# SCIENCE EDUCATION SERIES

## NO. 29

# DISEASES AND PARASITES OF DOMESTICATED ANIMALS IN SRI LANKA

by

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NATURAL RESOURCES ENERGY & SCIENCE AUTHORITY
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## FOREWORD TO THE SERIES

The dissemination of scientific information is one of the main functions of the Natural Resources, Energy & Science Authority. The Journal of the Natural Science Council published by this Authority provides a medium for the publication of scientific research papers, and "Vidurava", the quarterly science bulletin contains scientific articles of a general nature which is of interest to the public.

There is still a wide gap in the availability of reading material on scientific subjects of local interest. One result of this is that science students confine their reading only to their school notes and to the few available text books which are mostly published abroad. In an attempt to improve this situation, the Working Committee on Science Education Research of the Natural Resources, Energy and Science Authority decided to publish a series of booklets on scientific topics of local interest as supplementary reading material for students and the general public. The authors who have been selected by the Committee to prepare these booklets are experts in their respective fields. The manuscripts that were submitted by the authors were examined by referees before being accepted for publication. The views expressed in these publications are those of the authors and are not necessarily those of the Natural Resources, Energy & Science Authority.

I must thank the Working Committee on Science Education Research of the Natural Resources, Energy & Science Authority, and in particular Prof. V. Basnayake who is the Hony. Director of the Working Committee for the work they have done to make this project a success.

**R. P. Jayewardene**
*Director-General*

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# CHAPTER 1

# DISEASES OF CATTLE AND BUFFALOES

## NOTIFIABLE DISEASES IN SRI LANKA

In Sri Lanka, certain diseases of cattle are classified as notifiable. These diseases are essentially of an infectious nature and they are usually of considerable economic importance. It is vitally important to notify the nearest veterinary surgeon or the Grama Sevaka of the area, the moment the presence of the disease is suspected. If the existence of the disease is then confirmed by careful diagnosis, the premises should be immediately put under strict quarantine and thoroughly disinfected to prevent further spread of disease. The notifiable diseases in Sri Lanka are discussed below.

### FOOT AND MOUTH DISEASE

Foot and Mouth Disease (FMD) is an acute, highly infectious virus disease, predominently of cattle, but affecting all cloven-footed animals. In Sri Lanka, FMD appears to have existed even prior to 1842 and the first major outbreak was recorded in 1928 when the entire country was affected. This disease may occur sporadically in any part of the country. However it occurs in epidemic form periodically, roughly at intervals of four to six years.

A study of the pattern of outbreaks of FMD shows that the disease very often originates from certain villages in the eastern province, which are surrounded by jungles; and spreads to other parts of the country. It is thought in these instances the wild animals in the jungle are the source of infection. The study also indicates an increase in the incidence of FMD from about November to February, which coincides with the North East monsoonal period. Thus the occurrence of the disease in Sri Lanka seems to be influenced by climatic conditions and wild life.

Seven serotypes of FMD virus are known to exist, and of these only two types, namely, O and C have so far been detected in Sri Lanka. Animals pick up the virus either by direct contact with an infected animal or indirectly by contact with contaminated materials such as utensils, feedstuffs or fodder. Humans, birds and wild life have also been incriminated in several outbreaks in Sri Lanka.

The first observable symptom is an elevation of body temperature with profuse salivation and lameness. Upon closer inspection, vesicles will be seen inside the mouth, on the tongue and between the digits. The affected animals

make a peculiar smacking sound. After a few days, the blisters rupture leaving raw painful ulcers thus resulting in loss of appetite and loss in condition.

Blisters in the foot burst quickly because of the movement of the feet. These may be secondarily infected with bacteria. Death from this disease is rare among the indigenous 'Lanka' and Indian breeds, although some young animals may succumb to the condition. In the case of exotic breeds, however, the severity of FMD is greater.

The disease causes considerable economic losses to the cattle industry due to,

i) Reduction in milk yield during the course of the disease and after recovery.

ii) Loss of draught power due to lameness, which may sometimes become permanent.

iii) Loss in breeding efficiency. Pregnant animals may abort while some recovered animals may become sterile for life.

Since FMD is a virus disease, there is no specific treatment for this conditions. Treatment is aimed at preventing secondary bacterial infection and maggot infestation. To prevent the bacterial infection, affected areas can be regularly washed with five percent copper sulphate ('Blue Vitriol') solution and the maggot infestation of the foot can be prevented by applying Stockholm tar. Good nutrition and management will also help in speedy recovery. Recovered animals have a natural immunity, which has been shown to last from one to four and a half years.

When an outbreak of FMD occurs, every effort must be made to contain the disease within the farm or village in which it was first detected.

i) Notify the authorities concerned.

ii) Restrict the movement of animals, vehicles, persons and transport of feedstuffsin and out of such areas.

iii) In the developed countries, FMD is controlled by slaughter of affected and in-contact animals. In Sri Lanka, however, slaughter policy is not usually attempted because of the immense expenses involved.

iv) Vaccinate all the animals in the surrounding areas.

Outbreaks, however, can be minimised by regular vaccination of animals. Maternal immunity in calves lasts upto six months. Allcalves should be, therefore, vaccinated at six months with the appropriate local vaccine, subcutaneously at dewlap region. The duration of immuntiy is about six months. Therefore to maintain herd immunity at a high level, animals should be re-vaccinated every six months particularly in areas where FMD is endemic.

## HAEMORRHAGIC SEPTICAEMIA

Haemorrhagic Septicaemia (HS) is an acute septicaemic disease causing high mortality and is more common in buffaloes than in neat cattle. In Sri Lanka, this disease was recognised to occur in epidemic proportions in 1955 and since then it has occurred regularly, every year.

HS is more prevalent in the dry zone of Sri Lanka, where it is seasonal in occurrence. Outbreaks usually occur with the onset of North-East monsoonal (*Maha*) rains following hard work and stress. In these areas animals are normally in poor condition during the onset of *Maha* rains, partly because of the under nutrition during the preceding drier months and partly because they are heavily used for ploughing paddy fields when rains come.

HS is caused by specific serological types of the bacteria, *Pasteurella multocida*. The serotype present in Sri Lanka is called type 6:B. This is found in the nose and throat of healthy 'carriers' which carry the bacteria from one season to the next and from there spread to susceptible in-contact animals either by ingestion or by inhalation. There is no doubt that stress due to exhaustion, excessive work (particuarly in buffaloes) and starvation are factors responsible in precipitating the disease, presumably by causing latent 'carrier' animals to shed virulent bacteria into the environment.

The incubation period of the disease is about two to five days and this is followed by sudden onset of high fever (106-107°C). Other symptoms which follow almost immediately are dullness, loss of appetite and profuse salivation. Hot, painful subcutaneous swellings can be seen at the throat, spreading to dewlap and tongue. The throat lesions bring about difficulty in breathing and sometimes even suffocation. Death may intervene within six to 24 hours. In less acute cases, the alimentary tract is involved and haemorrhagic diarrhoes is seen. It has been estimated that about 8% of the cattle and 14% of the buffaloes in the dry zone die of HS causing an economic loss of over 100 million rupees annually.

Treatment is satisfactory only if given during the early stages, but the rapidity of the disease often prevents this. Sulphonamide drugs, particularly 'sulphadimidine', have been found to be effective. For treatment, 'sulphadimidine' (33.3 percent solution) should be given, sub-cutaneously or intra-venously

at the rate of 0.6 ml/kg body weight. Antibiotics such as streptomycin and oxytertracycline are as effective, and can be conveniently administered by the intra-muscular route. The disease is best controled by regular vaccination.

i) Vaccinate calves at 4 — 6 months with local adjuvant vaccine, intra-muscularly. Immunity from this vaccination lasts for 6 — 9 months.

ii) Re-vaccinate calves 3-4 months later.

iii) In dry zone areas, where rainfall is seasonal, vaccination should be done every year, one or two months prior to the onset of *Maha* rains.

iv) Whenever an outbreak of HS occurs, irrespective of previous vaccination history, all animals in the neighbourhood must be vaccinated using the alum precipitated vaccine.

## ANTHRAX

Anthrax is an actute, infectious disease of livestock communicable to man. This condition is characterised by sudden death. Cattle, sheep and goats are the most frequently affected species. In Sri Lanka the disease is common in the Northern province, while outbreaks occur sporadically in other parts as well.

*Bacillus anthracis,* a bacteria, is the specific cause of the disease. The bacilli in their active state are easily killed by disinfectants. But when passed from the bodies of sick or dead animals onto the ground, they form spores which are resistant to cold, heat and chemical disinfectants. These spores can lie dormant in the soil even for 20 years and still capable of infecting animals. Anthrax spores have been regularly isolated from soils all over Sri Lanka. It is not known, however, why the disease does not occur in the premises where organisms have been readily isolated.

Cattle contact the disease usually through infected food and water. Biting flies and dogs feeding on infected carcases have also been incriminated as sources of infection. Onset of the disease is so sudden that, in most cases, the animal is found dead without any premonitary signs. The clinical signs associated with the disease are dazed appearance, blood-shot eyes and nostrils, high fever (upto 107$^0$C) and muscle tremor. After a few hours, the animals may collapse and die. The period elapsing from infection to death is generally ten to forty eight hours. After death bloody discharging appears at the mouth, nostrils and external genital organs.

Although antibiotics are highly effective in the treatment of anthrax, because of the rapid nature of the disease rarely one gets an opportunity to treat

the affected animals. Where early diagnosis is possible (a rarity), penicillin can be given at the rate of 4 mg/kg body weight daily for at least six days. During an outbreak of anthrax, the following control measures should be adopted to prevent further spread of the disease.

i) Prompt disposal of the carcass by complete burning or deep burial in quick-lime. A depth of two metres is often prescribed for burial. All litter, dung and other contaminated material should be buried along with the carcass with a thick layer of lime on top and bottom.

ii) Disinfection of the premises where the animal died

iii) Animals should be kept out of the premises at least for six months.

iv) Vaccination of all animals in the area. Duration of the immunity is one year and after an outbreak annual re-vaccination should be carried out for at least three years.

## BLACK QUARTER

Black Quarter is an acute infectious disease caused by a bacteria, *Clostridium chauvoei.* It affects most commonly young cattle, six months to two years old, but may also occur in sheep and goats. *C. chauvoei* has been frequently isolated from Sri Lanka soils. The disease is common in the dry zone of Sri Lanka where it occurs seasonally during the warmer months of the year from July to August.

*C. chauvoei* is a toxin-producing anaerobe, the spores being highly resistant to heat and dessication. The spores survive in soil for many years. The spores probably enter the body through ingestion or by contamination of a wound. The disease does not spread by direct contact between the animals.

The disease is characterised by marked lameness with swellings in the upper part of the affected leg, complete loss of appetite and elevated temperature. Swellings are at first hot and painful, but soon become cold and painless, and the characteristic crackling sound due to gas formation within the swellings can be felt. The skin over the affected area become dry, hard and dark in colour. Soon trembling starts leading to violent convulsions and animals die within 36 hours.

Good results can be obtained with heavy doses of penicillin or a broad spectrum antibiotic, if rapid treatment follows early diagnosis. The disease is best controled by vaccination.

i) Vaccinate all calves at about 50 days.

ii) Revaccinate at 6 months and thereafter at 6 monthly intervals up to 2 years.

## BABESIOSIS

Babesiosis (or tick fever) is caused by two species of protozoan parasites found in the red blood cells of cattle, namely *Babesia bovis* and *B. bigemina*. In Sri Lanka, the disease is transmitted by the common cattle tick. *Boophilus microplus*. The incidence of babesiosis, therefore, closely parallels the incidence of the vector tick. Tropical breeds of cattle are much more resistant to tick fever than European breeds. Babesiosis is very common in mid and hill country regions of Sri Lanka where European breeds of cattle are maintained. The disease most frequently occurs during the dry periods, from March to April and form August to September.

Protozoa appear in the blood from seven to thirty five days after tick bite. At the time parasites appear in the blood the temperature rises and in milking cows, there is a fall in yield. This is followed by loss of appetite, depression and weakness. Shooting diarrhoea and coffee - coloured urine are other characteristic signs of the disease. Increased heartbeat and respiration become evident and are followed by anaemia. There will be jaundice towards the latter stages. In non-resistant animals, babesiosis can be highly fatal. A nervous syndrome may be seen in *B. bovis* infections characterised by excitement, delirium and inco-ordination of gait.

For treatment, diminzine aceturate ('berenil') at the rate of 3.5 mg/kg body weight should be given subcutaneously at the dewlap region. The drug is very effective and all protozoal stages are killed within 24 hours. If the animal is extremely anaemic, iron supplementation, orally or intramuscularly, is recommended.

Control of babesiosis could be achieved by two ways:

i) By eliminating the tick vector. Ticks can be eliminated by regular dipping or spraying of animals. Of the insecticides available, the most effective ones are the organo-phosphorous compounds like 'Asuntol'.

ii) The disease can be controlled by the use of vaccines which consist of blood from calves infected with either attenunated strains of *Babesia* or those subjected to irradiation. Such vaccines can be stored only for short periods, in liquid nitrogen. The vaccine is produced at the Veterinary Research Institute, Gannoruwa, and batches of calves can be immunized by prior arrangement.

### RINDERPEST

Rinderpest, or cattle plague, is a highly contagious viral disease of cattle, which during the nineteenth century caused serious economic losses. It was eradicated from Sri Lanka in the 1940s through systematic disease control methods. But the disease still exists in India, and the recent outbreak (1988) in the Eastern Province is associated with the animals brought from India.

Early symptoms include high fever, lack of appetite, inflammation of nasal and mouth membranes, salivation and nasal discharge. Severe diarrhoea, difficult breathing and a persistent cough are seen in the later stages. The temperature eventually becomes subnormal and death occurs within 6 - 10 days.

The rinderpest virus is readily destroyed by heat, by drying and by disinifectants, and will survive only a few hours outside the animal body. Transmission occurs only through close contact with infected animals. The control of rinderpest is therefore straightforward. A strict quarantine of affected animals and the surrounding area, along with an organized vaccination programme, is generally very effective.

## OTHER INFECTIOUS DISEASES

### FOOT ROT

The term 'Foot Rot' is used to describe a number of necrotic conditions affecting the feet of cattle, sheep and goats. The disease causes considerable economic loss in dairy farms where cattle frequently sustain foot injuries and stand for lengthy periods in mud. Usually the occurrence of the disease is seasonal, being much higher in incidence during hot humid seasons.

The disease is caused by a bacteria. *Fusiformis nodosus* (also called *Supherophorous necrophorus). F. nodosus* infects only when other factors are involved, either physical, such as injuries to the skin, or biological, such as attack by other organisms, which may create suitable conditions for infection. The disease is transmitted directly from infected to healthy animals.

Usually the first indication to be observed is lameness and with progressive invasion there is a rise in temperature, loss of appetite and loss in condition. Milking cows show a serious drop in yield. Area between claws swells up and the claws spread out. Further infection leads to abcess formation and death of deeper tissues. A characteristic foul odour is invariably present. In warm weather the feet may become infested with maggots. If untreated lameness may persist for several weeks during which period animal loses

condition, but affected foot may clear up. However, within the misshapen hoofs the infection often remains to break out again in the herd.

Proper treatment demands the removal of all dead tissues and hoof trimming. After this feet should be cleaned with a suitable disinfectant, such as ten percent formalin or 20 percent copper sulphate solution. To prevent maggot infestation, the wound may be treated with chloramphenicol oinment or stockholm tar. For best results, the treatment should be repeated at two to four day intervals. This should be supported by intravenous injection of sulphapyridine (M & B 693) at the rate of 0.2 g/kg body weight or by intramuscular injection of antibiotics at the normal dosage.

The disease is best controlled by the provision of mud-free yards, dry standings, regular hoof trimming and good sanitation. A foot bath, containing a disnifectant, placed near the entrance to milk shed in the farm is generally quite effective.

## MASTITIS

The term 'mastitis' refers to inflammation of the mammary gland, regardless of the cause. Although mastitis occurs in almost all mammals, it is of major economic importance only in dairy cattle. It is not unusual to find infectious mastitis in half the cows in a herd. In limited surveys conducted in Sri Lanka figures as high as 100 percent have been recorded. It is thus evident that mastitis is a serious threat to dairy development in our country.

The aetiology of mastitis is complex, it being caused by a wide variety of organisms and also by physiological and chemical means. The commonest cause of chronic contagious mastitis is *Streptococcus agalactiae.* Other bacteria, such as *S. dysgalatiae, S. uberis, Staphylococcus aureus, Escherichia coli, Corynebacterium pyogenes,* fungi and yeast also have been implicated in mastitis. There are two main sources of infection of mastitis, the infected udder and contaminated environment. The disease usually spreads by unhygienic milking.

Mastitis is characterised by physical, chemical and usually bacterilogical changes in the milk and by pathological changes in the glandular tissue of udder. The most important changes in the milk include discolouration, presence of blood or milk clots and the presence of a large number of white blood cells. The udder changes consist of swelling, which gives the organ a baloon-like appearance, pain and hardening, but sub-clinical cases may not show signs of pain. As the disease progresses, milk yield decreases and the affected tissue of the udder permanently loses its function.

Of the three forms of mastitis, namely sub-clinical, sub-acute and acute, the first one is difficult to detect and is the most troublesome to the farmer. Although there are no visible changes in the milk or udder, this condition is important because there is usually about ten percent drop in the milk yield and the majority of these cases flare into the clinical form. Of the tests used to detect sub-clinical mastitis, 'California Mastitis Test', which reflects the total leucocyte count, is the most commonest and reliable.

Antibiotics have proved to be the most useful therapeutic agents in the treatment of mastitis. The most widely used antibiotic is penicillin and the most convenient means of administration is by udder infusion via the teat canal. Treatment should be continued until recovery. However, not all mastitis producing micro-organisms are equally responsive to penicillin and therefore the antibiotic used should be matched to the causal organisms. In addition to the specific treatments to eliminate the causal agents, supportive treatments should also not be neglected. These include frequent hot fomentation of the affected quarters followed by gentle massage and stripping out to assist drainage of the inflammatory products.

The best method of controlling the spread of mastitis is to isolate the infected animals and to use sanitary measures. A five-point mastitis control programme is given below.

## 1. MILKING ORDER IN THE HERD

Cows are classified into groups on the basis of 'California Mastitis Test' and the following order of milking is a good routine to follow.

| | |
|---|---|
| Group I | Mastitis-free herd — milked first. |
| Group II | Mastitis recovered herd. |
| Group III | Mastitis suspected herd. |
| Group IV | Mastitis herd — milked last. |

## 2 HYGIENIC MILKING

i) Wash cows well before bringing into the milking shed.

ii) Wash the udder with soap and mild disinfectant.

iii) Do not wipe the udder or milker's hand with a cloth.

iv) Do a 'strip cup' test for presence of any abnormalities. If positive, milk them last.

v) Milk gently, quickly and completely using full hand technique of milking.

vi) Dip all four teats in a suitable disinfectant at the recommended concentration after milking.

## 3. DRY COW THERAPY

Sub-clinically infected quarters are best treated at the end of lactation, at drying off, with long-acting antibiotic preparations. These persist in the udder for 21 days and give much higher cure rates than quick-acting formulations given during lactation.

## 4. PROTECT UDDER FROM INJURIES

Since udder injuries predispose mastitis, protection of the udder from injuries is also of equal importance. A good housing and adequate stall space are absolute necessities to protect udder from injuries.

## 5. CONTROLLED CULLING

Cows having repeated attacks of chronic mastitis and not responding to treatment should be culled.

## BOVINE TUBERCULOSIS

Tuberculosis is a chronic, infectious disease characterised by the slow, progressive development of 'tubercles' in almost all the organs in the body except the skeletal muscles. It is zoonotic condition and children especially can become infected from drinking unpasteurized milk from tuberculous cows. Organisms are excreted in the milk and therefore milk is the most common source of infection. Though many years back, tuberculosis was detected in certain herds in Sri Lanka, now it appears to have been completely eradicated.

The disease may be caused by *Mycobacterium bovis*. The main method of transmission is directly from one animal to another by inhalation of droplets of nasal discharge from infected animals. Infection may also occur by ingestion of infected materials such as flesh or milk. *M. avium* and *M. tuberculosis* cause a chronic or retrogressive type disease in bovine and are communicated to cattle by birds and man. However, it is rarely that the infection is transmitted to cattle by man.

During the early stages, the disease is localised and shows no signs. However, progressive emaciation and a variable appetite is often seen. A most frequent indication of the disease is a chronic hacking cough occurring at irregular intervals. There is no effective treatment to the disease. A sound system of control by the use of 'tuberculin' test and elimination of reactors is preferred. The 'tuberculin' test, in general, consists of the intradermal injection of a small quantity (0.1 ml) of a culture of tubercle bacilli into an animal. Diseased animals react after 72 hours by exhibiting a swelling at the injection site which, by actual measurement of its size with calipers, can be interpreted as a reaction or otherwise subject to certain qualifications.

## ACTINOBACILLOSIS

Actinobacillosis is an infectious disease of cattle, which was first reported in Sri Lanka in 1983. The disease is caused by the bacteria, *Actinobacillus lignierisi.* Injury for the micro-organism to gain entry. Discharges of pus from infected animals are the source of infection to others.

The disease appears characteristically in the tongue or in the parotid region. At the parotid site, there is swelling which gradually increase in size, and become cold, hard and painless. Abscesses, that burst when mature, exudate a thick creamy, odourless, finely granular pus. Lymph nodes draining the region are invariably enlarged and may erupt with the characteristic pus. When the tongue is involved, excessive salivation and chewing motion can be seen.

Prompt treatment is probably the only effective control method. Isolation of affected animals is recommended to prevent the spread of infection. Local injections of antibiotics, when the abscess is circumscribed, can be quite effective provided they are commenced early in the infection. Surgical removal of the abscess is recommended where this is feasible.

# METABOLIC DISEASES

Metabolic diseases should be considered to some extent as man-made diseases, since they are largely the result of man's success for forcing higher production from dairy animals. They basically arise as a result of an imbalance between the supply of nutrients and the requirement of the animal. A common feature of these disorders is that they are almost exclusively confined to lactating or pregnant animals, in which the requirements for nutrients are high. Two metabolic diseases, namely milk fever and ketosis, are somewhat common among the high yielding cows in Sri Lanka.

## MILK FEVER

Milk fever (Parturient paresis or hypocalcaemia) is a complex condition that occurs most commonly within 48 hours of parturition in high-producing cows. Though a depression of the levels of ionized calcium in tissue fluids is the basic biochemical defect in parturient paresis, low serum levels of phosphorus and magnesium also play subsidiary roles. Mature cows, 5 to 10-years of age, appear to be most commonly affected.

Affected animals stagger in a dull manner and show reluctance to feed. Characteristic signs include grinding of teeth and tremors of the head and neck. At later stages, the cow becomes recumbent with the head turned into the flank in a characteristic manner. Milk fever, the common name, is a misnomer as there is no fever in this condition. The temperature may be normal or subnormal and usually there is no defaecation.

Treatment is indicated at any stage and will arrest further deterioration of the condition. But in the absence of treatment, death is the usual outcome and may occur within eight hours of the onset of clinical signs. Death is in fact rare, because treatment is highly effective. Treatment consists of the administration of calcium borogluconate (400 to 800 ml of a 25 percent solution depending on the weight of the cow), with or without magnesium, either subcutaneously or intravenously.

## KETOSIS

Ketosis (Acetonaemia) is primarily encountered during the first six weeks of lactation, with the highest incidence in high yielding cows. In Sri Lanka, ketosis is commonly precipitated by a fall in the feed intake resulting from feed shortage. A situation therefore develops in these animals where the suppy of glucogenic precursors to the liver is no longer sufficient to meet the demands of the body, milk or foetuses for glucose. The imbalance between supply and demand leads to the following sequence of metabolic events.

(1) A fall in the blood glucose concentration and a lack of glucose for synthetic and oxidative purposes.

(2) Lack of carbon skeletons to fuel the kreb's cycle for the production of energy.

(3) Mobilization and oxidation of free fatty acids from depot fat to provide energy as an alternative to the kreb's cycle.

(4) Accumulation of large quantities of acetyl coenzyme A and its condensation to form ketone bodies.

The early signs may be loss of appetite, sudden loss in milk yield and cessation of rumination and bowel movements. Animals may show excitability and inco-ordiantion. The breath and milk of affected cows have a sweet, rather sickly smell because of the presence of ketone bodies. The disease is rarely fatal as the fall in the milk yield relieves the animal of the nutritional stress.

Treatment is primarily aimed at increasing the supply of glucose to the tissues and is achieved by the following means:

(1) Intravenous administration of glucose.

(2) Introduction to the rumen of suitable glucose-forming substances; sodium propionate or glycerol at the rate of 4 - 8 ounces a day may be given for 5 days as a drench.

(3) Stimulation of gluconeogenesis by the intra-muscular administration of corticosteroids; Dexamethasone 10 mg or Hydrocortisone 0.5 g are effective.

Epsom salt may be given as a drench to encourage bowel movement followed by molasses and water as a source of carbohydrates. Exercise is also an important part of treatment. The incidence of ketosis can be greatly minimized by good husbandry and proper feeding.

## REPRODUCTIVE DISEASES

There are some contagious diseases which affect the reproductive system of cattle causing either abortion or embryonic death. These diseases cause considerable financial loss for a dairy herd not only through the loss of calf, but also through reduction of milk yield and fertility.

### BRUCELLOSIS

The most important reproductive disease in Sri Lanka. Preliminary surveys on brucellosis indicate that the incidence of this disease varies from one region to another in Sri Lanka. The disease is absent in the mid and the hill country regions. The highest incidence is in the North Central and Eastern Provinces where in certain herds, as many as 40% animals may be infected. Elsewhere, pockets of infection with varying percentage of reactors is present. The disease is caused by a bacteria, *Brucella abortus*. The bacteria is usually transmitted through ingestion of infected material, but infection can also occur via the respiratory tract, injuries, bloodsucking insects and copulation.

Abortion is the most prominent sign of the disease. Abortion usually takes place after the fifth month of pregnancy and is accompanied by a sticky rust coloured odourless discharge. Retention of the placenta and metritis (inflammation of uterus) often follow the abortion, and the animal remains temporarily or permanently infertile. In bulls, clinical signs may be absent. If they are present, they are in the form of orchitis (Inflammation of testicles), lack of sexual activity and infertility. Milk from infected cow may contain *B. abortus* and can cause undulent fever in man, if the milk is consumed without adequate heat treatment.

No effective treatment is known. Thus attempts are usually made to control the disease rather than treating it. There are several basic factors in control.

i) SANITATION — Sanitation involves the elemination of the source of infection and disinfection of the environment. The aborted foetuses and membranes must be located and burned or buried. Infected cows should be isolated and should not be served for at least for three months. Infected bulls should be culled.

ii) CULLING — In regions such as the mid and hill country or in herds elswhere in the country which have hitherto been free of brucellosis, the moment a case is detected, it is advisable to get the entire herd *Brucella* tested and to cull all reactors.

iii) IMMUNISATION — Vaccination is done using a live atteneuated vaccine ('strain 19') on female calves between three and six months. The vaccine is given subcutaneously at the caudal region. Vaccination is recommended only in areas where the disease is endemic, or in heards with a high prevalance of disease.

iv) BULL TESTING — Since the disease is transmitted by sexual contact, it is advisable to test all stud bulls regularly, and if found to be infected, they must be culled immediately.

## VIBRIOSIS

Though this disease is probably present in Sri Lanka no work has been done and therefore, it is not possible to assess its relative importance. The disease is caused by a bacteria *Vibrio (Campylobacter) foetus*. Transmission occurs, via the infected bull, during copulation. Infected bulls, however, do not show any clinical signs. Cows repeatedly and irregularly return to heat and eventually conceive, but later abort usually between four and seven months. Abortion rate is generally low.

Bulls may be treated with antibiotics in the form of penicillin or streptomycin cream injected into the prepuce. There is no direct treatment for cows. The disease is best controlled by the rigid check of bulls for the presence of *V. foetus.*

### TRICHOMONIASIS

This is caused by, a pear-shaped protozoa, *Trichomonas foetus.* Transmission is by copulation. Cows show signs of a profuse watery vaginal discharge about two weeks after coitus. Abortion may occur as early as one to four months and seldom after fifth month. The simplest control method is to stop breeding of cows for at least three heat periods and to use a clean bull for service or collection of semen for insemination.

## DISEASES OF CALVES

The most susceptible period in a young animal's life is the first three months of age during which time it is considered to be most susceptible to microbial infections, due mainly to the deficiency of immune antibodies. This vulnerability is often aggrevated by bad conditions of management resulting in either retardation of growth or death itself. A study of calf mortality conducted in some state cattle farms in Sri Lanka points out to an overall mortality rate of 20 - 25 percent. Under farm conditions, this figure may be expected to be still higher.

The loss of calves is a serious threat to the expansion of the livestock industry. Such losses can be largely reduced by good management. The most important single safeguard is to ensure that the calf drinks an adequate amount of colostrum within the *first few hours of life.* Colostrum is the first milk secreted by the udder at the birth of the calf. It is markedly different from normal milk. In addition to its high nutrient content and laxative nature, the colostrum also carries antibodies from mother to calf. The passive immunity thus acquired protects the calf against any infections during its early life.

### NAVEL ILL

The most common disease of calves in Sri Lanka. Navel ill (Joint ill) is caused by the entry of a variety of pathogenic organisms into the navel soon after birth, causing a localised infection and formation of abscesses in the navel. Organisms later enter the liver and the joints, multiply and cause enlargement of the joints. The affected animal will be unable to walk. If untreated, it terminates, in death.

The organism responsible varies, but is usually a *Streptococcus*, which respond well to sulphonamide or penicillin treatment. Navel ill could be easily prevented by good sanitary practices at calving time, particularly by treating the navel chord with a tincture of iodine.

## CALF PNEUMONIA

The major cause of mortality among calves in Sri Lanka.Contribution of this disease to total deaths has been reported to be as high as 60 percent in Bopatalawa and Polonnaruwa State Cattle Farms. Calf pneumonia is a highly infective respiratory disease characterised by inflammation of lungs.

In Sri Lanka, on an aetiological basis, pneumonia is caused commonly by viruses, often complicated with secondary bacterial infections. Occasionally pneumonic pasteurellosis which is a primary bacterial pneumonia, caused by *Pasteurella multocida,* is encountered. This second form has been reported only in young buffaloe calves. Bad housing, chilling from exposure and undernourishment predispose calf pneumonia.

The signs include elevated temperature, lack of appetite, harsh hacking type of cough, heavy breathing, discharge from nostrils, dullness and emaciation, terminating in death. Sick animals should be promptly isolated. Antibiotics and sulphonamide medications are treatments of value against the secondary bacterial infections. The disease is best controlled by good housing, adequate nutrition and sanitation. On account of the multiplicity of viruses and bacteria involved, no standard, effective pneumonia vaccine has been produced. In specific instances, autovaccines prepared against bacteria isolated from a particular outbreak of pneumonia has been found to be effective.

## COLIBACILLOSIS

An infectious disease of young calves caused by microorganisms, particularly *Escherichia coli,* which enter the digestive tract by way of the navel chord at birth or the mouth later on. The disease is largely due to faulty hygiene.

The disease is characterised by a profuse yellowish-white diarrhoea with pungent and disagreeable odour, exhaustion and emaciation. Severe attacks may be fatal. Diagnosis is often difficult, since diarrhoea may be due to various other causes. Treatment is of little use after symptoms appear. Broad spectrum antibiotics, such as tetracycline, may be used at the rate of 55 - 110 mg/kg body weight in two to three divided doses. Reducing the amount of milk and feeding diluted milk in several meals, when scours are first seen are desirable. The disease is best controlled by sanitation and proper care and feeding of new born calves, particularly with colostrum.

## SALMONELLOSIS

This is a specific bacterial infection caused by species of the genus *Salmonella.* It may cause a diarrhoea or a septicaemia. The speticaemic form occurs most commonly in weak calves deprived of colostrum. The commonest type of *Salmonella* affecting calves in Sri Lanka is *S. dublin.*

The disease mainly affects older calves, six to eight months old, and rarely young ones. Transmission occurs usually by contaminated materials. Symptoms include dullness, high fever and inco-ordination of gait, followed by diarrhoea containing blood clots. If untreated, death may occur at any time between 24 hours and five days. Broad-spectrum antibiotics ('Tetracycline', 'Chlorampenicol') or 'Sulphadimidine' could be used with some success in the treatment of the disease. Good management, hygiene and proper feeding can go a great way towards controlling the disease. In farms where the salmonellosis is endemic and the serotype involved is known, vaccines prepared against this organism may be effective.

## COCCIDIOSIS

The disease is caused a protozoan parasite, belonging to order *Coccidia,* genus *Eimeria.* The *Coccidia* multiply in the intestinal tract for a time, then change into oocysts — a resistant form — which are discharged in the faeces and are picked up by other animals from contaminated surroundings. Young calves are especially susceptible to serious coccidiosis.

Coccidiosis causes extensive destruction of cells of the intestinal lining. The early signs are loss of appetite, followed by a bloody diarrhoea, which soon results in profound anaemia. Dehydration and weakness are marked. Death may occur within about seven days.

Calves about six months or older are affected most. Sulphonamides, particularly sulphadimidine, are successful for treatment. For calves, the recommended dosage of sulphadimidine is 150 mg/kg body weight. Good hygiene and avoidance of overcrowding are the best possible ways of controlling coccidiosis.

# PARASITIC DISEASES OF CATTLE

Parasitic infestations cause considerable economic losses and are very important in a tropical country like Sri Lanka. Though most of them may not cause heavy mortality, the losses due to parasitism are much more insidious. An estimation puts the annual losses due to parasitic conditions at over 50 million rupees. The common parasites of cattle for Sri Lanka are discussed below:

## CESTODES

Important internal parasites of cattle. Cestode (tape worm) infestation is not a serious problem in mature cattle, but can be a problem in calves in some dry zone areas. The most important cestode species are *Moniezia expansa* and *M. benedeni.* The signs include rough coat, 'pot belly', anaemia and sometimes diarrhoea. The most effective control is the use of nicolosamide ('mansonil') at the dosage of 50 mg/kg body weight.

## GASTRO-INTESTINAL NEMATODES

Several species of nematodes (round worms) which infect the abomasum and small intestine of cattle are responsible for the condition known as 'parasitic gastro-enteritis'. The species of importance in Sri Lanka are *Haemonchus contortus, Mecistocirrhus digitatus, Trichostrongylus axei* and these species occur in the abomasum, whereas *Neoascaris vitulorum, Trichostrongylus* spp. and *Bunostamum* spp. occur in the small intestine.

Of these, *H. contortus, M. digitatus* and *Bunostomum* spp. are virulant blood suckers. Others apparently affect the host animal by producing toxins or by producing anti-enzymes which interfere with digestion. When found in large numbers, *N. uitulorum* may tangle together like solid mass producing serious intestinal obstructions.

The effects of these internal parasites are more pronounced in young animals, but adults are resistant. The worms cause varying degrees of anaemia and inflammation of the mucous membranes of the abomasum and small intestine. Scouring, loss of appetite and unthriftiness are the likely results of heavy infestation, and many affected young animals die. With *Haemonchus* and *Bunostomum,* oedama is likely and is often seen as a swelling at the throat region known as 'bottle jaw'.

*Neoascaris* infections in young calves, especially buffaloe calves, can be effectively treated with a piperazine compound (such as 'Coopane') at the rate of 220 mg/kg body weight. The most versatile drug for the blood sucking worms of the abomasum and intestine is phenothiazine ('Phenovis'). It is given as a drench at the rate of 200 - 400 mg/kg body weight. Tetramisole ('Nilverm') is also a highly effective anthelmintic. This is given as a drench at the rate of 15 - 20 ml/animal. Prevention of parasitic infestation depends largely on adequate nutrition, proper grazing management and regular worming.

## TICKS

Most important external parasite of cattle for Sri Lanka.They weaken the animal by sucking blood, damage hides and also transmit tick fever

(Babesiosis). The commonest tick found in Sri Lanka is *Boophilus microplus*. Regular dipping or spraying of animals has to be done to control these ticks. 0.05 percent coumaphos ('asuntol') solution or one percent trichlorphon ('neguvon') are highly effective against ticks.

CHAPTER 2

# DISEASES AND PARASITES OF SHEEP AND GOATS

Since the sheep and goat industries of Sri Lanka are still in their infancy, many serious diseases reported in other countries are yet to be recorded in Sri Lanka. The most common disease encountered by the first experiments are discussed below.

## CONTAGIOUS PUSTULAR DERMATITIS

Contagius Pustular Dermatitis (CPD) is a highly infectious disease caused by a virus. The disease is more severe in lambs and kids under one month of age producing raw sores chiefly around the mouth. Occasionally older animals are infected and the sores may appear elsewhere, notably on the udders.

Early clinical signs are somewhat reddened and swollen lips and gums. Later watery blisters appear and soon these rupture leaving raw bleeding sores. Scabs form, making it difficult for animals to nurse or eat. Thus affected animals lose condition. If secondary bacterial or maggot infections do not develop, the scabs gradually dry up and fall off in 15 to 20 days without leaving scars. CPD rarely causes death, except when complicated by secondary infections.

There is no specific treatment for this disease. The secondary infections, however, can be prevented by washing the mouth with a mild copper sulphate solution and applying margosa oil. Clean house and concentrate feeding will assist in speedy recovery. Animals that have recovered from sore mouth are immune for one year or more. The diseases is best controlled by vaccination with a local vaccine. It is applied much like small pox vaccine by means of a swab over a lightly scratched area inside one thigh. CPD is a Zoonosis. Care should be taken, therefore, when handling the infected animals.

## FOOT ROT

A common disease of sheep and goats caused mainly by a bacteria, *Fusiformis nodosus*. The occurrence of the disease generally coincides with rainy season, when the ground is muddy. Injuries in the skin act as predisposing factors to the condition. Thus animals kept under intensive conditions are more likely to suffer.

The disease is characterised by inflammation, necrosis, ulceration and penetration of underlying tissues of the foot accomanied by a characteristic

foul odour. Lameness is the first symptom noted. With progressive invasion, there is a rise in temperature, loss of appetite and loss of condition.

The disease is chronic and untreated animals may remain infected for years. Although mortality is uncommon, without treatment most animals become emaciated. Infected necrotic hoof should be completely pared away for any treatment to be successful. There are several treatments available, such as dipping the infected foot into a ten percent formalin solution for about ten seconds or if many animals are to be treated they may be driven through a foot path containing a five percent solution of formalin. Copper sulphate solution could be used in place of formalin. Sulphadimidine intravenously or Chloramphenical five percent topical application are specific and effective treatments for individual animals. The disease could be easily controlled by good sanitation, regular hoof trimmings and provision of dry standings and foot bath, especially during the rainy season.

## ENTEROTOXAEMIA

Enterotoxaemia (or Puply Kidney Disease) is an acute and fatal disease of lambs and kids caused by a bacteria, *Clostridium welchi*. An outbreak of this disease, which caused heavy losses, was recorded in Sri Lanka in 1969.

*C. welchi* is known to be present in the alimentary tract of many normal sheep and goats. Under conditions favourable to it, the organism multiplies and produces a potent toxin which is absorbed into the blood and reaches all tissues of body causing sudden death. Some animals may be found dead without previously manifesting clinical symptoms. The most striking symptoms are sudden onset of profuse watery or blood stained diarrhoea, excitement followed by convulsion, a short period of coma and death within few hours.

Since the symptoms are manifested after absorption of the toxins, treatment should be aimed at neutralizing the absorbed toxins and prevention of multiplication of the organism. Chlortetracycline ('Aureomycin') has been found to be effective in preventing the multiplication of the organism. The disease is best controlled by immunisation, by the use of bacterin-toxoid.

## PNEUMONIA

A major problem responsible for lamb and kid deaths in Sri Lanka. Animals of all ages, however, may be affected. Pneumonia is an inflammation of lung tissue, often accompanied by pleurosy. There are many causes of pneumonia, the common one being invasion of the lung by bacteria or viruses. Recent evidence suggests that *Pasteurella haemolytica* may be the major bacterial type associated with this disease in Sri Lanka. A bad housing or

prolonged exposure to inclement weather is often associated with outbreak of pneumonia.

A rise of body temperature usually occurs in early pneumonia. Loss of appetite, depression, coughing, nasal discharge and mouth breathing are other common signs. Although mortality may be low, the growth is adversely affected. Untreated animals usually die.

The type of treatment chosen depends on the cause. The sulphonamides and broad spectrum antibiotics, such as tetracycline, are indicated for cases due to bacteria.

## PREGNANCY TOXAMIA

Pregnancy Toxamia (or Ketosis) is caused by impaired metabolism of carbohydrates and fatty acids and is frequently associated with faulty nutrition. Ewes in a poor plane of nutrition and ewes carring twins are more susceptible. Lack of exercise, sudden changes in diets and excessive heat may also be predisposing factors. The most important predisposing cause of the condition is a decreasing plane of nutrition during the last eight weeks of pregnancy.

The death of one or more ewes just before lambing time is sufficient to justify suspicion of this condition. The signs usually include grinding of the teeth, twitching of the ears, weakness, frequent urination, muscle spasms and convulsions. The final stage is complete collapse followed by death in 90 percent of the cases.

Treatment is often ineffective. Injections of dextrose solution may be of some use. Some workers have reported good results from the administration of glycerine, four ounces daily by mouth. Immediate steps should be taken to improve the nutrition of the flock, but the change must be gradual. Adequate exercise and a well-balanced ration are the two most important preventive measures.

## COCCIDIOSIS

Coccidiosis is a disease of the alimentary tract, caused by protozoan parasites belonging to the genus *Eimeria*. This is usually seen in lambs and kids, about two to four weeks old, especially when they are kept in confined areas.

The first sign is watery diarrhoea which may contain blood clots. Lambs lose their appetite and become thin and weak. In severe cases, death may occur. Treatment with sulphonamides is advisable in severe outbreaks. The disease is best controlled by good hygiene, especially of food and water troughs, and floor.

## MANGE

Mange, or 'scab' as it is commonly called, is caused by mites belonging to *Sarcoptes* species. Sporadic outbreaks of this parasitic condition has been reported in Sri Lanka. The condition breaks out mainly during wet weather and is common among goats.

The burrowing and feeding habits of the mite cause intense itching as indicated by scratching and rubbing, and dermatitis (inflammation of the skin) with the formation of scabs. The condition spreads rapidly in the flock. Mange could be effectively treated by repeated application of a mixture of sulphur and crude engine oil to the affected parts.

## CEREBROSPINAL NEMATODIASIS

Cerebrospinal Nematodiasis (or goat paralysis) has long been known to exist among goats in Sri Lanka. The condition is caused by filarial worm, *Artionema digitata,* which is naturally found in the peritoneal cavity of cattle. The worms apparently cause no harm to the cattle. Their larvae are found in blood of cattle and transmitted to goat by mosquitos. In goats, the larvae migrate and damage the central nervous system which results in paralysis. Indigenous goats are resistant to this condition, while imported breeds are seriously affected.

The condition could be cured if treated early with piperazine diethyl carbamazine ('Caritol'), at the rate of 40 mg/kg body weight, daily for three days. The disease could be prevented, to some extent, by rearing goats and cattle separately and also by controlling the mosquito vector. Where imported animals are reared, 'caritol' may be given as a prophylactic measure.

## FLY STRIKE

Fly strike (or Myasis) is the name given to the infestations of the skin and subcutaneous tissues of sheep and goat caused by maggots of blow flies belonging to *Calliphora* species. Although blow flies are not major pests in Sri Lanka, they do cause trouble in some areas.

Animals are struck most frequently in the breech and around the tail where the hair is soiled by urine and faeces. Other parts of the body may become affected, especially if wounds are present. The flies are attracted to the dirt or wounds and they deposit eggs in these areas. The maggots burrow into the tissues causing great suffering and often leads to subsequent bacterial infection. If the disease is allowed to progress, death from the absorption of toxins may follow within a few days.

The affected parts must be treated to kill the maggots, promote healing of wounds and prevent reinfection. The hair over the infested area must be clipped and cleaned with a disinfectant. Petrol or chloroform may be used to remove maggots. Wounds should then be dressed with a wound dressing that contains a fly repellant such as margosa oil. The condition could be prevented by regular clipping of hair around the crutch.

## SHEEP NASAL FLY

The sheep nasal fly (*Oestrus ovis)* is a small, dark grey fly with head and legs of dull yellow. It is prevalent in most parts of the country, but active only during warmer months.

It does not lay eggs, but deposits its larve at the entrance to the nostrils. Once deposited, the larvae crawl up into the nasal passage and communicating sinuses, irritating the lining membrane. This irritation may lead to secondary bacterial infections resulting in pneumonia. The symptoms include incessant sneezing and copious dischages which are often tenacious. Animals are greatly disturbed when the flies attack to oviposit. They often drive sheep frantic. Animals may lose much grazing time and their condition.

Treatment has generally not been effective, although 'neguvon' appears to be of some use. When given as anthelmintic against worms, 'neguvon' appears to clear the bots as well, possibly acting via the blood circulation. Use of fly repellants (such as stockholm tar) particularly during the hotter months may be a useful method of preventing flies ovipositing on the nostril.

## INTERNAL PARASITES

Internal parasites are inevitable when sheep and goats are reared in large numbers under intensive conditions and grazed on limited acreage. These parasites have always been a major cause of loss in sheep and goats throughout the world. They not only lower the weight gains but also, in heavy infestations, result in losses through lamb and kid deaths.

### TAPE WORMS

The tape worms most commonly met with in sheep and goats belong to the genus *Moniezia.* These worms are common in many areas of Sri Lanka, but are usually considered harmless except when present in large numbers. In great numbers, they interfere with digestion. Healthy animals are able to eliminate most of their tape worms, but young ones may be seriously affected.

Nicolosamide ('Mansonil') at the dosage of 50 mg/kg body weight is reported to be 100 percent effective against tape worms of sheep and goats. The treatment should be repeated every 45 days.

## ROUND WORMS

The round worms (Nematodes) most frequently found in sheep and goats belong to the genera *Haemonchus, Trichostrongylus* and *Oesophagostomum. Haemonchus* spp., which occur in the abomasum, are blood sucking parasites and this infection results in anaemia and unthriftiness. In some prolonged cases, swellings develop under the jaw. This condition is referred to as 'bottle jaw'. Death may occur in acute cases.

*Oesophagostomum* species are found in the large intestine. These worms enter the intestinal wall and form nodules or knots. When present in great numbers the nodules interfere seriously with the health of the sheep. *Trichostrongylus* species are found both in the abomasum and the small intestine. The general signs of worms infestation include anaemia, 'pot bellied' abdomen, diarrhoea with lot of mucous and general unthriftiness.

Tetramisole ('Nilverm') is highly effective against all nematodes. This is normally used as a drench at the rate of 5 ml and 10 ml for young and adult animals, respectively. A recently introduced anthelmintic febantel ('Rintal') has been claimed to be highly effective against all gastro-intestinal nematodes in sheep and goat at a dose of 5 mg/kg body weight. It is a good practice to worm young animals regularly every six weeks between two and six months, and biannually thereafter. However, it is of little value to treat animals without carrying out proper control measures. Young animals get infected with these parasites, most freauently, either from infected mother or pasture. The infestations are best controlled, therefore, by drenching mothers before parturition and by good pasture management. Sanitation and proper nutrition will also go a great way in preventing the infestations.

CHAPTER 3

# DISEASES AND PARASITES OF SWINE

Though a large number of serious infectious diseases of swine, such as African swine fever, swine erysipelas, enzootic pneumonia, foot and mouth disease etc., have been reported in other countries, fortunately most of these diseases are not reported in Sri Lanka. The common diseases of swine in Sri Lanka are discussed below.

## SWINE FEVER

Swine fever (or hog cholera) is a notifiable disease in Sri Lanka. Any suspicion of the disease should be reported to the nearest veterinary surgeon or the grama sevaka with all practical speed. The Sri Lankan swine industry was free of this serious desease until 1983 when it was apparently introduced through infected swill from Katunayake International Airport.

Swine fever is a highly infectious febrile disease, which is generally but not always characterised by a high morbidity and high mortality rate. It is caused by a virus which produce a generalised septicaemia of a haemorrhagic nature. The virus appears in a number of strains which are not immunogenically the same. The causative virus has been recovered after 1 month in smoked and salted pork, and after 4½ years in frozen pork. It is however, killed by boiling and disinfectants. Recovery from the infection results in a lasting immunity.

Ingestion is the major method of acquiring the infection, but inhalation can also occur. It has been shown that the virus can be carried by birds, on human beings, on vehicle tyres or by flies. Pork products in particular can transport the virus over very long distances. Infected swill is probably the most important mode of transmission. Infection is greatly influenced by the virulence of the strain of virus involved and by the susceptibility of the host.

The incubation period is usually between 3 and 6 days, although it may be shorter or much longer. There is an initial rise of temperature, then the animal becomes listless, anorexic and dejected. There is a tendency to huddle together in the corners of the pen and to resent being moved. Usually there is discharge from the eyes and nose, and the eyelids are often partially glued together. The skin may develop a purple rash around the ears, buttocks and belly. Vomition and an evil smelling diarrhoea may occur at this stage. Wasting is rapid and death may occur within a week.

There are two major methods of control, namely total eradication by slaughter and vaccination. Where the disease is newly introduced into a free area (as in Sri Lanka), eradication by slaughter of all infected and in-contact pigs is the only reliable method. However, cost of such a slaughter policy would be enormous and not practicable in a developing country like Sri Lanka. Alternatively, use of hyper-immune serum is recommended when the disease appears in the herd. Active immunisation through the use of inactivated or live virus vaccines have also been successfully used.

## COLIBACILLOSIS

Colibacillosis (white scours, pigling scours) is the most troublesome and common disease of piglings in Sri Lanka. It is caused by a bacteria *Escherichia coli.* Unhygienic conditions, poor housing, overcrowding and insufficient milk predispose the disease.

The disease can occur as early as 12 hours after birth and usually up to seven days of age. Affected piglings have a white pasty diarrhoea. They are depressed and rapidly lose condition. The bacteria may invade the blood stream and affected piglings have signs of fever. Mortality may be high if piglings are left untreated and survivors are often stunted.

Sulphonamides or antibiotics may be used for treatment of pigling scours. The disease responds well to streptomycin and tetracyclines. The treatment may have to be repeated if scouring persists. Good sanitation and adequate amounts of colostrum will go a great way in reducing the losses due to plgling scours.

## ENTERITIS

Cases of enteritis (inflammation of digestive tract) are extremely common in pigs. The condition is often seen in young pigs and most often where these are reared under crowded, dirty conditions which are so common in Sri Lanka. The disease is characterised by scouring which may be yellowish or whitish. The affected pigs do not thrive and mope around with a general air of complete dejection.

Enteritis is caused by a variety of factors, such as faulty feeding and ingestion of instant toxic substances to helminth parasites, bacteria or viruses. Symptomatic and supportive treatment is directed towards controlling the diarrhoea and preventing dehydration which may lead to death. Specific treatment depends on the identification of the cause. A consideration of the history, clinical examination of the pig and laboratory examination of the faeces will help to identify the cause. *Escherichia coli* and *Salmonella* spp. are two common bacteria causing enteritis, particularly in the young. There is a

condition called transmissible Gastroenteritis (TGE) caused by a specific virus, but this has not been reported in Sri Lanka.

## PNEUMONIC PASTEURELLOSIS

Pneumonic pasteruellosis in swine due to *Pasteruella multocida* was first reported in Sri Lanka during 1983. The serotype involved appears to be similar to that causing haemorrhagic septicaemia in cattle. The disease is rarely primary, but usually occurs as a secondary infection following debilitation from stress.

The major clinical sign is high fever (104 - 106°C). Other signs include respiratory inflammation, dry cough and often a purulent nasal discharge. The affected animals are lethargic and may go off feed. In advanced cases, the septicaemia is associated with incordination and death. There is no satisfactory treatment, but oral administration of sulpha drugs reduces death losses.

## AGALACTIA

The causes of agalactia (absence or lack of milk) are many and varied. Although it may occur as an independent lactational failure, in most instances it is associated with mastitis and metritis. Hormonal imbalances, difficult farrowing, digestive troubles of dietary origin, poor nutrition during pregnancy, management errors and stress factors such as chilling and high temperature may also cause the condition. Thus most often agalactia arises from non-specific causes, thereby posing a problem in treatment.

Agalactia occurs in the sow immediately after farrowing or within the first 48 hours. There is loss of milk flow with hardening and congestion of the udder. The problem is often revealed by the piglings squealing excessively while attempting to suckle and by their rapid loss of condition. Usually there is no systemic signs in the sow, but she is depressed and goes off feed.

Prevention should include corrective measures to eliminate the known stress factors or the management deficiencies. Proper feeding of pregnant sow and rest following parturition are imperative. Quantity of feed should be reduced and a laxative ration must be fed a short time before farrowing to reduce the strain on mammary glands. Moderate exercise is also advisable.

Treatment requires one or more injections of oxytocin to restore milk flow. To prevent overfeeding by starved piglings, strip some of the milk from the udder by hand or limit them to intermittent suckling during the first day.

## HYPOGLYCEMIA

Hypoglycemia (or, baby-pig disease) is the result of pigling starvation because of agalactia in the sow or a condition in the piglings that prevents them from suckling.

Because its energy reserves are very small during the first few days of life, the pigling is very susceptible to hypoglycemia (decrease in the level of blood sugar) if it does not suckle at regular intervals. Normal piglings of 48 hours. old have about 100 mg glucose/100 ml of blood serum. In affected piglings, this level may fall down to 25 mg/100 ml. Once the piglings are six days old, starving will not produce hypoglycemia.

Affected piglings show symptoms of shivering, dullness and no appetite, and they tend to huddle together. The hair is rough, the skin cold and the heartbeats slow and feeble. If the condition persists, the pigling passes into a coma and dies. Early recognition of the condition is the key to effective treatment. Intraperitoneal or intravenous injections of 15 ml of a five percent glucose solution are indicated as early as possible. These injections should be repeated at intervals of four to six hours. If complete or partial loss of milk flow is observed in the mother, then the piglings should be fed by transferring them to a foster sow or by providing them a suitable milk substitute, and treatment and preventive measures recommended for agalactia should be followed.

## PIGLET ANAEMIA

A common condition in Sri Lanka. The condition is caused by deficiency of iron and sometimes copper, cobalt and vitamin B12 may also be involved. It occurs in piglings two to four weeks old.

Piglings are normally born with adequate reserves of iron, but the reserve get depleted from 10 - 12 mg to 2 - 4 mg 100 ml blood within first two weeks due to the dynamic red blood cell formation. Since the sow's milk is deficient in iron, external sources of this element are imperative. The rapidly growing pigling requires an average of 15 mg iron daily during the first two to three weeks, an amount which cannot be satisfied by the sow, In the absence of supplementation, the first two to three weeks becomes an appropriate period to get symptoms of anaemia. Signs of anaemia — lethargy, unthriftness, rough hair coat and paleness of the mucous membranes — are usually not noticed before two weeks of age. Some piglings may have a laboured jerky breathing known as 'Thumps'.

Treatment and prevention are achieved by supplying iron by mouth or through intramuscular injection. Effective treatment is by the injection of iron-dextrin which should contain at least 100 mg of available iron. For prevention,

it is standard practice to provide a small amount of soil in the corner of the pen. The piglings will use it as a lick and generally this will provide sufficient iron for them. Alternately iron salts in sticky solutions may be painted around the sow's teats so that piglings ingest some iron while suckling.

## MANGE

This is caused by a miscroscopic mite (*Sarcoptes scabiei* var. *suis)* and is a common skin infection encountered in all piggeries in Sri Lanka. The mite penetrates the skin and burrows into the horny layer to lay its eggs. The skin damage produces intense itchiness and irritation. Constant rubbing may result in loss of hair, dermatitis, and thickening and wrinkling of the skin. Secondary infections leave an oozing type of eczematous dermatitis with offensive smell. When lesions become extensive, emaciation of the host may be pronounced and death may result.

A number of compounds are available for treatment of mange. 0.01 - 0.02 percent gamma — BHC ('Gammexane') is widely used for this purpose. Alternatively sulphur in a light mineral oil base (such as engine oil) or a mixture of sulphur and lime (25 g sulphur and 8 g lime in a litre of water) may also be used. For better results, preliminary cleaning to remove the scab must precede spraying. Spraying of the animals and the quarters should be repeated in 10 to 14 days.

## LUNG WORM

The lung worm, *Metastrongylus apri,* is a common parasite of swine in Sri Lanka particularly where the pigs are reared outdoors. The adult worms are 1 - 6 cm long and inhabit the windpipe and bronchi of pigs. The larval stage of this parasite is spent in the earthworm. The pigs become infested by ingesting earthworms containing infective larvae. The larvae migrates from the intestine to the lungs, where it develops into the adult stage. Heavy infestations with worms can damage the lungs causing loss of condition and even death. Secondary bacterial infections may lead to pneumonia. Probably the most effective treatment is tetramisole ('Nilverm'). This may be administered as a drench, at a dosage of 15 mg/kg body weight.

## GASTROINTESTINAL WORMS

Worm infestation is extremely common in all the piggeries and its responsible for widespread economic loss. Of the internal parasties of pigs,the most important one is the large, intestinal roundworm, *Ascaris summ,* which is morphologically similar to the human roundworm *A. lumbricoides.*

The adult worms are found in the small intestines. But the second stage larvae, hatching from the ingested infective eggs of the worm, burrow into the wall of the intestine and enter the liver. From the liver, they are carried in the blood stream to the lungs. The greatest damage is caused while the larvae migrate through liver and lungs. Damage may be extensive if many larva are present. In the lungs, there is considerable haemorrhage and pneumonia may occur. The adult worms living in the intestines cause a certain amount of irritation and an animal heavily infested will appear dull and unthrifty and may show diarrhoea. At times the worms may become balled together obstructing the intestines.

Piperazine compounds (such as 'Coopane') are effective in removing adult round worms. Unfortunately there is no drug available to kill the harmful larval stages. Strict sanitary measures, therefore, must be adopted to prevent infestation. Since the neonate piglings pick up the infection from their mother, it is advisable to worm the sows two to three weeks before farrowing. Round worms are best controlled by sanitation and regular worming.

CHAPTER 4

# DISEASES AND PARASITES OF POULTRY

## RANIKHET DISEASE

Ranikhet disease (New castle disease) is an acute highly contagious disease of domestic fowls and turkeys caused by a virus, *Myxovirus multiformae.* It is probably the most important virus disease which has hindered the expansion of our poultry industry. The disease was introduced into Sri Lanka in 1927 through table poultry imported from india.

Under natural conditions, the disease spreads rapidly via air-borne droplets disseminated from the respiratory tract of infected birds by coughing or sneezing. It also can be carried through contaminated food and clothing of farm workers, by crows and rats. Four forms of the disease are generally recognised.

i) Velogenic form — This form of the disease is characterised by high morbidity and mortality. Mortality may reach 90 percent, thus wiping out the whole flock.

ii) Mesogenic form — This is a less virulent form. Mortality is low varying between five and fifteen percent.

iii) Lentogenic form — A mild form of the disease. Mortality in adult birds may be negligible, but may reach 50 percent in chicks.

iv) Asymptomatic form — No clinical signs are seen in this form and can be recognised only by serological test. Normally found in 'Carrier' brids.

These variations are believed to be due to differences in environment, degree of virulence of virus forms and resistance of host birds. The incubation period of the disease is five days. It is followed by dullness, respiratory distress as indicated by coughing, sneezing and gasping, and diarrhoea. Nervous symptoms develop in a few days and is shown by paralysis of legs or wings and neck muscles. This may develop into complete twisting of neck and the birds may be seen to do backward somersaults. The condition spreads to all in-contact birds and there is a tendency for birds to huddle together.

Birds of all ages are susceptible, but adults are relatively less susceptible than the young birds. In layers there is a drastic drop in egg production, sometimes even to zero level, and eggs laid have thin shells. The mortality may range anything from 5—100 percent depending on the form of the disease. In

recovered birds there is always stunted development and in layers the egg production is permanently lowered.

The disease is best controlled by sanitation and production of immunity by vaccination. There is an egg-transmitted immunity in young chicks from immune mothers which lasts about 30 days.

A locally produced freeze-dried vaccine is available. This is first administered to birds at 3 weeks and twice the dose is repeated at 3 months of age. The freeze-dried vaccine is dissolved in the recommended volume of sterile distilled water, and must be administered by injection within a few hours. Storage for more than 3—4 hours after dissolving will render the vaccine ineffective. The same vaccine can also be given orally in drinking water, but at each time, double the recommended dose has to be given. This leads to a considerable waste of vaccine and is therefore not recommended. Oral vaccination is recommended for broiler chicks and is administered during the first week of life.

There is no known treatment that is effective. However, in the event of an outbreak, the healthy birds may be re-vaccinated. Since infection spreads by direct contact, all sick birds should be isolated and killed. Premises may be disinfected with condy's powder (one teaspoonful in ten gallons of water) or with bleaching powder (one ounce in four gallons of water).

## FOWL POX

Fowl pox in another important virus disease of poultry in Sri Lanka. The disease is usually transmitted by direct contact or by contact with contaminated materials. The virus cannot, however, penetrate intact skin of the birds and injury to the skin or mucous membranes is necessary for the entry of the virus. It has been also shown that the virus can be transmitted by mosquitos, ticks and lice. Insanitary conditions and overcrowding are conducive for perpetuation of the disease in a flock.

The disease spreads slowly and its course in a flock may take two or three months. The mortality is generally low, but sometimes may go up to 50 percent. Fowl pox can manifest itself in two forms, a skin form generally termed contagious epithelioma and a diptheritic form usually termed avian diptheria.

In the skin form, typical pox lesions appear on the comb, wattles, eyelids and face. In severe cases, other parts of the body may also be affected. The lesions increase in size and coalesce to become large grey wart-like growths. The form is generally mild, but may be aggravated by secondary infections. In the diptheric form, cheesy patches appear on the mucous membranes of the

mouth, air passages and eyes interfering with breathing and eating. The skin form is more common of the two, but because of the interference with respiration the diptheric form is usually more fatal. All ages are susceptible, but birds in the 6—12 month age group are more likely to be affected than older birds.

There is no effective treatment for this condition. Painting warts with tincture of iodine may be useful in preventing secondary infections. Recovery from the disease produces a durable immunity.

The disease can be controlled by vaccination with the local vaccine, produced by the vaccine production laboratory at Gannoruwa, which is safe and effective. In a routine vaccination programme, first vaccination is given at one month. Vaccine 'takes' within seven days and is shown by a small pox scab at the point of vaccination. The immunity lasts for three months. A revaccination is, therefore, important at around four months of age. When an outbreak occurs the affected and the healthy birds should be separated and strict sanitary measures, including disinfection of pens, should be put into effect. It may be advisable to cull and slaughter the affected birds. Healthy birds can then be vaccinated.

## AVIAN ENCEPHALOMYLETIS

Avian encephalomylephis (epidemic tremor) was recognised in Sri Lanka only in 1969. It has been shown, however, that the incidence of the condition is fairly high and it could now be regarded as one among the important diseases affecting poultry in Sri Lanka. Epidemic tremor is an infectious disease caused by an enterovirus. The infection is usually egg-transmitted, but it also could take place by direct contact. The virus is highly transmissable and the infection runs through the flock in a very short time.

The prominent symptom in the affected chicks is a progressive paralysis of the legs. The first recognizable sign of the disease is weakness of the legs. Affected chicks are unsteady and often flop on to their hocks after this stage. They have difficulty in standing and are seen lying on their sides. There is also a pronounced trembling of the head. However, this is not a constant feature of all outbreaks. The usual outcome is death. Adult birds do not show any clinical symptoms, but there is a drop in egg production. During this period the eggs are viraemic and the virus transmitted through the egg.

Infection at any stage after six weeks results in the development of a strong immunity which will last throughout the laying period and thereby prevent egg transmitted infections. The most effective method of ensuring that all pullets are fully immuned is to expose them to an avirulent strain given in

drinking water around 14 weeks of age.Control is effected on general principles of hygiene.

## AVIAN LEUCOSIS COMPLEX

This group of diseases is characterised by uncontrolled multiplication of the precursors of blood-cells. The disease complex is classified into two main entities, namely marek's disease and leucosis sarcoma group.

### MAREK'S DISEASE

Marek's disease (neurolymphomatosis) is a highly contagious disease affecting poultry usually from 6—20 weeks of age, but it may affect birds of all ages. Since its recognition in Sri Lanka in 1972, several outbreaks of the disease have been reported in the country. The disease is caused by a herpes B virus. It spreads easily by direct, as well as, by indirect contact and can also be disseminated by the airborne route.

There are two forms of the disease, the acute and the chronic. The acute form generally affects younger age groups (6—10 weeks old), whereas the chronic from affects birds between 12 to 20 weeks age group. The chronic form is characterised by progressive asymmetric paralysis of legs, wings and neck. The femoral portion of the sciatic nerve is commonly affected. Mortality with this form is generally very low. In the acute form of the disease, there are no characteristic signs other than increased mortality which may reach 50 percent. Post-mortem examination of acute cases will reveal tumours of proliferating lymphoid cells in the liver, spleen and all other visceral organs including the kidney and ovary.

Marek's disease could be easily controlled by vaccination with Marek's disease vaccine. The vaccine is not manufactured locally, but imported commercial vaccines are available. The disease could be prevented through combination of methods such as selecting for genetically resistant stock and good hygiene.

### LEUCOSIS SARCOMA GROUP

Of the five forms in this group, namely lymphoid leucosis, erythroid leucosis, myeloid leucosis, osteopetrosis, and rous sarcoma and other non-leucotic tumours, the lymphoid leucosis is the most important and common form in Sri Lanka. The disease is caused by a virus or group of viruses that are distinct from the Marek's disease agent.

The virus is spread via the eggs or by contact. However transmission by direct contact is slow and rather inefficient. The disease is seen in birds four months of age or older and there are no clinical signs. The disease is seen most often in laying hens. Tumours may be found in all tissues of the body except nerves. The liver and spleen are frequently affected, becoming large and very pale. Infected birds gradually lose weight and death may occur.

No vaccine has been produced that is effective against lymphoid leucosis virus. Since the disease is mainly transmitted by eggs, the best control method is to eliminate infected layers from flocks or to use genetically resistant stock.

## INFECTIOUS BRONCHITIS

This is a respiratory disease caused by a filterable virus which may attack birds of all ages. Though the disease is prevalent in Sri Lanka, it is not a serious problem. The disease spreads by airborne infection and is perhaps the most infectious poultry disease.

The disease generally takes a more acute course in the chicks and a mild course in the adult. In chicks symptoms include gasping and respiratory distress, sometimes accompanied by convulsive coughing. Mortality in severe outbreaks may reach 40 percent. In adults there may be gasping movements and marked reduction in egg production. The eggs laid by affected birds are misshapen, thin-shelled and small.

There is no known satisfactory cure for infectious bronchitis. The disease can be prevented by giving vaccines, but these vaccines are not locally available. The spread of the disease could be prevented by isolation of sick birds and by thorough cleaning and disinfection of poultry house.

## INFECTIOUS LARYNGOTRACHEITIS

Though the presence of this disease has not been confirmed serologically or by virus isolation, clinical evidence suggests its occurence in Sri Lanka. The disease is caused by a virus termed *Tapeia avium*. This is an highly infectious disease affecting mainly adults and young adults. Infection occurs usually by the respiratory tract and recovered birds act as carriers for long periods.

The outstanding symptom of the disease is gasping; during inhalation the head is extended upward with mouth wide open and during exhalation the head is lowered with mouth closed. Rattling and gurgling sounds in breathing are characteristic. There may be expulsion of blood and mucus from the

trachea. The disease lasts an average of two weeks and mortality may reach 70 percent.

There is no specific treatment. The disease is best controlled by vaccination with live virus vaccine at ten weeks. The vaccines, however, are not available in Sri Lanka.

## PULLORUM DISEASE

Pullorum disease (or bacillary white diarrhoea) frequently causes enormous losses among chicks in Sri Lanka. It is caused by a bacteria called *Salmonella pullorum*. The disease mainly affects baby chicks, in which infection is primarily transmitted via the hatching egg. When the disease occurs in a breeding flock, many birds recover and become carriers. Eggs from such birds will contain *S. pullorum*. Upon hatching the chicks so infected will transmit the bacteria widely. Chicks are highly susceptible to infection up to the age of one month. Direct transmission via ingestion or inhalation can also take place from adult birds to susceptible chicks.

In chicks the disease may be acute or chronic. In the acute form, chicks may be found dead or dying immediately after hatching and they may continue to die for three to four weeks. Mortality may range from 20 to 80 percent. Losses are highest between one and three weeks of age. Symptoms include dejection, dropping wings, a 'pot-bellied' appearance, continuous chirping, staggering and collapse. The white pasty diarrhoea which foul the vent, from which the name bacillary white diarrhoea is derived, is not a constant feature, but does occur. The Chronic form is often seen between three and eight weeks of age. There is usually lameness, marked swelling of hock joints, depression and lack of growth. Mortality is around five percent.

In adult birds, the infection is generally inapparent but there will be lowered egg production, lowered fertility and reduced hatchability. Diagnosis of the disease cannot be based on clinical symptoms, because they are not sufficiently characteristic. The 'rapid whole blood' agglutination test can be carried out where the disease is suspected and is generally reliable.

There is no cure for pullorum and control depends basically in locating and eliminating all carrier hens. Testing for carriers should be carried out annually on all birds over five months of age in areas where the disease exists. If reactors are found, re-testing should be carried out every six weeks until no more reactors are found. Reactors should be immediately removed and slaughtered. They can be used for human consumption.

Furazolidone has been found to be effective in preventing the occurence of carriers. A course of treatment consisting of furazolidone at 0.04 percent of the

mash daily for ten days is recommended. This will be of great assistance in controlling the disease and supplements, but does not replace, testing and elimination of reactors. Where incubators are involved in transmission regular fumigation, using formaldehyde, is recommended.

## FOWL TYPHOID

Fowl typhoid is a septicaemic disease caused by a bacteria, *Salmonella gallinarum*. The disease is less common in Sri Lanka.

Adult birds are most commonly affected. The disease is usually transmitted through droppings, and contaminated feed and water. The first symptom is yellow patchy discolouration of the droppings. Birds become depressed and cease feeding and within 48 hours diarrhoea, which is bright yellow in colour, intervenes. A high temperature develops, giving rise to an acute thirst. Death usually occurs within two weeks.

Treatment with sulphadimidine ('sulphamezathin') or sulphaquinoxaline ('embazine') will cure the condition, but the carrier state will continue to exist and be a source of further infection. Slaughter of affected birds and furazolidone treatment (0.04 percent in the mash for ten continuous days) of healthy birds is effective in eliminating the disease.

## FOWL PARATYPHOID

Fowl paratyphoid (or salmonelloses) is a general term used to describe infections produced by members of genus *Salmonella* other than *S. pullorum* and *S. gallinarum*. The disease is usually seen in chicks below a month old in which it runs an acute course. It is also a zoonosis. *Salmonella* infections in man result in severe intestinal disturbances and rarely even death.

The infection is usually egg-transmitted. The symptoms of paratyphoid, in many ways, resemble those of pullorum. Diagnosis can only be made by serological tests. Furazolidone given in feed (50 g/ton of feed) is effective in preventing losses from paratyphoid infection. Sulphonamides are also useful. The incidence of the disease can be reduced by good sanitation and by the use of salmonella-free hens as sources of hatching eggs.

## FOWL CHOLERA

Although fowl cholera (avian pasteurellosis) occurs sporadically, it is not a serious problem in Sri Lanka. It is caused by specific serological types of

bacteria, *Pasteurella multocida*. The bacteria occurs as a normal inhabitant in the naso-pharynx of poultry, but under stress they precipitate the disease.

Symptoms may be pneumonic, septicaemic or localised. In the pneumonic type there is gasping, coughing and sneezing. Septcaemic syndrome is characterised by diarrhoea. In the localised syndrome there is lameness and arthritis(inflammation of joints) of legs and wings. In acute cases death is extremely rapid and occurs within few hours of the bird showing any symptoms.

Treatment is hardly economical in birds already showing symptoms. 'Sulphamezathine', one percent, in the mash has been found useful in reducing mortality. Chlortetracycline ('Aureomycine') in the mash is also effective. Good management, particularly in eliminating the stress factors, and good hygiene can do much to limit the spread of the disease.

## INFECTIOUS BACTERIAL CORYZA

This is an acute 'cold' of short duration caused by *Haemophilus gallinarum*. The disease is common in Sri Lanka. Transmission is usually by direct contact, by the air-borne route or by water. The symptoms include discharges from the nasal passages, inflamed and swollen eyes and respiratory distress due to the clogging of air passages with exudates.

Sulphonamides are useful in treating the disease. Streptomycin in doses of 0.1—0.2 g, intramuscularly, is also effective in complicated cases. Medication, however, is not the solution to effective long term control.

## MYCOPLASMOSIS

Mycoplasmosis (or chronic respiratory disease) is a complex respiratory disease caused by the organism, *Mycoplasma gallispeticum*, usually in association with other bacterial or viral infections. The *Mycoplasma* organism is a primitive type of bacterium, very small, with no rigid cell wall.

The disease affects the airsac primarily. They become thickened, filled with exudates, and the lungs become hard. Mortality rate is fairly high. The disease is mainly egg-transmitted. The tetracycline group of drugs is useful in treatment if given continuously for a week as soon as the symptoms are seen. The dosage recommended is 100—400 g/ton of feed. Furazolidone is also effective. The condition is best controlled by using mycoplasma-free breeding flocks, sanitation and good management.

## ASPERGILLOSIS

Aspergillosis (or brooder pneumonia) is caused by a fungus, *Aspergillus fumigatus*, and is often associated with bad management. *A. fumigatus* is a rather ubiquitous organism that is normally found in the environment. When conditions in litter and feed support growth of molds, such as a combination of high humidity and moderate temperature, the spores sporulated may be breathed in and result in the disease.

Usually chicks are affected. The symptoms are not very characteristic and may include gasping movements, difficult breathing and inflamed eyes. There is no satisfactory treatment for the condition. Sick birds must be destroyed and premises should be thoroughly disinfected. The best way to avoid the disease is by preventing mold growths. Feed should be low in moisture and the litter should be maintained day.

## AVIAN MALARIA

The disease is caused by a protozoan parasite, *Plasmodium gallinaceum*. Like the human malaria, the disease is transmitted by mosquitos. Young birds are more susceptible. There is at first a fever with greenish diarrhoea. This is followed by anaemia and progressive emaciation. Paralysis of limbs may occur.

Many of the drugs used in the treatment of malaria in humans are suitable for treating avian malaria. Those commonly employed are 'chloroquin' at 5 mg/kg body weight or 'Paludrine' at 7.5 mg/kg body weight.

## COCCIDIOSIS

Coccidiosis is perhaps the most widespread and economically important parasitic disease in Sri Lanka. The disease is caused by a number of species of protozoa, belonging to the genus *Eimeria*. Each species favours a particular location in the digestive tract. Three species *E. tenella, E. necatrix* and *E. acervulina*. *E. tenella* invades the caeca and *E. necatrix* the small intestine but part of its life cycle may be spent in the caeca. *E. acervulina* which affects the duodenum is not very pathogenic.

Transmission usually occurs by the ingestion of viable infective oocysts in food, water and from the litter. Human and rodents also may transmit occysts mechanically. *E. tenella* affects chicks up to eight weeks and *E. necatrix* affects chickens from eight weeks onwards; other *Eimeria* species are found in older birds, but younger ones may also be affected. The symptoms include emaciation, listlessness, rough plumage, and the birds may be seen

huddling together. The faeces are blood-tinged and watery in consistency. With *E. necatrix,* recovered birds remain emaciated for months afterwards. In affected layers, egg production will go down considerably. Presence of blood in faeces is usually diagnostic of coccidiosis.

The prevention and control of coccidiosis is based on two basic principles, namely good hygiene and use of coccidiostats.

i) Good hygiene — maintain the litter dry and if there is a build up of oocysts in the litter, it should be replaced and the house should be thoroughly cleaned. Avoid overcrowding.

ii) Coccidiostats — An ideal coccidiostat should be effective against all pathogenic species of *Eimeria.* While controlling the coccidiosis, it should also enable the bird to develop natural immunity. The most widely used coccidiostats today are sulphaquinoxaline ('embazine'), 'zoaline' and 'amprolium'. They can be used on chicks and layers, but usually given to chicks and withdraw one month before commencement of lay, when the birds have attained immunity. 0.008 percent 'embazine' or 0.0062—0.015 percent 'zoaline' or 0.003125 percent amprolium can be used in the chick mash as a general preventive measure for coccidiosis.

For treating coccidiosis, sulphonamides are the drugs of choice. Of the sulphonamides 'embazine' is the widely used, because it is readily taken by the birds in drinking water. The drug is usually given in water for 3—5 days or the 3—2—3 schedule where the drug is given for three days, withdrawn for two days, and given again for three days. The dosage recommended is 0.025—0.06 percent. Many new preparations, containing other therapeutic agents for the treatment of coccidiosis, have been introduced into the market in recent times.

## GAPE WORMS

The gape worm, *Syngamus trachea,* lives in the trachea of the fowl and is a widespread, though not a serious, problem. Gape worms are common when birds are reared on range but seldom seen in deep litter houses, since they need earthworms or snails for completion of their life cycle.

Young birds between one and three months are more susceptible, while adult fowls and turkeys act as carriers. Birds heavily infested with gape worms have difficulty in breathing and continuously throw their heads upward and forward in order to draw in air, a syndrome which is called 'Gapes'. Feed consumption is reduced and growth is retarded. In severe cases, the birds may die of suffocation. Dusting of the birds with barium antimonyl tartarate in a closed space is very effective for treatment of gape worms.

## INTESTINAL WORMS

The large round worm, *Ascaridia gallinarum,* is one of the most common intestinal parasites of poultry often causing serious damage among growing chickens under four months of age. The worm is usually found in the intestine. Infection occurs by ingestion of the infective eggs. The larva from the egg penetrates the duodenal mucosa where it remains for seven days and then comes out into the lumen. During this phase in the mucosa, it produces enteritis. The birds have diarrhoea, become emaciated and anaemic. Birds with heavy worm infestations are generally less productive, inactive and rather unhealthy in appearance.

The caecal worm, *Heterakis gallinarum,* is a small white round worm that lives in the caeca. The worms are not very pathogenic but they serve as carriers for the protozoa, *Histomonas melegridis,* which is the causal agent of blackhead disease, a troublesome disease of turkeys.

Control of these worms is largely a matter of sanitation, particularly that of litter, and good husbandry. Piperazine compounds ('Coopane') are useful against the large round worms. they may be given at the rate of 50 mg/200 ml drinking water. As a routine measure, worming may be done during the sixth, sixteenth and twentysixth week of a bird's life. Caecal worm infestations can be treated with phenothiazine ('Phenovis'). The dose for an adult is 0.5 g.

Tape worms may be a problem where birds are reared in free range. Since snails and slugs are important for completion of their life cycle, tape worms are not usually found in birds under deep litter or battery systems. Chlorosalicylamide ('Yomesan') at the rate of 500 mg bird has been found to be effective for treatment of tape worm infections.

## POULTRY LICE

Lice are the ocmmonest external parasites of the fowl in Sri Lanka. They seldom cause any harm, but if the infection is heavy there is an insidious economic loss due to reduced production, wasting, irritation and anaemia.

Lice are generally transferred from one infected bird to another. Therefore if chicks enter clean pens with no older birds, lice infestations are not likely to be encountered. Lice could be controlled by the use of insecticides. Dust containing one percent D.D.T. or 0.2 percent B.H.C. may be useful. 0.1 percent Malathion used as a spray is very effective.

## A SUGGESTED PROPHYLACTIC PROGRAMME FOR POULTRY FARMS IN SRI LANKA.

| | |
|---|---|
| Day 1 | — Vaccination against Marek's disease. |
| 1—3 days | — Glucose (2 tablespoons per litre of water), particularly if the chicks have been transported over long distances. |
| 1—3 weeks | — Vitamin B complex tablets (3—4 tablets per litre of water); cheap and effective method to overcome any 'suspected' stress. |
| 1—3 weeks | — Terramycin (1 teaspoon per 4 litres of water). |
| 3 weeks | — Ranikhet vaccination (4 ml per chick, intramuscular injection). |
| 4 weeks | — Fowl pox vaccination; by scarification. |
| 6 weeks | — First deworming (Coopane, 25 g/30 birds). |
| 3½—4 months | — Booster dose against ranikhet. (½ ml per bird, intramuscular). |
| 4 months | — Second fowl pox vaccination. |
| 4—5 months | — Second deworming (Coopane, 25 g/30 birds). |
| 6—7 months | — Third deworming (Coopane, 25 g/30 birds). |

# CHAPTER 5

# DISEASES AND PARASITES OF RABBITS

## COCCIDIOSIS

One of the worst and at the same time commonest disease problems of the rabbit in Sri Lanka. This is a disease of digestive tract caused by protozoan parasites belonging to the genus *Eimeria*. The commonest species are *E. steida, E. perforans* and *E. magna*. The symptoms vary with the age of the rabbit. These include loss of appetite, dry staring coat and the tendency to adopt a listless huddled position. Diarrhoea need not necessarily be present. Affected rabbits quickly lose weight.

The disease could be prevented by good hygiene and sound management, particularly of the litter. The incidence of coccidiosis could be lowered by the use of wire floors which reduces the risk of infection. 'Sulphamezathine' is effective in treating the disease.

## SNUFFLES

Snuffles (or pasteurellosis) is a highly contagious and fatal respiratory disease of rabbits. The disease is caused by a bacteria, *Pasteurella multocida*. The disease appears to be associated with adverse environmental factors, such as poor nutrition and unhygienic conditions, which lower the resistance to the disease. The incidence of snuffles usually high during the rainy periods.

Symptoms vary according to the severity of the infection. Some rabbits show definite respiratory symptoms such as sneezing followed by a nasal discharge; others exhibit no clinical signs at all, but are often found dead after appearing to be perfectly healthy. With nasal discharge, fur around nostrils becomes matted.

Sound management, particularly good housing and sanitation, would appear to be the key to prevention of snuffles. Infected animals must be immediately isolated and the house be disinfected. Sulphadimidine has been found to be effective in treating the condition. Streptomycin also could be used.

## MANGE

A common and often serious problem in Sri Lanka. This is caused by a microscopic mite belonging to *Sarcoptes* species. The condition is highly

contagious and is quickly transmitted from rabbit to rabbit. The burrowing activities of the mite lead to an irritation of the skin. This may be accompanied by a sour-smelling discharge. Affected rabbits frequently shake their heads and scratch violently. They lose appetite and waste away.

Attention to the hygiene of the rabbitry will prevent mange infestation. Infected animals should be isolated immediately and their hutch must be thoroughly cleaned and disinfected. Mange could be effectively treated with a mixture of sulphur and engine oil or a mixture of sulphur and lime.

## MYXOMATOSIS

Myxomatosis is a highly virulent rabbit disease caused by a virus. This is not contagious, but may cause 100 percent mortality. This virus is transmitted by biting insects, such as mosquitos and fleas. The infection is greatest during rainy season, when mosquitos are abundant. The first symptoms are watery discharge from the eyes and swelling of eyelids. Later symptoms include protrusion of the rim of the eyes and swelling on the other parts of the body, particularly the ears, nose and genital organs.

The disease is best controlled by good husbandry and sanitation. Biting insects should be prevented from entering the rabbitry, when the disease is known to be present in the neighbouring areas. Insecticidal sprays may be used at monthly interval. Affected rabbits should be immediately slaughtered and a thorough disinfection programme must then be carried out. Antibiotic may be given to prevent secondary infections.

## INTESTINAL WORMS

Intestinal worms in rabbits are extremely common, but they rarely cause any serious trouble. Infection with tape worms occurs through eating food that have been contaminated by dog's faecal material. Control depends on the exclusion of food and litter likely to have been fouled by dogs. Tape worms are, therefore, rare in rabbits reared in hutches.'Mansonil'or 'Yomesan' could be used to treat tape worm infestation.

Round worms, of importance, in rabbits belong to the genus *Oesophagostomum*. These worms form nodules in the intestinal tract. When found in large numbers, the nodules interfere seriously with the health of the rabbit. Heavy infestations may promote diarrhoea and retard growth. Control measures are mainly directed toward sanitary conditions and good husbandry. 'Piperazine' can be used at the rate of 300 mg/kg of body weight for treatment.

# CHAPTER 6

# DISEASES AND PARASITES OF DOGS AND CATS

## RABIES

Rabies is caused by a virus, which attacks the brain and spinal cord with fatal results. All mammals, including man, are susceptible but it is predominantly a disease affecting carnivores. In our country it is spread mainly by the bites of rabid dogs. The virus exists in the animal's saliva and infects the wound. The virus of rabies is easily destroyed by sunlight and heat, and its infectivity becomes negligible when it is exposed to ordinary environmental conditions of light, heat and air. Thus extensive disinfection procedure may not be necessary. It can be easily destroyed by washing with soap and water

Following the bite of a rabid animal, the incubation period varies from a few days to many months, the length of incubation being roughly related to the distance from the central nervous system to the location of bite and its severity. In dogs the average incubation period varies between 21 and 60 days. In man the incubation period averages one to three months, but may range from ten days to eight months.

Symptoms vary from animal to animal. In the dog three stages, namely prodromal stage, furious stage and dumb stage,have been recognised.

i) In the first stage, there is a change in disposition such as hiding in dark corners, not responding to the call and snapping at imaginary objects.

ii) This is followed by the stage of 'furious rabies' where the dogs run aimlessly biting any human or animal with which they come in contact and continue to run until exhaustion. If confined, it may even inflict upon itself severe injuries. This is accompanied by profuse salivation.

iii) 'Dumb rabies' is the last stage and is characterised by paralysis of facial muscles. Death, due to respiratory paralysis, occur within 3 to 11 days. Mortality rate is nearly 100 percent.

In many instances, dogs do not show the furious stage and pass on to the paralytic stage. Thus the classical 'Rabid dog syndrome' is not seen in every case of rabies.

It is important to note that the rabies virus may be present in the saliva of a dog from 7—8 days before it displays visible signs of rabies. Thus all

persons who have been bitten by or who have handled a dog showing signs of rabies within 7—8 days previously should seek medical advice immediately.

No treatment has any effect on the course of rabies, but immediate cleaning of the wound with soap and water should be carried out. Where rabies is suspected in a dog, the animal should be confined and observed for at least ten days. If the dog dies, the head of the suspect dog may be sent to the Medical Research Institute, Colombo for diagnosis.

There are two basic principles involved in the control of rabies.

i) Strict government legislation to prevent the exposure to infection. In Sri Lanka two legislative enactments, namely the Rabies Ordinance of 1894 and the Dog Registration Ordinance of 1902, are available though they are often not enforced.

The first ordinance empowers the local authority to seize all stray dogs, impound them and destroy them if they are not claimed within three days. The second ordinance specifies that all towns and villages should have all dogs within the area registered and licensed. The license is to be issued only for dogs vaccinated against rabies.

ii) Vaccination — Rabies could be easily prevented by effective immunization. A routine vaccination procedure is to immunize all dogs over three months of age and to give a booster dose one year later. Several types of rabies vaccines are available in the market. Depending on the type of vaccine used, re-vaccination every 2—3 years is recommended thereafter.

If you have not vaccinated your pet dog, and if it is bitten by a rabid dog, you are strongly advised to have your dog destroyed immediately. If your pet dog has been previously vaccinated as recommended and it is bitten by a rabid dog, it must be immediately re-vaccinated, kept under confinement, without a chance of contact particularly with children, for 30 days. Even after release from confinement, it should be observed carefully for a further 60 days.

## CANINE DISTEMPER

Another important virus disease of dogs in Sri Lanka. It is quite similar to influenza in human beings, and, like influenza, is caused primarily by a virus followed by secondary bacterial infections. The disease is highly contagious and often fatal. Pups and dogs upto three years of age appear to be

more susceptible than older dogs. The usual method of transmission is by direct contact between dogs. Indirect contact via drinking water, feeding bowls and other formites does not appear to be important as means of transmission.

Apart from complications, the disease runs its course in about four weeks. Symptoms vary widely depending on the secondary organism, but is usually characterised by a diphasic temperature curve (a fluctuating temperature with two peaks) and a catarrhal inflammation of all the mucous membranes of the body. Following the feverish signs, the dog refuses food and has nose and eye discharges. A cough develops and breathing is abnormal and quickened. Diarrhoea is usual and the discharge from eyes and nose thickens into pus. There may be vomition and in odd cases blisters may be seen on the inner thighs and belly. In some cases a thickening of the skin of pads of the feet occurs, giving rise to a condition known as 'hard pad disease'. Nervous signs, such as convulsions and paralysis of hind legs, occur somewhat later in the course of the disease. Death occurs while the animal is in coma.

Affected animals should be isolated and their quarters disinfected. Antibiotics are extremely useful for treating the secondary infections. While treating the animals, attention to hygiene, nutrition and comfortable environment are essential and can have a marked effect in minimising complications. The disease is best controlled by vaccination.

## CANINE INFECTIOUS HEPATITIS

A highly infectious virus disease of dogs. The disease affects mostly young animals, three to eight months old; transmission occurs via discharges from the respiratory system of an infected animal. Transmission may also take place through urine.

During the early stages, the symptoms are identical with those of distemper. There is a rapid course characterised by apathy, loss of appetite, vomition, high fluctuating (but not diphasic) temperature, and nasal and eye discharges. Usually the tonsils are enlarged, but respiratory involvement is rare. About one-third of affected dogs develop corneal opacity (cloudiness of the cornea). There is no jaundice and nervous signs are rare. In some cases there may be convulsion, spasms and 'running fits'.

Antibiotics are widely used for treatment of secondary infections. Feeding with feeds fortified with vitamins are strongly recommended. Good nursing is of great importance. The disease is best controlled by vaccination. The vaccines are often combined with distemper vaccine.

## CANINE PARVOVIRUS

Canine parvovirus is a new disease of dogs caused by a virus known as canine parvovirus type — 2 (CPV - 2). The route of infection is presumed to be faecal - oral.

The disease in dogs usually takes two forms; enteritic or myocardial.

1. The enteritic form occurs in dogs of all ages, but severe illness is encountered more often in pups. This form is characterized by the acute onset of fever, vomiting and diarrhoea. The stool and the vomition are blood-stained in about one-half of clinical cases.

2. Acute myocarditis is confined almost exclusively to pups between 3 and 8 weeks of age. Clinical signs appear suddenly and progress rapidly. Affected pups are often found dead without premonitory signs, or succumb after short period periods of difficult breathing, crying and retching. Mortality usually exceeds 50% in affected litters. Surviving littermates may appear clinically normal, but may develop congestive heart failure even years later. Vaccination using attenuated CPV is widely practised, and appears to provide durable protection against reinfection. Recovery from the disease usually confers long-lived immunity.

## FELINE ENTERITIS

The most serious disease of cats. The disease is sudden in its onset and rapid in its course. It is especially disastrous to young animals, among which the mortality rate is often higher than 80 percent. The virus that causes the disease is spread by direct or indirect contact and by fleas.

Although the symptoms are variable, those most characteristic are high fever, inappetance, a marked decrease of white blood cells, depression, severe diarrhoea, vomition, rapid loss of flesh and sometimes a discharge from the eyes and nose. Affected cats manifest extreme soreness of the abdomen due to pertonitis (inflammation of peritoneum).

Affected cats should be isolated, kept in warm dry quarters, and fed broth or milk if they will eat. Antibiotics are of value in treatment. Control is effected by vaccination. It is of utmost importance to vaccine all kittens around two or three months of age.

## CANINE BABESIOSIS

Canine babesiosis is caused by protozoan parasites, *Babesia gibsoni* and *Babesia canis,* which are transmitted by the blood sucking ticks. These parasites affect the red blood cells. Highly bred exotic dogs are much more susceptible than indigenous dogs. The disease runs a mild course in mature dogs. Affected animals are listless and suffer from anaemia. The central nervous system may be involved, as manifested by excitement alternating with lethargy. Puppies may show much more severe symptoms. High fever, prostration, anaemia and rapid emaciation are characteristics. The appearance of jaundice is an unfavourable sign. If untreated, it may terminate in death.

Diminazine aceturate ('Berenil') given at the rate of 3.5 ml/kg body weight is a satisfactory treatment. There appears to be no natural resistance in puppies; but recovered animals remain in a premune state. Elimination of blood sucking parasites, particularly ticks, will reduce the incidence.

## CANINE EHRLICHIOSIS

Canine ehrlichiosis (Tropical Canine Pancytopaenia — TCP) is a highly fatal disease of dogs caused by *Ehrlichia canis,* a rickettsial organism that parasitise circulating leukocytes. The organism is transmitted by ticks.

The clinical signs include bleeding from nostrils, intermittent high fever, loss of appetite, distressed breathing, posterior weakness and vomiting. When death occurs, it is usually due to uncontrolled bleeding (resulting from insufficient platelet numbers) or secondary infections (resulting from low leukocyte numbers). Oxytetracycline is the drug of choice in the treatment of the disease. Dogs in early stages of infection respond dramatically.

## BACTERIAL ENTERITIS

Bacterial enteritis is another important problem in dogs. It may be secondary to infections such as distemper and hepatitis; on the other hand, it may be secondary to faulty feeding, stress or other predisposing factors. Various bacterial species, such as *Salmonella, Streptococci, Escherichia coli, Clostridium welchii, Lactobacilli,* have been incriminated as causes of this condition. There is desentery, anaemia and weight loss in young puppies. In adults it usually produces only intermittent diarrhoea. *E. coli* may cause severe haemorrhagic enteritis in adult dogs.

All these infections respond to antibiotics. A good diet, comfortable quarters and sanitation should accompany any treatment for the condition.

## NEPHRITIS

The most common form of nephritis (inflammation of the kidney) seen in Sri Lanka is interstitial nephritis, caused by a bacteria belonging to the genus *Leptospira.* Transmission of the disease occurs by direct as well as indirect contact. Leptospires are found in the urine of the affected animals and this one of the main methods of transmission. Rats also act as carriers of leptospiral infection.

Symptoms vary widely. Vomiting may be present and is intermittent. Diarrhoea is a frequent intermittent symptom. The urine is often excess in amount with a low specific gravity. The coat become rough and the animal is dehydrated. As the kidney function becomes less efficient,definite evidence of uraemia sets in. There is vomition, depression, drowsiness, a urinous smell, ulcers on the mouth and tongue, discolouration of teeth, anaemia and sometimes eczema. The animal rapidly ages, wastes away and destruction of kidney tissue may lead to its death. Most of the antibiotics could be used in treating the condition. Good nursing, nourishment and warm quarters will assist in recovery.

## SPIROCERCOSIS

A parasitic condition in dogs caused by a round worm,*Spirocerca lupi.* This is common in Sri Lanka. The worm is found in the walls of the oesophagus, stomach and aorta. The lifecycle is indirect. Eggs hatch after ingestion by coporphagous beetles. The beetle is then ingested by the dog or alternatively by numerous small animals which in turn are eaten by dogs. In the dog's stomach larvae are liberated, penetrate into the wall, enter the arteries and migrate to the aorta, oesophagus and other organs. In these tissues larvae produce haemorrhage, necrosis and abcesses, and the adults produce nodules which may cause obstructions. Symptoms vary according to the tissue involved. For example, if the lungs are affected there will be respiratory distress. There is often difficulty in swallowing and vomition. Sometimes an infected aorta may rupture causing immediate death.

Treatment with diethyl carbamazine, 20 mg/kg body weight, will alleviate symptoms but will not kill all the worms. Disophenol ('Ancylol') injection, 4.5 percent solution, at the rate of 0.25 ml/kg body weight is also recommended and quite effective. Control may be effected by preventing dogs from eating intermediate hosts, but that would be difficult.

## INTESTINAL ROUND WORMS

*Toxocara canis* is the commonest worm parasite of dogs in Sri Lanka. Eggs, passed out in the faeces of dogs, become infective in about ten days. After ingestion and hatching in the intestine, the larvae migrates over the body of the animal settling in lungs, liver, kidney and other tissues. In the pregnant bitch they even migrate to the foetus, settling down in the liver. At birth of the pups, they are in the lungs and in a month they mature and start passing eggs in the intestine.

A related species *Toxocara cati,* which affect the cats, also goes through a similar lifecycle. Prenatal infection of worms, however, does not occur in cats.

Young animals suffer most. Generally there is weakness, wasting, 'pot belly', diarrhoea or constipation, vomiting and anaemia. Prenatal infections may cause the whole litter to die. Nervous signs are frequently seen. Migration of larvae through the lungs may cause coughing and, in advanced cases, pneumonia. Occasionally migration of worms to the bile duct will result in jaundice.

Thorough hygiene in kennels with constant removal of faeces containing eggs is essential in controlling the infestations. Treatment of animals should be regularly carried out where the parasites are known to exist. Treatment with piperazine adipate ('coopane'), 100—200 mg/kg body weight, is quite effective. Pyrantel pamoate ('Combantrin') is also recommended and is very effective.

## TAPE WORMS

Quite a variety of tape worms infest dogs. Of these, *Diplylidium caninum* which occurs in the small intestine is the commonest one all over the world. It infests cats and also human beings. The ripe segments of the worm pass out, with eggs, in the faeces. Larval fleas or the dog louse then eat the eggs and in these secondary hosts, the larval forms develop. The dog may then become infected by swallowing the infected fleas. Children are accidentially infected by swallowing such fleas.

Unless the parasite is present in large numbers, symptoms of tapeworm infection in dogs are usually minor and are much more likely to be seen in young puppies. With heavy infections, nervous symptoms as manifested by irritation twitching, incordination and convulsions have been observed. Control consists of treatment of animals for tape worms and breaking the life cycle by both eliminating the fleas from kennels and destruction of faeces after worming. Niclosamide ('yomesan') given orally at the rate of 50 mg/kg body weight is very effective against *D. caninum* and other common tape worms.

## DEMODECTIC MANGE

The condition is caused by a mite, *Demodex foliculorum*. It lives deep in the hair follicles and sebaceous glands of the skin. The general effect is to produce a chronic inflammation with thickening of the epidermis and loss of hair. There are two clinical forms, the squamous in which the thickened epidermis becomes scaly, wrinkled and reddened; the pustular form usually follows the squamous form and is associated with secondary bacterial infection. Pustules may develop into abscesses. Dogs, particularly when in poor condition, often become seriously affected and may die.

Treatment is very difficult, probably due to the mites habit of living deep in the skin. Perhaps the most reliable application is 'neguvon'. Lesions must be cleaned thoroughly before application. Antibiotics will destroy the secondary infections found in the pustular form.

## SARCOPTIC MANGE

This is extremely common and highly contagious. The condition is caused by a mite, *Sarcoptes scabei* var. *canis*. The female burrows into the skin, forming tunnels in which she lays eggs. The young stages also may burrow into the skin to moult and to feed. The parasites cause great irritation resulting in inflammation and production of exudates. The condition is seen mainly on the less hairy parts of the animals, but if untreated will spread to other parts. When lesions become extensive, emaciation of the host may be pronounced and death may occur.

Benzyl benzoate ('Ascabiol') or Benzyl salycilate are widely used for treating the condition. It is important to treat both the animal and its quarters to eliminate the mites. Chlorinated hydrocarbons such as Gamma-GHC should not be used on dogs.

## A HEALTH CARE SCHEDULE FOR DOGS

'Prevention is better than cure'. With regular checkups, early signs of diseases may be identified and treated. Take your dog for thorough veterinary checkup every six months.

### Vaccinations

To protect your dog against contagious diseases, the following vaccinations will be necessary.

— All dogs require a rabies vaccine. The first dose at 3 months of age and a booster dose one year later are recommended. The dog must be re-vaccinated every 2—3 years thereafter.

— (For puppies) A series of shots against such common diseases as canine distemper, canine infectious hepatitis and canine parvovirus infection is necessary.

**Worming**

— Puppies are born with round worms, and the tape worms are quite common in adult dogs. Stool samples must be checked by the veterinarian regularly and the dog must be wormed.

— It is also essential to eliminate fleas. Your vet can prescribe a suitable flea dip or powder. Most cases of eczema in dogs are due to sensitivity which develops to flea bites.

## REFERENCES

Abeysena, F.A. and Seneviratne, P. (1970). Studies on **Babesia argentina** in cattle in Ceylon. **Ceylon Vet. J.** 18(3):16.

Balachandran, K. (1978). Diseases of goats in the Jaffna range. **Ceylon Vet. J.** 26:56 (abstract).

Barsenbach, G.L. (1974). Some facts about rabies. **Animal Production and Health Bulletin.** 8:44.

Bongso, T.A. and Pinto M.R.M (1972). Studies on tuberculin sensitivity in livestock in Ceylon. I. Patterns in sensitivity in cattle. **Ceylon Vet J.** 20:94.

De Alwis, M.C.L. (1974). Some problems in the control of haemorrhagic septicaemia in Sri Lanka. **Animal Prod. & Health Bull.** 8:28.

De Alwis, M.C.L. (1975). Some aspects of calf pneumonia in Sri Lanka. **Animal Prod. & Health Bull.** 9:52.

De Alwis, M.C.L. (1979) Haemorrhagic Septicaemia in Sri Lanka. **Animal Prod. & Health Bull.** 12:33.

De Alwis, M.C.L. and Vipulasiri, A.A. (1980). An epizootiological study of haemorrhagic septicaemia in buffaloes and cattle in Sri Lanka. **Ceylon Vet. J.** 28:24.

Eltinger, S.J. (1983). **Textbook of Veterinary Internal Medicine (Diseases of the Dog and Cat).** Second Edition. W.B. Saunders Company. London. 1124 pp.

Fernando, S.T. (1957). Coccidia of goats in Ceylon — Preliminary observations. **Ceylon Vet J.** 5:19.

Fernando, W.W.H.S. (1959). Foot and mouth disease in Ceylon. **Ceylon Vet J.** 17(3):43.

Fernando, W.W.H.S. (1980). A plan for control of foot and mouth disease in Sri Lanka. **Animal Prod. & Health Bull.** 13:5.

Hall, H.T.B. (1977). **Diseases and Parasites of Livestock in the Tropics.** First edition. Longman Group Ltd., London. 288 pp.

Horadagoda, N.U., Wettimuny, S.G. de S., De Alwis, M.C.L., Vipulasiri, A.A. and Anthony, C.S.U.B. (1980). Association of **Parteurella haemolytica** with pneumonia in goats. **Ceylon Vet J.** 28: 66 (abstract).

Kulasegaram, P. (1968) Mycoplasma infection in poultry. **Animal Prod. & Health Bull.** 2: 54.

Kulasegaram, P. (1969). Avian encephalomyelitis (epidemic tremor) infection. **Animal Prod. & Health Bull. 3(3): 119.**

Kulasegaram, P. (1971). An oral vaccine to immunise chicks against ranikhet. **Animal Prod. & Health Bull.** 5(4): 115

Kulasegaram, P. (1975 a). A seven point plan for the control of mastitis among dairy herds. **Animal Prod. & Health Bull.** 9: 14.

Kulasegaram, P. (1975 b). An analysis of the records of postmortem examinations carried out in chickens between 1960 and 1974. **Ceylon Vet J.** 23: 39.

Rajadevan, P., Goonewardene, L., Ravindran, V. and Rajaguru, A.S.B. (1987). An investigation on the productive traits of crossbred rabbits in Sri Lanka **World Review Animal Prod.** 23:91.

Ranatunga, P. (1970). Anthelmintics for gastrointestinal nematodiasis. **Animal Prod. & Health Bull.** 4(2): 78.

Ranatunga, P. (1971 a). Kid mortality on two government farms in Ceylon. **Tropical Animal Health & Production (U.K.).** 3: 52.

Ranatunga, P. (1971 b). Nasal bot fly in sheep and goats. **Animal Prod. & Health Bull.** 5(1): 23.

Ranatunga, P. (1971 c). Common parasitic problems in sheep and goats. **Ceylon Vet J.** 19(4): 126.

Ranatunga, P. (1974). Calf mortality in hill country dairy farms in Sri Lanka. **Ceylon Vet J.** 22: 4.

Ranaweera, A. (1978). Metabolic disorders in ruminants related to pregnancy and lactation. **Animal Prod. & Health Bull.** 11: 48.

Ranaweera, A. (1980). Biochemical aspects of pregnancy toxaemia in ewes: a review. **Ceylon Vet J.** 28: 1.

Rasiah, P. and Kulasegaram, P. (1972). The pattern of coccidiosis among chickens in Ceylon. **Ceylon Vet J.** 20: 96.

Rupasinghe, T. and Kulasegaram, P. (1978). Incidence and aetiology of subclinical mastitis in cows in Sri Lanka. **Ceylon Vet. J.** 26: 22.

Seneviratne, P. (1959). An outbreak of avian malaria in a flock of domestic fowls. **Ceylon Vet J.** 7: 51.

Seneviratne, P. (1966). **Diseases of Poultry.** First edition. T.B.S. Godamunne & Sons, Ltd., Kandy 325 pp.

Seneviratne, P. (1967 a). Economic losses due to parasitic diseases of livestock in Sri Lanka. **Ceylon Vet J.** 15: 5.

Seneviratne, P. (1967 b). Rabies. **Animal Production & Health Bull.** 1(2): 61.

Seneviratne, P. (1968). Avian leucosis complex. **Animal Production & Health Bull.** 2(3): 60.

Seneviratne, P. (1972). Newer concepts of Marek's disease. **Animal Production & Health Bull.** 6(3): 102.

Shoho, C. and Kulasegaram, P. (1957). Studies on cerebrospinal nematodiasis in Ceylon. **Ceylon Vet J.** 5: 85.

Subasinghe, H.A. and Fernando, H.S. (1975). *Salmonella dublin* associated with a case of calf pneumonia. **Ceylon Vet J.** 23: 25.

Subasinghe, H.A. and Ramakrishnaswamy, A. (1975). Enteritis in piglets associated with *Salmonella* in Ceylon. **Ceylon Vet J.** 21: 7.

Sivakanesan, R. (1975). **Handbook for Veterinarians.** First edition. T.B.S. Godamunne & Sons, Ltd., Kandy. 103 pp.

Siriwardene, J.A. de S. (1959). Fowl cholera in Ceylon. **Ceylon Vet J.** 7: 10.

Wanasinghe, D.D. (1970). A report of an outbreak of enterotoxaemia among a herd of goats. **Animal Prod. & Health Bull** 4(2):74.

Wanasinghe, D.D. (1971). Economic losses due to mastitis. **Ceylon Vet J.** 19: 124.

Wanasinghe, D.D. and Gunatilake, A.A.P. (1983). An outbreak of swine fever in Sri Lanka. **Proceedings of the Sri Lankan Association for the Advancement of Science** 39: 16. (abstract).

Wanasinghe, D.D. and Somaratne, M. (1983 a). Actinobacillosis in cattle in Sri Lanka. **Proceedings of the Sri Lankan Association for the Advancement of Science.** 39: 17 (abstract.)

Wanasinghe D.D. and Somaratne, M. (1983 b). Pneumonic pasteurellosis in swine in Sri Lanka. **Proceedings of the Sri Lankan Association for the Advancement of Science.** 39: 17 (abstract).

Wanasighe, D.D., Balasuriya, B.R.U. and Maithripala, H.A. (1986). Pnuemonia due to *Pasteurella haemolytica* in a herd of goats. **Proceedings of the Sri Lankan Association for the Advancement of Science.** 42: 17 (abstract).

Wanasinghe, D.D., Wijewardene, T. and Vipulasiri, A.A. (1986). Pasteurellosis among animals in Sri Lanka. **Proceedings of the Sri Lankan Association for the Advancement of Science.** 42: 16 (abstract.)

Weligama, D.J. (1974 a). Studies on Boophilids in Sri Lanka. **MVSc Thesis.** University of Sri Lanka, Peradeniya.

Weligama, D.J. (1974 b). Babesiosis in cattle in Sri Lanka. **Animal Prod. & Health Bull.** 8(3): 65.

Weligama, D.J., De Alwis, M.C.L. and Shanmugalingam, K. (1980). An outbreak of tropical canine pancytopaenia in Sri Lanka. **Ceylon Vet J.** 28: 66 (abstract).

West, G.P. (ed.) (1976) **Black's Veterinary Dictionary.** Twelfth edition. Adam & Charles Black, London. 867 pp.

Wickremasinghe, R. and Peiris, H.J. (1985). An outbreak of fowl cholera in a poultry farm in Sri Lanka. **Sri Lankan Vet. J.** 33:29.

Wickremasinghe, W.A.T. (1973). Livestock immunisation. **Animal Prod. & Health Bull.** 7(4): 102.

Wickremasinghe, W.A.T. (1975 a). Animal vaccines produced in Sri Lanka. **Animal Prod. & Health Bull.** 9(3): 72.

Wickremasinghe, W.A.T. (1975 b). Some observations on Marek's disease in poultry in Sri Lanka. **Animal Prod. & Health Bull.** 8: 89.