Phylum: Arthropoda
Class: Arachnida
Order: Acarina
Family: Argasidae
Genus: Argas (the fowl tick)
Sp., Argas persicus (soft tick) (Fig100)

The members of this family characterize by having skin like coat with no scutum, capitulum and mouth parts in nymphs and adult located on ventral surface of the body.

The members of this species called fowl ticks and its commonly distribute in highly and moderate temperate areas it attack chickens, pigeons, ducks and wild birds also could attack human.

Its oval in shape and the anterior part of the body more narrower than the posterior one, engorged female tick have red to blue in color due to the blood, while non-engorged one have brown to yellow in color, also dark color of intestine could be seen.

There is a difficulty in recognition between males and females but could be distinguish by the shape of the genital opening which larger in female than male and locate in anterior portion of the ventral surface in both sexes.

Life cycle:

Eggs are laid by females in cracks of the walls of houses, 20-100 egg in each time, then it hatch to larvae with three pairs of legs feeding on host then moult to nymphs, there are two nymph instar feeding also on host, moulting after this to adults.
Pathological effects of *Argas persicus* on host:

1. Anemia in case of heavy infestation.
2. Sleeplessness and loss of productivity.
3. It is a vector of *Borrelia anserina* and *Aegyptianella pullorum*.

**Family : Ixodidae** (Fig: 101)

1. The species of this family have a hard chitinous layer called scutum which running a long the dorsal part of males and only a little anterior part of females, nymphs and larvae.
2. Mouth parts located at the anterior portion of the body and it can be seen when we looked it from the upper aspect.
3. When the eyes present, lies on each side of the scutum and two in number.
4. Adult have two stigmata on each side of both fourth coxae.
5. Posterior margin of the tick body were notched and called festoon.

**Life cycle:** (Fig:102)

Females put its eggs in hidden areas down of the stones and mud masses cracks of the walls. Eggs hatch to larvae, moulting to nymphs then to adults.

**Genus: *Hyalomma* sp.**

1. Inornate tick or ornate some time.
2. Eyes present.
3. Festoons absent or present.
4. Hypostome and palps are long.
5. Spiracles are comma shaped in males and triangular in females.
Genus: *Rhipicephalus* sp.

1. Inornate ticks.
2. Eyes and festoons present.
3. Hypostome and palps are short.
4. Spiracles comma shaped, short in the female and long in the male.
5. Coxae 1 with two strong spurs.

Genus: *Boophilus* sp.

1. Inornate ticks.
2. Eyes present and festoons absent.
3. Hypostome and palps are short.
4. Coxae 1 bifid.
5. Spiracles circular or oval.

**Important of ticks:**

2. Injuries done by their bites, which may predispose the hosts to attacks by blowflies, screw-worm flies and biting flies generally.
3. Transmit viruses, rickettsiae (*Anaplasma*), bacteria and protozoa like *Babesia, Theileria*.
4. Ticks paralysis: is caused by the injection of a (toxin) by certain developmental stages of ticks, chiefly the adult female, but some time by the nymph as a *Dermacentor andersoni*.
5- Sweating disease caused by ticks *Hyalomma transiens*.

**Class: Arachnida**

**Family: Dermanyssidae**

*Dermanyssus gallinae* (Fig: 103)

1. Attacks the fowl, pigeon, canary and other cage birds and also many wild birds, it may also feed on man.
2. It is called the Red mite of poultry, only red when it has recently fed on its hosts blood, otherwise it is whitish, greyish or black.
3. The engorged adult female is about 1mm long.
4. The dorsal shield does not quite reach the posterior end of the body and its posterior margin is truncated.
5. The setae on it are smaller.
6. The anus is on the posterior half of the anal plates.
7. The chelicerae are long and whip like.

**Life cycle:**

The eggs are laid, usually after blood meal, in cracks in the walls of the poultry houses, up to seven eggs being laid at a time. The eggs hatch, at outdoor in 48-72 hours, liberating six legged larvae which does not feed. These moult in 24-48 hours to become protonymphs, which feed on the hosts blood and moult to become deutonymphs and these after a blood meal, moult in 24-48 hours to become the adults. The whole life cycle can be completed in seven days under optimal conditions.

**Importance of this parasite:**
The nymphs and adults causes:

1. Irritation and anemia.
2. Listless.
3. Reduce in egg production.
4. It is vector of *Borrelia anserina* the cause of spirochaetosis of the fowl.

*D. gallinae* may occur as a temporary parasite on humans causing skin lesions.

**Family : Sarcoptidae**

**Genus : Sarcoptes**

*S. scabiei* (Fig: 104)
1. The cause of scabies (sarcoptic mange) of man, sheep, goats, cattle, pigs, equines, dogs and rabbits.

2. *S. scabiei* burrow more deeply into the skin causing marked thickening rather than the formation of scabs.

3. The body of this mite is globose. The legs are short.

**Importance of the parasite:**

The predilection sites for the mites are areas such as the ears, muzzle, face and elbows. Irritation, itching, scratching and inflammation of the skin is accompanied by an exudate which coagulates and forms crusts, excessive keratinization and proliferation of connective tissue, resulting in skin thickening and wrinkling.

**Family:** Psoroptidae

**Genus:** Psoroptes (Fig: 105)

**Species:**

- *p. ovis*: the body mite of sheep.
- *P. equi*: the body mite of horse.
- *P. natalensis*: body mite of cattle.
- *P. cuniculi*: occurs in rabbit.

1. The cause of Psoroptic mange of the sheep, goats, cattle and equines.

2. The mites do not burrow into the skin, but are parasites the surface layers, causing the formation of thick, heavy scabs rather than thickening of the skin.

3. The body is oval.

4. There are no dorsal spines.

5. The legs are longer and project beyond the margin of the body.
Clinical signs:

Scab lesion may occur on all parts of the body that are covered with wool or hair, but occur most frequently around the shoulders and along the sides of the body and back in wooled sheep.

In early lesions the wool is disturbed over the lesion by the biting and scratching of the sheep and usually has a lighter colour than the surrounding wool. From about the fifth day onwards the exudates begins to coagulate, forming pale yellow crusts, older lesions are easy to detect on account of the loss of wool and presence of scab.

Life cycle generally:

female *Sarcoptes* burrows into the skin to lay eggs, but in the *Psoroptes* the eggs are laid on the skin at the edges of the lesion, these hatch to produce a six legged larvae and developed to the nymphs which have four pairs of legs, but no genital apertures. Finally, males and females are differentiate. Infection is spread mainly by contact with wandering larvae, nymphs and fertilized young females.

Diagnosis:

For confirmatory diagnosis, skin scrapings must be examined by using 10% KOH to clearing the skin scrap from debris and fatty materials.

Family: Demodicidae

Genus: Demodex (Fig: 106)

The mites live in the hair follicles and sebaceous glands of various mammals, causing demodectic or follicular mange. The parasites which occur on different species of hosts are usually regarded as distinct species, although it is difficult to distinguish between them morphologically, since the main difference is that of size. Most of the species are called according to their hosts, for instance:
D. canis: occurs in dog.
D. ovis: occurs in sheep.
D. caprae: occurs in goat.
D. bovis: occurs in cattle.
D. folliculorum: occurs in man.

The parasites are elongate, which a head, thorax which bears four pairs of stumpy legs and elongate abdomen which is transversely striated on the dorsal and ventral surface. The mouth parts consist of paired palps and chelicerae and an unpaired hypostome. The eggs are spindle shaped.

**Life cycle:**

The life cycle is completed in the hair follicles or sebaceous glands. Eggs, larva, protonymph, deutonymph and adult. Infection is transmitted by direct contact.

Diagnosis: The mites can be found in deep scrapings and in the contents of pustules and abscesses.
Chapter Six : Arthropoda

Class : Insecta

Order : Phthiraptera (lice)

1. Species of this order are small and wingless, dorsoventrally flattened.
2. The antennae are short and composed of 3-5 segments.
3. The eyes are reduced or absent.
4. The segmentation of thorax is indistinct.
5. The tarsi consist of one or two segments and each tarsus bears one or two claws.
6. There is one pair of spiracles on the mesothorax and six pairs of abdominal spiracles.
7. The operculated eggs are cemented, to the hairs or feathers.
8. There is little or no metamorphosis (The phase of the life cycle history that leaves the eggs resembles the adult and is called the first nymph. There are three ecdyses) (eggs → nymph1 → nymph2 → nymph3) Uninfected hosts are infected by close contact with infected ones, but lice may also be spread by farm equipment.

The lice are divided into two suborders:

1. Anoplura (sucking lice) : ectoparasites of mammals.
2. Mallophaga (biting lice) : ectoparasites of mammals and birds.

Anoplura:

1. The mouth parts are adapted for sucking the tissue fluids and blood of the hosts.
2. The sizes of lice up to 5 mm with small pointed head and terminal mouth parts.
3. The head is narrow than the body
4. The two antennae are visible at the sides of the head and usually composed of 5 segments.
5. The thorax is small and its three segments are fused together.
6. The abdomen is relatively large with seven of its nine segments visible, the segment often bear at their sides dark brown areas of thickened chitin, called paratergal plates.
7. The eyes are reduced or absent.
8. The first pair of legs is usually smaller with weaker claws, the third pair of legs is usually largest.
9. Each tarsus has only one claw.
10. Three families of veterinary importance, namely:

**Family** : Haematopinidae (Haematopinus), the short-nosed louse, largest louse on domestic mammals, example : *H. suis, H. asini* (Fig: 107).

**Family** : Linognathidae (Linognathus) long-nose on cattle, sheep and goats (Fig: 108).

**Family** : Pediculidae (Pediculus) human head and body lice.

**Mallophaga** :

1. The mouth parts are adapted for chewing.
2. Species of biting lice up to 3 mm.
3. The head is relatively much larger occupying the width of the body, and is rounded anteriorly with mouth parts which are ventral.
4. The antennae may be lie in grooves in the sides of the head or are visible at the sides of the head.
Biting lice on mammals: example

*Damalinia* (*D. bovis, D. equi, D. ovis*) Fig(109).

*Felicola* on cats (Fig: 110).

Biting lice of birds: example

*Menacanthus stramineus* (the yellow body louse of poultry)(Fig: 111).

**Order: Siphonaptera**

**Morphology:**

1. Fleas are dark brown, wingless insects, with laterally compressed bodies.
2. Eyes when present are simply dark, photosensitive spots.
3. The antennae are short.
4. The third pair of legs is much longer than the others an adapted for leaping.
5. The head may bear at its posterior (pronotal) or ventral (genal) borders rows of dark spines called ctenidia or combs (are the most important features used in identification.
6. Both sexes are blood suckers, and only the adult are parasitic.
7. The life cycle (eggs → larvae → puparium → adult)
Fleas of mammals:
Ctenocephalides: *C. canis* (dogs), *C. felis* (cats) (Fig: 112).
(having genal and pronotal combs)
*Xenopsylla cheopis* (no combs) on man.(Fig: 113).

Order: Hemiptera

Family: Cimicidae

Genus: Cimex

Sp.,: *C. lectularius* (Fig: 114)

1. The bed bugs attacks man and animals to suck blood.
2. The parasites are elongate oval in shape and yellowish brown to dark in color.
3. The head bears a pair of long antennae with four joints.
4. The compound eyes project conspicuously at the sides of the head.
5. The prothoraxis is large and deeply notched anteriorly where head is inserted in it.
6. The wings are vestigial.
7. The abdomen has eight segments.
8. The whole body is covered with characteristic spinose bristles and some hairs.
9. The tarsi have three joints.
10. The adult has a pair of ventral thoracic stink glands and the young stages have similar dorsal abdominal glands. These glands are responsible for characteristic odour of the insect. The mouth parts are adapted for piercing and sucking. There are five nymphal stages (eggs → nymph 1 → nymph 2 → nymph 3 → nymph 4 → nymph 5 → adult).
Order: Diptera

Suborder: Nematocera

* The antennae are long and compose of more than 8 segments (Mosquitoes).

Family: Culicidae

* This family comprises the mosquitoes which are slender Nematocera with small, spherical heads and long legs.
* The antennae of 14-15 segments are conspicuous and plumose in the male.

**Distinguishing characters of Anopheline and Culicine mosquitoes**

<table>
<thead>
<tr>
<th>Anopheline (Anopheles)</th>
<th>Culicine (Culex)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eggs: Laid singly, boat shaped with paired lateral floats</td>
<td>Laid in rafts or singly, No floats</td>
</tr>
<tr>
<td>Larva: No siphon tube</td>
<td>Well-developed siphon tube</td>
</tr>
<tr>
<td>Palmate hairs on dorsal</td>
<td>No palmate hairs</td>
</tr>
<tr>
<td>Surface of abdomen</td>
<td></td>
</tr>
<tr>
<td>Pupa: Breathing trumpets short and broad in lateral view.</td>
<td>The pupa has a rounded body which consists of head and thorax and an elongate abdomen. Breathing trumpets long and narrow in lateral view.</td>
</tr>
<tr>
<td>Adult: Female palps as long as proboscis(Fig: 115), male palps as long as proboscis clubbed scutellum evenly curved. (Fig: 116)</td>
<td>Female palps very short (Fig: 117)male palps as long as proboscis not clubbed scutellum tri-lobed. (Fig: 118)</td>
</tr>
</tbody>
</table>

* The antennae of both genus in females are pilose while in males are plumose.
The importance of mosquitoes:

1. Although mosquitoes can be a great nuisance and their bites may cause pain full reaction.
2. They are the intermediate hosts and vectors of several important parasitic and virus diseases of man and domestic animals.

Human Malaria → *Plasmodium* (Anopheles)

Bird Malaria → *Plasmodium* (Culex)

**Anopheles → Intermediate host of Filariid Nematodes**

**Family: Simuliidae Fig(119)**

* The species of this family are often called black flies or buffalo gnats.
* The thorax is humped over the head and the piercing proboscis is short, long antennae, which have 11 segments.
The wings are broad and they are not spotted
They have no scales and they are not hairy except for bristles on the thick anterior
* The body is covered with short golden or silvery hairs.

**Life cycle**: (egg → larvae → pupa → adult)

1. The eggs are laid on stones or plants just below the surface of the water in running streams.
2. The larvae are cylindrical and attach themselves by a posterior sucker-like organ which is armed with small hooks, but they are able to move about. Anteriorly are the mouth parts and a pair of brush-like organs, the larvae are carnivorous, near the anterior extremity the ventral surface bears an arm-like appendage called the proleg which has a circlet of hooks at its free end, and the larva uses this when it moves about Fig(120).
3. The larvae moult six times and at the last moult the pupa appears, the mature larva spins a triangular cocoon on the surface to which it is attached and in the pupal stage is passed.

4. The pupa has one dorsal and one ventral respiratory tubes, the branches of which float out of the cocoon then to the adult on the water surface and fly.

**Medical Important of Simulium :**

1. The simuliiids occur in all parts of the world but they are trouble some especially in warm countries.

2. They bite the legs , abdomen ,head and ears of the host.

3. The bites give rise to vesicles, which burst or wart like papules.

4. Poultry are often attacked and may even become anemic from lose of blood.

5. *Simulium sp.*, transmits the viruses of Eastern equine encephalitis and vesicular stomatitis, and they also transmit various protozoa and nematodes in cattle (intermediate host) of the filariid Nematode *Onchocerca gutturosa* and in poultry transmit *leucocytozoon* (Blood protozoa).

**Suborder : Cyclorrhapha**
Family : Oestridae

1. The adults are hairy flies which have rudimentary mouth parts and does not feed.
2. They usually lay their eggs on animals.
3. The larvae are parasitic maggots and consist of 12 segments, which the first two are fused together. Oral hooks are usually present, but there is no head.
4. The posterior stigmata open through semicircular plates which may be retractile.
5. The larvae moult twice during their parasitic life and leave their hosts when they are full grown to pupate in the ground. They feed on the body fluids of the host or on exudates which surround them.

Genus : Gasterophilus

Members of this genus are commonly referred to as "bot flies", their larvae termed bots, spend most of their time developing in the stomach of equines.

Hosts :
Horses and donkeys.

Major species : G. intestinalis

Adults :
Bot flies are robust dark flies 1-2 cm long, has irregular dark, transverse bands on the wings.
Larvae : (Fig:121)

They are cylindrical when mature and present in the stomach or passed in the faeces, 16-20 mm long and reddish-orange with posterior spiracles two rows of spines dorsally and ventrally to at least 10th segments, spines blunt-tipped. The adults flies occur during the latter half of the summer and live only a few days.

_G. intestinalis_ deposits its eggs mainly around the fetlocks of the fore-legs, also higher up the legs and in the scapular region the eggs hatch to larvae spontaneously or are stimulated to do so by warmth which may be generated during licking and self-grooming, larvae crawl into → mouth tongue → pharynx → oesphagus → stomach (where they attach to the gastric epithelium) → passed in the faeces → pupation takes place on the ground → adult.

**Genus : Oestrus**

_O. ovis_, the "sheep nasal fly" has a dark grey colour with small black spots which are especially prominent on the thorax and it is covered with light brown hairs. They appear from spring to autumn, particularly in summer. The larvae (Fig:122) occur in the nasal passages in sheep and rarely in goats, mature larvae are about 3.0 cm long, yellowish-white, tapering anteriorly with a prominent step posteriorly. Each segment has a dark transverse band dorsally. The females are viviparous and infect the sheep by squirting a jet of liquid containing larvae at the nostrils during flight up to 25 larvae being delivered at a time → 1st larvae migrate → nasal passages → frontal sinuses → L2 → L3 → migrate back to the nostrils → pupating on the ground → adults.
Genus: *Hypoderma*

The members of this genus are the "warble flies".

**Hosts**: Cattle, the larvae occur erratically in other animals including equines, sheep and very rarely man.

**Species**: *Hypoderma bovis, H. lineatum*

**Adults**: *H. bovis, H. lineatum* resemble bees, but being Diptera, have only one pair of wings, the abdomen is covered with yellow-orange hairs with a board band of black hairs around the middle.

**Larvae (Fig:123)**:

The mature larvae are thick and somewhat barrel-shaped, tapering anteriorly, when mature they are 2.5-3.0 cm long and some segments bear short spines. The color is dirty white when newly emerged from the host, but rapidly turns to dark brown, the pupa is almost black. The flies appear in summer, the female attach their eggs to hairs. *H. bovis* lies its eggs singly on the lower parts of the body and on the legs above the hocks while *H. lineatum* deposits a row of six or more on individual hairs below the hocks, first stage larvae penetrate the hair follicles → diaphragm → *H. bovis* (epidural fat in the spinal canal), *H. lineatum* (submucosa of the oesophagus → 2nd larvae → black → L3 (which can be palpated as distinct swelling "warbles"), the larvae breath by applying their spiracles to the aperture → after about 4-6 weeks in this site they emerge and fall to the ground where they pupate → adults.
Chapter Six: Arthropoda

(Fig:100) *Argas persicus*

(Fig:101) Female, male and larvae of Tick

(Fig:102) Life cycle of Tick

(Fig:103) *Dermanyssus gallinae*

(Fig:104) *Sarcoptes scabiei*
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(Fig:105) Psorptes
(Fig:106) Demodex spp
(Fig:107) Haematopinus
(Fig:108) Linognathus
(Fig:109) Damalinia
(Fig:110) Felicola
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(Fig:111) Menacanthus

(Fig:112) Ctenocephalides canis

(Fig:113) Xenopsylla cheopis

(Fig:114) Cimex lectularius
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(Fig:115) mouth parts of Female of Anopheles

(Fig:116) mouth parts of male of Anopheles

(Fig:117) mouth parts of Female of Culex

(Fig:118) mouth parts of male of Culex

(Fig:120) Larvae of Simulium and pupa

(Fig:119) Simulium adult
(Fig:121) larvae of *Gastrophilus intestinalis*

(Fig:122) larvae of *Oestrus ovis*

(Fig:123) larvae of *Hypoderma bovis*