>
<td><em>Ixodes pilosus</em></td>
<td>Cattle, sheep, goat, horse, dog, cats</td>
</tr>
<tr>
<td><em>Boophilus microplus</em></td>
<td>Cattle, sheep, goat</td>
</tr>
<tr>
<td><em>B. annulatus</em></td>
<td>Cattle, sheep, goat</td>
</tr>
<tr>
<td><em>Hyalomma detriticum</em></td>
<td>Cattle</td>
</tr>
<tr>
<td><em>Rhipicephalus appendiculatus</em></td>
<td>Cattle, sheep, goat, horse, dog</td>
</tr>
<tr>
<td><em>R. sanguineus</em></td>
<td>Dog</td>
</tr>
<tr>
<td><em>Haemophysalis leachi</em></td>
<td>Sheep, goat</td>
</tr>
<tr>
<td><em>H. bispinosa</em></td>
<td>Cattle, sheep, hrose, dog</td>
</tr>
<tr>
<td><em>Dermacentor andersoni</em></td>
<td>Cattle, dog</td>
</tr>
<tr>
<td><em>Amblyomma maculatum</em></td>
<td>Cattle, horse, sheep, dog</td>
</tr>
<tr>
<td><em>Argus reflexus</em></td>
<td>Poultry</td>
</tr>
<tr>
<td><em>Otobius megnina</em> (Spinsoe ear tick)</td>
<td>Cattle, horses</td>
</tr>
</tbody>
</table>

Effects of tick

- Tick bites may be directly debilitating to domestic animals, causing mechanical damage, irritation, inflammation and hypersensitivity. Ticks, when present in large numbers, damage skin and depreciate leather value.
- Feeding may cause anaemia and reduced productivity.
- The salivary secretions of some ticks may cause toxicosis and paralysis.
- Ticks may also transmit a range of pathogenic viral, bacterial, and rickettsial diseases to livestock.

Morphology

Ticks are actually a specialized group of mites and share many features with other mites. In general, they are larger than most mites, ranging from about 0.2 to 0.6 cm (about 0.08 to 0.24 in) in length; the immature stages are very similar morphologically to the adults. The larva is sometimes known as the seed tick. The larva has three pairs of legs and the nymph has 4 pairs. The adult tick has a mite-like body with a tough skin and four pairs of clawed legs. The male ticks are smaller than the female ticks.

Tick diversity

Ticks are divided into two families: hard ticks and soft ticks based on the presences of a hard dorsal covering plate called the scutum. Tick with scutum are called hard ticks and without the soft ticks. In male, larva and nymph stages of hard ticks the scutum covers the entire dorsal surface while in the female has small scutum. In hard ticks, the mouth parts are visible from above. Hard ticks are parasites primarily of mammals but are also found on birds and reptiles. The nymphs may feed on a different host species in each developmental stage; in each stage, the nymph feeds only once. The adult female lays a single large batch of eggs after her final meal.
In soft ticks; the mouthparts are hidden underneath the body. In general, soft ticks are parasites of birds, but some feed on other hosts. Usually all the developmental stages feed on a single host species. Each stage may feed many times over a period of at least several days, taking refuge in nearby crevices or under rocks when not feeding. The adult female soft tick lays relatively few eggs over an extended period. Based on the number of host involved in their life cycle, ticks can also be classified as:

- One-host ticks, eg. *Dermacentor, Boophilus annulatus*
- Two host ticks and, e.g. *Hyalomma spp*
- Three host ticks, e.g. *Ixodes spp, Haemophysalis sp*

**Clinical findings**
- Cutaneous injury
- Unthriftness and anemia
- Irritation and dermatitis
- Paralysis. Mostly hind limbs are affected
- Frequent shaking of the ea and tail wagging

**Diagnosis**
Detection of tick on the animal’s body

**Treatment and control**
- Tick infested animals should be separated from the herd and acaricides applied.
- All the vegetations surrounding the animal shed should be cleared
- Treatment of infected house with suitable acaricides
- Dipping may be done, if available spraying or dusting.
- Following solutions can be used for dips or spray:
  - Sumithion 1% sprays,
  - Malathion 0.5%,
  - Amitraz 250 ppm,
  - Ivermectin 0.2 mg/kg BW s/c