



Training on Diseases of Small Ruminants

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Training Overview

- **diseases caused by helminths**
- **diseases caused by bacteria**
- **diseases caused by viruses**
- **diseases caused by protozoa**
- **diseases caused by arthropods**
- **fungal infections**

a. Nematodes

- Nematodes associated with parasitic **gastro-enteritis** in small ruminants are:
 - *Haemonchus*,
 - *Oesophagostomum*,
 - *Trichostrongylus*,
 - *Bunostomum*,
 - *Cooperia*,
 - *Trichuris*,
 - *Strongyloides*,
 - *Gaigeria* and *Chabertia*.
- **Lungworms** such as *Dictyocaulus filaria*, *Muellerius capillaris* and *Protostrongylus rufescens* cause parasitic bronchitis particularly in young animals.

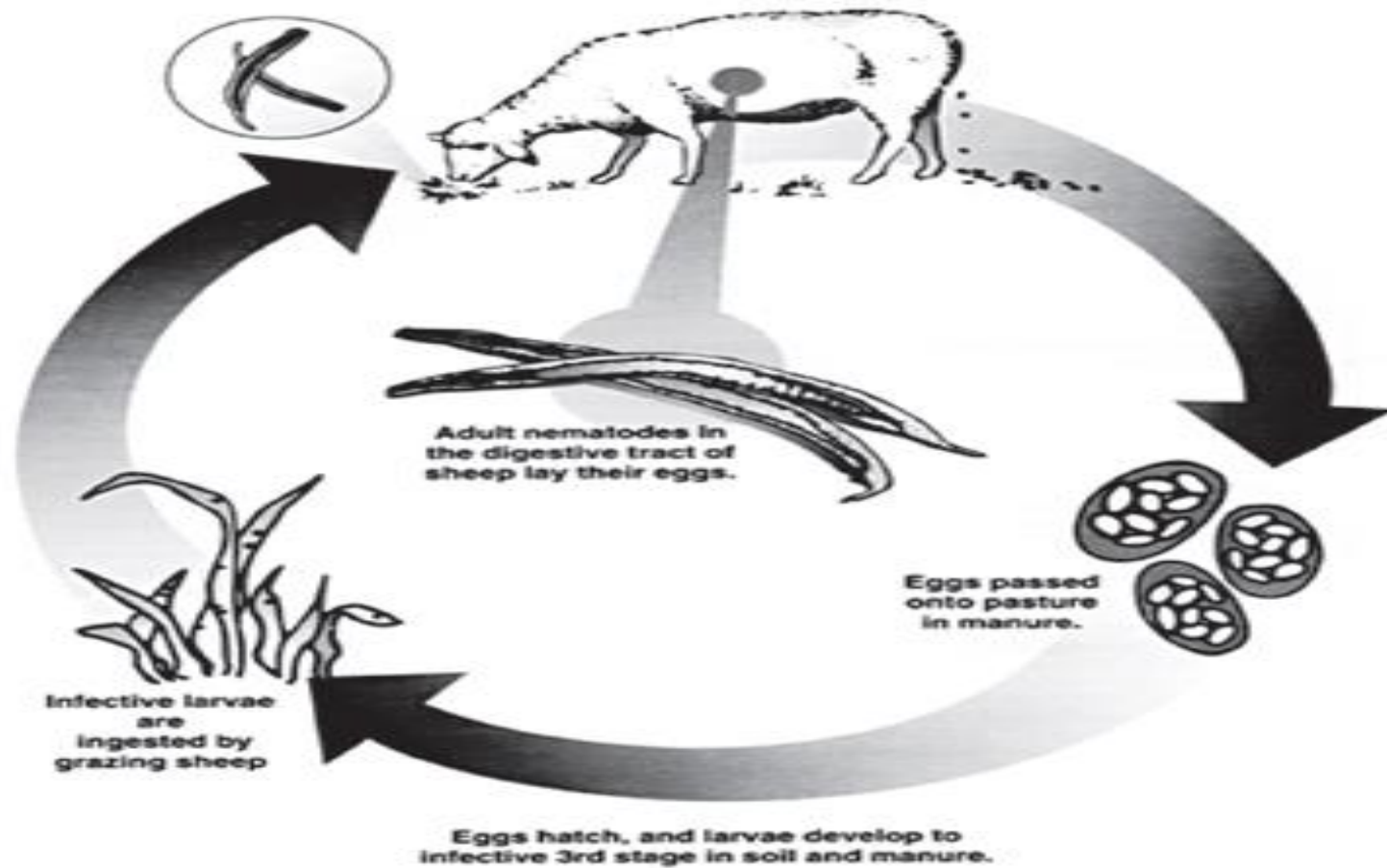
i. Gastrointestinal nematodes

- The epidemiology of gastrointestinal nematode infections is influenced by;
 - climatic factors(particularly rainfall and temperature),
 - management systems,
 - host factors and parasite factors.

Transmission

- Females lay eggs with faeces of the host.
- The eggs = L1 = L2 = L3 larvae, the latter being the infective stage.
- Animals are infected by ingestion of L3 with pastures.
- After ingestion, the L3 of *Haemonchus spp* and *T. axei* to L4 and mature into adults in the abomasum.
- *T. colubriformis* and *Oesophagostomum spp* occur in the small and large intestines respectively.

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- **L3** of *Bunostomum spp* and *Strongyloides spp* enter the host mainly by skin penetration although infection through ingestion is also possible.
- After skin penetration = the venous circulation through the heart and the lungs = the larvae penetrate the alveoli = are coughed up and then swallowed = they pass to the small intestine where further development and maturation occur.
- The larva of *Trichuris ovis* is contained within the egg and the infective L1 is released when the egg is ingested by the host.
- The prepatent period for most gastrointestinal trichostrongyles is about 21 days.

Clinical signs

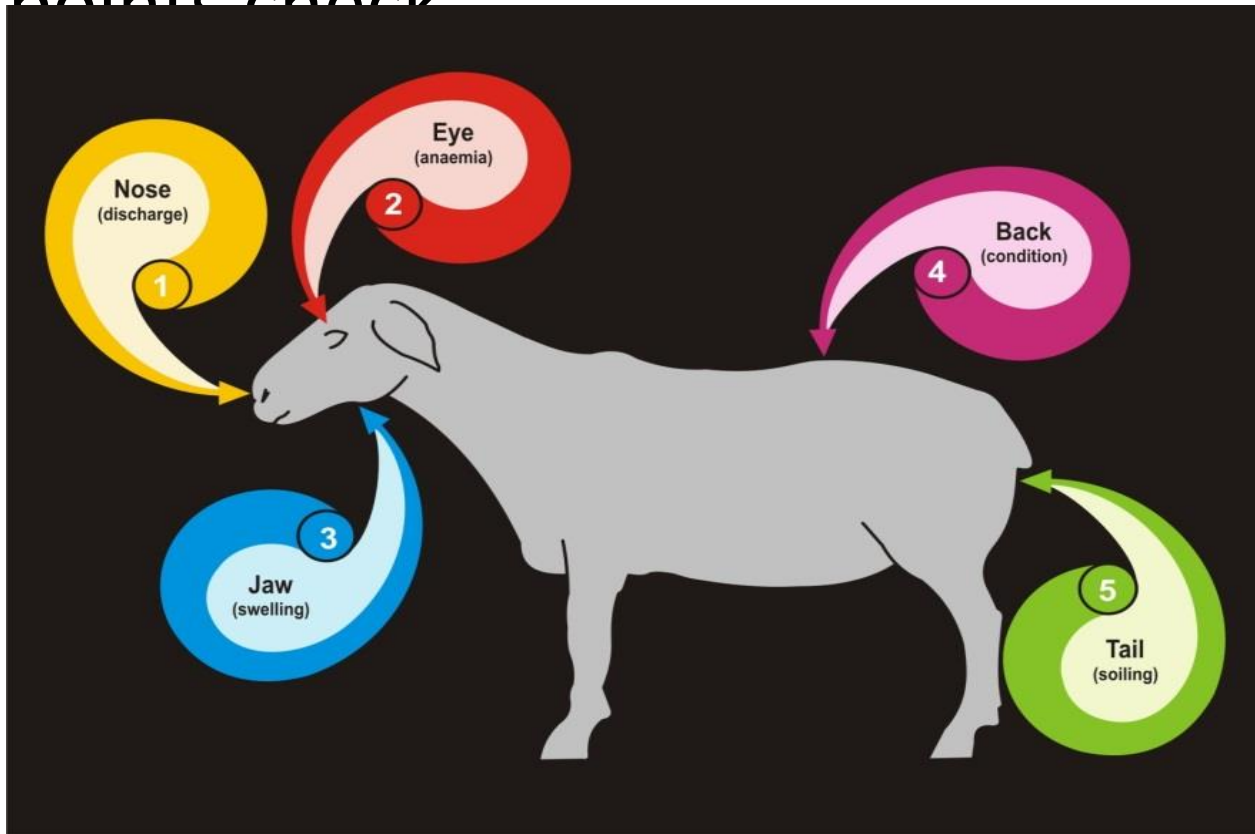
- hemorrhagic gastritis.
- Dark colored feces
- foul smelling feces.
- weakness,
- progressive weight loss,
- rough hair coat and stunted growth.
- Loss of appetite, emaciation, loss of weight, dry skin, diarrhea,
- Oedema and atrophy of skeletal muscles or myocardium.
- Mucoid diarrhea or sometimes
- constipation, prostration and death are the common clinical features.

Diagnosis

- Diagnosis of helminthosis is based on;
 - history,
 - epidemiological,
 - clinical and pathological findings and
 - laboratory analysis of appropriate samples.
- Faecal egg counts, faecal cultures, determination of infective larvae on herbage and worm counts at *post mortem*.

5 (five) points check

Five points check



Treatment

- Broad-spectrum anthelmintics
(Benzimidazoles, imidazothiazoles,
organophosphates and ivermectins)
- Therefore, it is always important to adhere to
the manufacturers 'instructions before using
them.

Control

- The control of GI nematodes is designed to reduce the prevalence of nematodes.
- ***Control by use of anthelmintics, through management and Control by breeding resistant stocks.***

ii. Lungworms

- The epidemiology of lungworms is similar to that of gastrointestinal nematodes. A damp and cool environment is very suitable for the development of *D. filaria* and the third stage larva (L3) is resistant to cold.
- Some animals may harbour adult worms in the lungs and act as carriers which continue to contaminate the pastures and maintain the infection in the environment.

Transmission

- Adult Dictyocaulus spp (trachea or bronchi) where eggs are produced. The eggs are coughed up and swallowed. Hatching occur (air passages /intestines) and L1 in host faeces. The L1 hatches into L2 and L3 in the environment.
- Infection is acquired through ingestion L3 and the L3 migrate through the intestinal wall and enter the mesenteric lymph nodes where they moult into (L4).
- The L4 passes through the lymphatic and venous circulation to the heart and then through the pulmonary circulation to the lungs where enter the alveoli. Maturation occurs in the bronchi or trachea and the mature worms start to produce eggs.

Clinical signs

- Parasitic bronchitis (verminous pneumonia) more common in kids or lambs under 6 months.
- *Adult D. filaria cause alveolar and bronchiolar irritation leading to coughing, dyspnoea and loss of body condition.*
- The bronchioles are filled and may be blocked with exudate.
- Mucopurulent exudate through the nostril.

Diagnosis

- Similar with gastrointestinal nematodes.
- **Treatment**

Use of broad spectrum anthelmintic.

- **Control**

Control strategy similar for all helminthes.

b. Trematodes

- However, unlike gastrointestinal nematodes, trematodes have indirect life cycles and intermediate hosts play an important role in their epidemiology.
- Therefore, factors determining the availability, development and survival of intermediate hosts in the environment will also influence the level and severity of trematode infections.
- The epidemiology for *F. gigantica*, *Paramphistomum microbothrium*, and *Schistosoma spp* is similar.

Transmission

- Adult *Fasciola spp* lay eggs in the bile ducts - eggs are transported to the gall bladder through the bile- Gall bladder contracts the eggs enter the duodenum and then are expelled - eggs hatch into miracidia- *penetrate snail hosts and develop through the sporocyst, redial and cercarial stages.*
- *The cercariae* leave the snail hosts, encyst onto herbage just below the water level and become metacercariae, which are the infective stage.
- The metacercariae are ingested by grazing animals with infected herbage or water.
- They excyst in the duodenum, penetrate the intestinal wall and pass through abdominal cavity (or sometimes through the blood stream) to the liver where they penetrate the liver capsule.
- The immature flukes migrate in the liver parenchyma and then enter the bile ducts where they mature and start to produce eggs.
- The transmission of *Paramphistomum spp* is similar to that of *Fasciola spp*. *However, after excystation and attachment in the duodenum, the immature paramphistomes migrate up the alimentary tract and finally attach to the epithelium of the rumen and reticulum.*

Clinical signs

- As few as 42 flukes can cause clinical fasciolosis in goats.
- Three syndromes; acute, subacute or chronic fasciolosis may occur.
- ***Acute fasciolosis: acute traumatic hepatitis caused by the migration of larvae through the parenchyma leading to extensive destruction and marked haemorrhage; progressive weakness, pallor of the mucous membranes, enlargement of the liver, abomasal distension and Anorexia.***
- ***Subacute and chronic fasciolosis is associated with ingestion of a large number of metacercariae over*** a long period of time. Characterised by anorexia, rough hair coat, slight abdominal distension, pallor of mucous membranes, disinclination to move and emaciation, ***anaemia*** and submandibular oedema.

Diagnosis

- Patent *Fasciola spp*, *Paramphistomum spp* and *Schistosoma spp* infections can be diagnosed by faecal egg and *post mortem* worm counting.
- **Treatment:** use of broad spectrum anthelmintics.
- *Control:* similar for all helminthes

DISEASES CAUSED BY BACTERIA

1. PNEUMONIA

- Refers to the inflammation of the pulmonary parenchyma.

➤ Aetiology

- *Pasteurella spp* are the most common bacteria isolated from cases of clinical pneumonia.

Transmission

- The main route of transmission of pneumonia and other respiratory infections is by inhalation of infective aerosols.

➤ Clinical features

- Characterized by laboured breathing, coughing, nasal discharges, lacrimation, anorexia, depression and sometimes pyrexia if there is a systemic involvement.
- Exercised animals exhibit dyspnoea.

Diagnosis

- A tentative diagnosis of pneumonia can be achieved by consideration of the epidemiological, clinical and pathological findings.
- Pneumonia caused by other bacteria can be confirmed by bacteriological tests.

Treatment and Control

- *P. hemolytica* is sensitive to oxytetracycline at 20 mg/kg given parenterally. The treatment should be repeated after 4-6 days because relapses may occur.
- **Control** of pneumonia in a herd can be achieved by isolation and treatment of the affected animals.
- Avoidance or minimization of predisposing factors such as overcrowding, long distance trekking and inclement weather can greatly reduce the incidence of pneumonia in a herd or farm.

BRUCELLOSIS

- This is a disease caused by genus *Brucella* and it is characterised by abortion in late pregnancy and subsequent high rate of infertility.
- **Transmission:** The source of infection is the infected doe or ewe and *Brucella spp* tend to be abundant in the placenta, placental fluid, uterine exudate and aborted fetuses.
- **Inhalation** is the most important route of infection in goats and sheep but infection may also be acquired through **ingestion** of infected material and by penetration of **conjunctival mucosa**.
- *In utero transmission* may occur. The infective discharges can contaminate the environment very rapidly causing grazing animals to ingest massive numbers of the organisms.
- *Overcrowding of animals in houses, communal grazing areas and water sources and, poor hygiene* favour the rapid spread of the disease. The unrestricted movement of animals and personnel can facilitate the transmission of brucellosis between herds.
- **Man** can be infected through handling of contaminated materials, consumption of infected meat or milk.

Clinical features

- Abortion in **late pregnancy** is the principal manifestation of brucellosis.
- Other features include reduced milk yield and birth of weak kids or lambs.
- Epididymitis, orchitis, synovitis, hygromas, osteoarthritis, lameness and infertility are usually observed in male.
- The infection in ewes is characterized by abortion, stillbirths or birth of weak lambs.

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Diagnosis

- The clinical history, endemicity of the disease in the area and clinical signs may be suggestive of the disease.
- The disease can be confirmed by demonstration of the bacteria in smears made from the vaginal discharges, placenta, colostrum and the abomasum of the aborted foetus.

Treatment and Control

- Treatment of the affected animals is usually not undertaken and such should be **culled** in order to reduce the sources of infection.
- Regular testing of animals, restriction of movement of animals and personnel between herds and purchase of animals with known health and reproductive records can prevent introduction and reduce the spread of the disease.
- All the infected materials should be incinerated and the contaminated premises disinfected.
- **Vaccination** with a live attenuated *B. melitensis* Rev 1 strain vaccine confers strong immunity but it causes abortion if used in pregnant does and ewes.

FOOTROT

- Footrot is a contagious infection of the feet characterized by inflammation of the skin-horn junction, under-running of the horn, ulceration and necrosis of the sensitive laminae of the foot and severe lameness.
- The disease is associated with production losses and sometimes mortality due to starvation.
- **Aetiology:** Footrot in sheep is caused by bacteria, *Bacteroides nodosus*, *Fusobacterium necrophorum* and other aerobic or anaerobic bacteria.

Transmission

- Footrot is a contagious infection and discharges or exudates from the affected feet contaminate the pasture or bedding.
- Infection occurs through contact with infected material and the organism gain entry into the body by penetration through broken skin.
- Prolonged wetting of the skin, scratches and bruises or surgical wounds facilitate the penetration of the bacteria and are therefore important predisposing factors.
- Wet and warm weather conditions favour the proliferation of the bacteria and soften the animal's skin thus making it easily breakable and penetrable.
- The congregation of animals in communal grazing areas, poor floor types and poor disposal of urine and faeces favour the spread of the disease.

Clinical features

- There is always interdigital necrosis.
- A characteristic black, foul smelling material is present due to the bacterial necrosis of the horn. Spread of the infection to joints may result in pyo-arthritis and accumulation of pus in the joint cavity.
- **Diagnosis:** Clinical signs are highly suggestive of the disease.

Treatment and Control

- A single heavy dose of penicillin-streptomycin given intramuscularly can be effective in the treatment of the disease.
- A follow-up treatment may be required if the response after the initial injection is not satisfactory.
- Regular hoof trimming is recommended and has been found to facilitate recovery of the treated animals.
- **Control** is based on the prevention of the spread of the bacteria, maintaining good hygienic conditions in the herds and minimization of predisposing factors. Foot-baths containing 5 % copper sulphate, 10 % zinc sulphate and 5 - 10 % formalin are used in intensive production systems.

Dermatophilosis (Streptothricosis)

- This is an acute, subacute or chronic and sometimes fatal exudative dermatitis of animals which is characterised by exudation, matting of the hair/wool and formation of crusts and thick scabs.
- **Transmission:** The source of infection is the sick or carrier animal and the disease spreads by contact. Prolonged wetting and mechanical damage to the skin either by bruises, scratches or surgical wounds are the predisposing factors.
- Arthropod vectors such as ticks, *flies*, *lice* and *sheep ked* may be involved in the transmission of dermatophilosis.
- The incidence of the disease increases with increase in rainfall, humidity and insect activity and hence the prevalence of the disease tends to higher during the rainy season compared to the dry season.

Clinical features

- Clinical signs include papular and scab formation on the muzzle, face, nose, ears, scrotum and feet.
- The under surface of the scabs is covered with a yellow, creamy or haemorrhagic and hair-matting exudate.
- In sheep, the lesions start on the dorsal parts of the body and spread laterally and ventrally. Lesions may also occur on the ears, neck, face, muzzle and outer sides of legs.
- Coalescence of the lesions results in the formation of wartlike masses which may extend from the coronet to the hock or knee regions.

Diagnosis

- Epidemiological and clinical features are highly suggestive of the disease. The disease is confirmed by demonstration of bacteria in the laboratory.
- The differential diagnosis of dermatophilosis include mange, contagious ecthyma, fungal dermatitis, fleece rot and photosensitisation.

Treatment and Control

- Heavy doses of penicillin-streptomycin are effective if administered in early stages of the disease. Heavy doses of long acting tetracyclines and a 2.5% chloramphenicol ointment may be applied topically.
- Control of ticks and biting insects by dipping or spraying with insecticides may limit transmission of the disease. Zinc sulphate (0.5 %), copper sulphate or magnesium fluosilicate (0.2 %) solutions have been found to be effective in reducing the spread and incidence of the disease. Wherever possible injury of the animal's skin should be avoided.

DISEASES CAUSED BY VIRUSES

Peste Des Petits Ruminants

- The disease is caused by a PPR virus of the genus *Morbillivirus* and family *Paramyxoviridae* which closely resembles the rinderpest virus.

Transmission: The source of infection is the sick or sub-clinically infected animal and the virus is discharged in milk, saliva, urine or faeces.

- The disease spreads primarily by inhalation but the virus can also be acquired by ingestion and penetration through the conjunctival mucosa.
- Animals may acquire the infection by licking or muzzling each other. Bedding, feed and water troughs can be sources of infection.
- Presence of other diseases and other stress factors precipitate the occurrence of the disease.

Clinical features

- The syndrome is characterised by severe depression, pyrexia, sneezing, dyspnoea, coughing, serous or mucopurulent occulo-nasal discharges which lead to matting of eyelids and blockage of nostrils.
- There may be crackling lung sounds which are clearly audible. Focal necrotic stomatitis, halitosis, anorexia, profuse mucoid diarrhoea or dysentery and sometimes tenesmus are prominent features. Abortion occurs and there may be superficial erosions on vulva or prepuce.
- Solid immunity develops in recovered animals and passive maternal immunity protects kids under 4 months.

Crusting around the mouth and nose, and also openmouthed breathing



Diagnosis

- A tentative diagnosis of PPR is based on the epidemiology, clinical and pathological features.
- The differential diagnosis of PPR include rinderpest, contagious ecthyma, goat/sheep pox, Nairobi sheep disease, blue tongue, CCPP, pneumonic pasteurellosis, salmonellosis, colibacillosis and parasitic gastro-enteritis.

Control

- Treatment of secondary bacterial pneumonia using broad spectrum antibiotics may be effective in the early stages of the disease.
- Fluid therapy is recommended to alleviate the effects of diarrhoea/dysentery. Good nursing of the sick animals may facilitate recovery.
- Control of the disease can be achieved by preventing the contact between susceptible animals and clinically or sub-clinically affected ones. Affected animals should be isolated and infected premises disinfected.
- **Vaccination** is commonest method of control of PPR in endemic areas.

Goat And Sheeppox

- Goat and sheep pox are caused by the goat and sheep pox viruses of the genus *Capripoxvirus* and family Poxviridae.
- **Transmission:** The disease is highly contagious and transmission occurs mainly by inhalation but animals can also be infected by drinking contaminated milk or by direct contact.
- Cuts and abrasions on the skin facilitate entry of the virus into the body.
- The virus can be spread mechanically by insects, birds and personnel.
- Transplacental transmission has been demonstrated.
- Congregation of animals in communal grazing lands, markets, dips and the dry and dusty environments are favourable for the transmission of the disease because the virus can be excreted through nasal and conjunctival discharges.

Clinical features

- The disease is more severe in sheep than goats and in young than adult animals.
- In sheep, the disease is characterised by depression, pyrexia (40-41 °C), anorexia, laboured breathing, ocular and nasal discharges.
- Cutaneous nodules normally appear on hairless areas of the body such as lips, nostrils, udder, vulva, scrotum and under the tail but they may also occur on hairy areas.
- The nodules progress through vesicles, pustules and finally become scabs.
- Severe erosive and ulcerative plaques may be found on the buccal, oesophageal and tracheal mucosae.
- Lesions in the alimentary tract may lead to diarrhoea whereas, those in the genital tract can cause abortion.

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Diagnosis

- The pox lesions are characteristic and highly suggestive of the disease.
- Goat and sheep pox has to be differentiated from contagious ecthyma, FMD, blue tongue, peste des petits ruminants and mange.

Control

- No treatment is available for the disease.
- Goat/sheep pox is a notifiable disease and quarantine measures should be imposed immediately if an outbreak occurs to minimize its spread.
- The affected flock should be destroyed and infected premises properly disinfected.
- Vaccines are used to vaccinate animals in countries where the disease is endemic.

DISEASES CAUSED BY PROTOZOA

COCCIDIOSIS

- This is an enteric disease affecting particularly kids and lambs and it is characterised by debility, malaise, inappetance, diarrhoea or sometimes dysentery, dehydration and death in untreated animals.

Transmission: The unsporulated oocysts are voided in faeces of infected hosts and under optimum conditions they sporulate and become infective in 2-5 days.

- The sporulated oocysts are ingested by goats or sheep followed release of sporozoites in the intestine.
- Sporozoites penetrate the intestinal wall and become trophozoites.
- The latter subdivide to form schizonts (meronts). The schizonts rupture and release merozoites which infect new intestinal cells.
- When the host cell ruptures, the oocysts are released into the intestinal lumen and are passed out in faeces.

Clinical features

- Diarrhoea which may be mucoid or bloody, abdominal pain, tenesmus, inappetence, debility, loss of weight and dehydration are the common features associated with coccidiosis.
- Anaemia may also be encountered. In the acute disease, there may be fever, ocular and nasal discharges. Subclinical coccidiosis is associated with reduced feed intake, poor weight gains and poor food utilisation.

Diagnosis

- This is based on history, clinical signs, necropsy features and microscopic examination of intestinal mucosa and faeces.
- The differential diagnosis of coccidiosis include colibacillosis, salmonellosis, cryptosporidiosis, lamb dysentery and helminthosis.

Treatment and Control

- Sulphonamides such as sulphadimidine, sulphamerazine, sulphamethazine and sulphaquinoxaline at dosage rates of 50-100 mg/kg for 4 days are effective against coccidiosis in small ruminants.
- Amprolium in feed is also used to treat the disease in goats (100 mg/kg) and sheep (50 mg/kg).
- **Control:** Proper hygiene in the house and minimization of predisposing factors are important factors to be considered in the control strategies of coccidiosis. Provision of adequate nutrition enhances the resistance of animals to coccidiosis.

Diseases Caused By Arthropods

MANGE

- The mange mites which are reported to affect small ruminants include *Sarcoptes scabiei*, *Psoroptes spp*, *Demodex spp*.

Transmission: Clinically affected and carrier animals are the source of infestation.

- Direct contact and contaminated fomites can be sources of infestation.
- Overcrowding of animals in houses, markets, dips and communal grazing land facilitates rapid spread of the parasites.
- Moist conditions favour the proliferation of the mites while desiccation is detrimental.
- Poor nutrition and intercurrent infections increase the susceptibility of animals to mange mites.

Clinical features

- *Sarcoptes spp* pierce the skin, suck lymph and feed on young epidermal cells.
- There is intense itching and the animal rubs on hard surfaces and objects resulting in partial or complete alopecia.
- Alopecic patches are evident in the medial aspects of the rear limbs, axillae, the brisket, the abdomen, trunk, udder and teats.
- *Psoroptes spp* are which are non-burrowing mites puncture the epidermis, suck lymph and stimulate a local inflammatory reaction.
- *Psoroptes spp* infestation is characterized by intense pruritus, restlessness, scratching and rubbing on objects and raised tufts of wool.
- Reddish or yellowish vesicles, pustules and papules are formed and the exudate from papules results in the formation of crusts and matting of the wool.
- Later on, tufts of wool fall leaving alopecic areas which may cover the whole body.
- Thickening and cracking of the skin occur. Severely affected animals become emaciated, anaemic and may die due to exhaustion. Lesions first appear on the lumbar region and spread to other parts of the body.

Diagnosis

- Tentative diagnosis is based on clinical manifestations and the definitive diagnosis depends on the demonstration of the mange mites in skin scrapings.
- The differential diagnosis of mange include ringworm, dermatophilosis, contagious ecthyma, goat/sheeppox and scrapie.

Treatment and Control

- Sarcoptic mange can be treated using ivermectin (0.2 mg/kg), 0.05% diazinon, 0.1% phoxim and 0.05% coumaphos. Two applications of phoxim (0.05%) at 10 days interval has been found to be effective against chorioptic mange and, permethrin (4 % w/v) can be used as a pour-on formulation. Propetumphos (0.005%) applied twice or thrice at 10 days interval has been used to treat psoroptic mange.
- **Dipping** with other insecticides is useful in the control of the parasites.
- **Hygiene** in houses and avoidance of overcrowding will minimise the accumulation and spread of the mites.

FLEA AND LOUSE INFESTATION

- Heavy infestation with fleas and lice can cause severe anaemia in young animals in addition to the damage of the skins causing considerable losses in the leather industry.
- **Transmission:** Infested animals are the sources of infection and they contaminate bedding and farm equipment thus perpetuating the infestation in the herd. Overcrowding and a warm, humid environment favour the built up of fleas and lice burdens.

Clinical signs and Diagnosis

- Clinical signs of heavy flea and louse infestation include unthriftiness, restlessness, pruritus, alopecia, body weakness, scratching, rubbing and licking.
- Heavy infestation with fleas and lice causes anaemia.
- Fleas and lice infestation can be diagnosed by careful examination of the coat.
- The use of magnifying lens can aid the diagnosis.

Treatment and Control

- Ivermectin has been found to be effective in the treatment of flea and lice infestations.
- **Dipping or spraying** with effective insecticides are commonly used in the control of these parasites.
- Avoidance of overcrowding, regular **cleaning of houses** and change of bedding can prevent the built-up of flea and louse burdens.

TICK INFESTATION

- Heavy infestation with ticks can also cause anaemia.
- Some species of ticks cause tick paralysis while others cause tick toxicosis.
- Intense lameness has been noted in Goats and sheep where ticks are attached around the coronary band.
- **Transmission:** High humidity is favourable for the maintenance of tick populations.
- Direct contact is the principal mode of transmission but animals can be infested by various stages of ticks which have dropped on pastures by other livestock or wild animals.

Control of ticks

- The main method of control of ticks is by dipping animals using recommended acaricides.
- In small herding units, ticks can be manually removed from the animals.
- Rotational grazing has also been recommended as a means of controlling tick infestation.

Oestrus Ovis Infestation

- The adult bots deposit larvae around the nostrils and the larvae migrate to the frontal sinuses and dorsal turbinates. The migrating larvae traumatise the nasal mucosa with their spiny surface inciting a nasal catarrhal inflammation.
- **Clinical signs:** include sneezing, snoring respiration and mucopurulent nasal discharge. The affected animals become restless, stamp their feet and shake or press their heads against objects. Secondary bacterial infection may cause suppuration and complicate the clinical picture. At necropsy, the larvae are found in the sinuses.
- **Treatment:** Ivermectin (0.2 mg/kg), rafoxanide (7.5 mg/kg) and nitroxynil (7.5 mg/kg) are used for the treatment of *O. ovis myiasis*.
- *Spraying with insecticides can reduce activity of the nasal adult bots.*

FUNGAL INFECTIONS

- The importance of the disease is related to the destruction of the skin leading to losses in the leather industry. Ringworm is characterized by round, alopecic lesions which expand in a ringed fashion. The lesions may be only localised to few parts but may also spread and cover the entire body.
- Spontaneous regression of the lesions occur in 4-5 weeks. Fungal spores or hyphae can be demonstrated in skin scrapings.
- Treatment is not normally undertaken because spontaneous recovery occurs but commercial anti-fungal preparations may be used when circumstances necessitate treatment.

Thank You!!!!