

# **APPLIED PARASITOLOGY**

## **(ZOO 401)**

# \*SYNGAMIASIS

- \*This disease is caused by the *Syngamus trachea*
- \*Also commonly called the Gapeworm in
- \*Hosts: *S. trachea* is found in chickens, turkeys, pheasants, guinea fowls, geese and various wild birds throughout the world.
- \*Predilection site: The adult worms are found in the trachea or in the lungs.
- \*The buccal capsule is cup-shaped with six to ten teeth at the base. The males have two spicules which measure 53 - 82 cm.
- \*The eggs have a thick operculum in both poles and measure 70- 100 x 43 - 46 cm.

**MORPHOLOGY:** The worms are red in colour and the two sexes are found in permanent copulation (Figure 3.12).

The female is bigger than the male, measuring 5 - 20 mm, the male 2 - 6 mm. *S. trachea* has a wide mouth opening, without leaf-crowns.

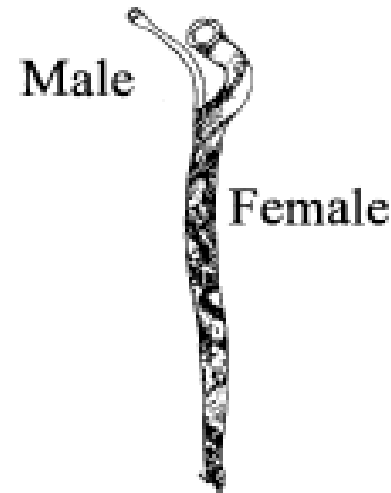


Figure 3.12 *Syngamus trachea*: Male and female in permanent copulation (Wehr 1937).

# \* LIFE CYCLE

- \* Infection happens when infective eggs or larvae are ingested. The life cycle may be direct or indirect as the larvae may be swallowed by earthworms, snails, flies or other arthropods.
- \* When these "intermediate" hosts are swallowed by poultry the infection is passed on.
- \* The larvae migrate through the intestinal wall and are carried by the blood to the lungs. Here they develop into the adult stage.
- \* The pre-patent period is three weeks. Eggs are coughed up and swallowed and passed with the faeces.
- \* Depending on the temperature and humidity, the eggs become infective in 2 to 7 days.
- \* Infections with *S. trachea* mainly affect young birds except for turkeys which are affected at any age. Pheasants and other reared game birds are highly susceptible.



## RISK FACTORS

- \* Crowding of birds
- \* Unsanitary living conditions
- \* Small chicken breeds, such as bantams and younger chickens ingestion of earthworms, slugs, or snails.

## CLINICAL SIGNS AND PATHOGENICITY

The characteristic signs of *S. trachea* infections are: dyspnea and asphyxia, occurring when mucus accumulates in the trachea (gaping). Death follows when the mucus blocks the trachea.

Emaciation, anaemia and weakness are also seen as clinical signs. At the post mortem examination the carcass is emaciated and anaemic and the adult worm is seen macroscopically when opening the trachea.

## DIAGNOSIS

- \* History
- \* Clinical signs
- \* Physical exam (Bronchoscopy: To visualize inside the airways)
- \* Fecal flotation
- \* Necropsy



# \*TREATMENT AND PREVENTION

- \* Bronchoscopic surgery: To remove worms from lungs
- \* Numerous classic broad spectrum anthelmintics are effective against *Syngamus trachea*, e.g. several benzimidazoles (albendazole, fenbendazole, flubendazole, mebendazole, oxfendazole, etc.), levamisole, as well as macrocyclic lactones (e.g. ivermectin).
- \* For use on poultry these active ingredients are usually available as additives for feed or drinking water, seldom as injectables or tablets (mainly for single animal treatment, typical for fighting roosters).
- \* Most such wormers (e.g. benzimidazoles, levamisole, piperazine derivatives and pyrantel) kill the worms shortly after treatment and are quickly metabolized and/or excreted within a few hours or days. This means that they have a **short residual effect**, or no residual effect at all.
- \* As a consequence treated animals are cured from worms but do not remain protected against new infections. To ensure that they remain worm-free the animals have to be dewormed periodically, depending on the local epidemiological, ecological and climatic conditions.

## PREVENTION

Prevention may be possible by doing the following:

- \* proper food preparation
- \* water sanitation
- \* In endemic regions it is highly recommended to keep the birds' bedding as dry as possible and to frequently change it, because survival of the worms' eggs needs humidity.
- \* It is also advisable to restrict the access of free-range poultry to dark and humid environments where intermediate hosts are usually more abundant.
- \* Outdoor cages should be equipped with adequate screens or nets that keep wild birds off, since they are carriers of worms. All these measures are especially important for young birds, which are likely to suffer more from *Syngamus* infections.
- \* Young birds should be reared separately from old birds that could carry worms even if they show no symptoms.

# HAEMONCHOSIS

\* *Haemonchus* is a genus of parasitic roundworms that infects cattle, sheep and goats and other wild ruminants.

\* Worms of this genus are also called **barber's pole worms**, **twisted wireworms** or **large stomach worms**. It is found worldwide but is more frequent and harmful in regions with tropical and subtropical humid climates.



The most relevant species for livestock are: *Haemonchus contortus* infects mainly sheep and goats, but also cattle.

*Haemonchus placei* infects mainly cattle, but also sheep and goats.

\* These worms do not affect dogs and cats.

\* The disease caused by *Haemonchus* worms is called **HAEMONCHOSIS**.

\* Final location of *Haemonchus* worms  
Predilection site of  
adult *Haemonchus* worms is  
the stomach (abomasum).

# \* LIFE CYCLE

- \* *Haemonchus* worms have a **direct life cycle**, i.e. there are no intermediate hosts involved.
- \* Adult females lay eggs in the stomach of the host that are shed with the feces.
- \* Once in the environment the eggs release the L1-larvae that complete development to infective L3-larvae in about 4 to 7 days.
- \* By moist and warm weather these infective larvae can survive on pasture and remain infective for several months. However they are not very resistant to cold. Infective larvae are able to climb upwards in moist leaves and stems of pasture plants, where they are more likely to be ingested by grazing hosts.
- \* Livestock becomes infected after ingesting infective larvae with pasture. These larvae enter the pit of gastric glands and feed voraciously on blood flowing out of the lesions they cause to the stomach's lining with their mouthparts.
- \* Later on they complete development to adult worms and females start producing up to 10'000 eggs daily. L4 larvae can become **arrested** (dormant, hypobiotic) in the stomach tissues to survive the cold or the dry season. They resume development to adults later on when environmental conditions become more favorable.



They are the **most damaging gastrointestinal worms** for livestock in tropical and subtropical regions, particularly for sheep and goats. Both the larvae and the adults feed on blood and cause a considerable damage to the stomach tissues.

While feeding they release anticoagulants to hinder blood clotting. All this causes numerous lesions in the stomach wall, which becomes irritated (gastritis).

Blood loss results in anemia. Other effects of chronic infections are edema, i.e. accumulation of liquid in the abdomen, thorax, and also in the submandibular tissue, which is known as "bottle jaw" and is characteristic of infections with *Haemonchus* and other gastrointestinal worms.

- \* Severe infections can also cause liver damage, weight loss, unthriftiness, diarrhea (mostly dark) and dehydration. Fatalities are not infrequent.
- \* Massive infection of **young lambs** can be fatal in a few days, without previous symptoms and without previous shedding of eggs in the feces. The reason is that the immature stages are already voracious blood feeders.
- \* Most *Haemonchus* infections are mixed with other gastrointestinal roundworms (e.g. *Cooperia* spp, *Nematodirus* spp, *Ostertagia* spp, *Trichostrongylus* spp, etc.) which worsen the damage caused to affected livestock.



# \* PREVENTION AND TREATMENT

- \* Preventative measures that reduce the contamination of pastures with infective larvae (e.g. pasture rotation) and reduce the risk the animals become infected are essential to control *Haemonchus* infections. This is particularly urgent for this parasite because **resistance** to almost all available anthelmintics is now widespread in many regions. Such preventative measures are the same for all gastrointestinal roundworms and are explained in a **specific article in this site**
- \* Such measures must be applied for both young and adult livestock, because *Haemonchus* infections can be fatal for animals of any age

Livestock exposed to these worms often develop natural resistance progressively and may recover spontaneously, but only well fed healthy animals, not already weakened animals. Such resistant animals do not become sick if re-infected, but continue shedding eggs that contaminate their environment. Some indigenous livestock breeds may show a high natural resistance to these worms. Unfortunately such breeds are often not the most productive ones and thus not appreciated by most farmers for economic reasons.

# COCCIDIOSIS



- \* **Coccidiosis** is a parasitic disease of the intestinal tract of animals caused by coccidian protozoa.
- \* The disease spreads from one animal to another by contact with infected feces or ingestion of infected tissue.
- \* **Occurrence:** Worldwide.
- \* **Species affected:** Mostly chickens, some species can also have disease including turkeys, quail and pheasants.
- \* **Age affected:** All ages after 7 days of age.
- \* **Causes:** Protozoan parasites of the genus *Eimeria*. Nine species occur in the chicken, of which *E. tenella*, *E. maxima*, *E. necatrix*, *E. acervulina*, *E. dispersa* and *E. mitis* are the most important.
- \* **Effects:** Watery and/or bloody droppings, poor weight gain and feed conversion, anaemia, depression, drop in egg production in layers.
- \* **Morbidity** can be as high as 100%, **mortality** ranges from 0-50%.

# \* LIFE CYCLE

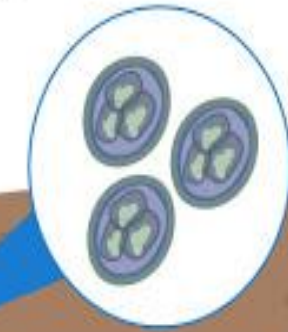
- \* All avian *Eimeria* with the exception of *E. dispersia* infect only one poultry species. *E. dispersia* may infect and cause disease in turkeys, quail and pheasants.
- \* All avian *Eimeria* with the exception of *E. dispersia* infect only one poultry species. *E. dispersia* may infect and cause disease in turkeys, quail and pheasants.
- \* The *Eimeria*; oocyst contains 4 sporocysts. Each sporocyst contains 2 sporozoites. The organism undergoes two rounds of asexual reproduction (schizogony) and 1 round of sexual reproduction (gametogony).
- \* All chicken coccidia are species-related (occur only in the chicken) and are tissue trophic (occur in particular areas of the intestine).
- \* Acute to chronic disease can occur after 7 days of age.
- \* Direct transmission occurs by consumption of sporulated oocysts in the faecal material. Only birds reared on moist, contaminated used litter have access to sporulated oocysts. Soil may be contaminated. Oocysts need 48 hours to sporulate (sporogony). Oxygen and moisture are needed for sporulation. The entire process takes 4-7 days depending on the species of *Eimeria*.



## *Eimeria* spp Life Cycle

Infected bird

Infected bird sheds noninfective oocysts (eggs) in feces, contaminating the environment.



Oocysts sporulate within 48 hours and become infective.

Oocysts hatch and invade intestinal tissue, causing damage, and creating more oocysts.

Other birds ingest infective oocysts while drinking/eating

Poultry  
DVM!

Standing hunched up,  
with ruffled feathers

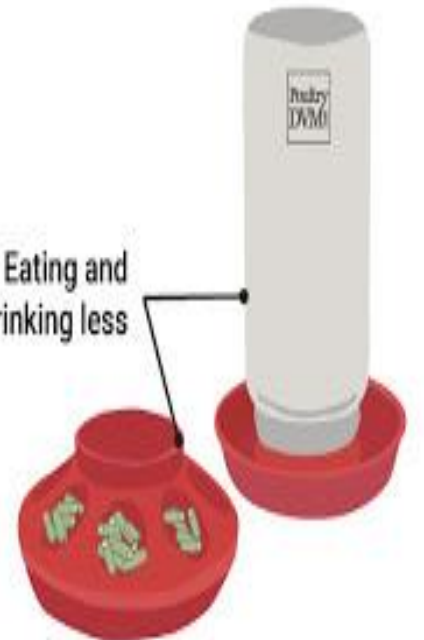
Paleness



Off-color and/or  
bloody droppings

Inactive, off on  
their own

Eating and  
drinking less





## \*COCCIDIOSIS IN TURKEYS

There are **six species** of *Eimeria* that can infest turkeys: *E. meleagridis*, *E. dispersa*, *E. gallopavonis*, *E. meleagrimitis*, *E. innocua* and *E. subrotunda*.

This species parasite different parts of the **digestive tract** and with different severity, for which signs and lesions observed in necropsies can help with the diagnosis.



*Eimeria meleagridis*  
*Eimeria gallopavonis*



*Eimeria meleagrimitis*



*Eimeria dispersa*  
*Eimeria innocua*



*Eimeria subrotunda*

Characterization of <i>Eimeria</i> species that affect turkeys					
			Pathogeny	Lesions	Others
Large intestine	<i>E. meleagridis</i>	Caecum (mainly)	Low ↓WG	Ulcerations <u>Content</u> : white caseous plugs/fibrinous necrotic content	
	<i>E. gallopavonis</i>	Caecum (mainly)	Higher ↓↓WG, mortality	Petechiae/thickening of distal ileum and rectum, ulcerations <u>Content</u> : clotted blood, caseous plugs, yellow exudate over the ulcers	
Small intestine	<i>E. meleagrimitis</i>	Small gut, mostly lower part (jejunum)	Medium ↓WG, occasional mortality	Thickening of jejunum, few petechiae <u>Content</u> : watery, white mucus strands	
	<i>E. dispersa</i>	Small gut, mostly upper part (duodenum)	Low ↓WG	<u>Content</u> : white mucus in duodenum, strong blood perfusion	Polar body
	<i>E. innocua</i>	Small gut, mostly duodenum	Low ↓WG	<u>Content</u> : watery, white mucous similar to <i>E. dispersa</i>	No polar body
	<i>E. subrotunda</i>	Small gut	No		

- \*Coccidia which are deep tissue invaders such as *E. maxima*, *E. necatrix* and *E. tenella* cause severe necrosis, haemorrhage of the intestinal mucosa, and bloody diarrhoea and may result in death.
- \*Signs include watery and/or bloody droppings, mortality (0-50%), and morbidity (0-100%). Culls appear as pale birds with anaemia, depression, poor weight gain and feed conversion, and a drop in egg production.
- \*Enteritis characteristic of *Eimeria* species is seen. The intestinal tract can be enlarged and have necrotic and/or haemorrhagic foci, undigested feed and gas. Localisation of lesions is *Eimeria* species-related.

## DIAGNOSIS

- \*Intestinal scrapings should be examined for oocysts. The site and degree of lesions and size and shape of oocysts and schizonts are all used to differentiate between *Eimeria* species. It appears similar to bacterial enteritis in chickens, especially necrotic enteritis.

## TREATMENT & CONTROL

- \*Feeding anti-coccidial feed additives for the entire broiler grow-out or at least 3 weeks for pullet reared on the ground.
- \*Vaccine containing live or attenuated oocysts can be given by coarse spray in the hatchery or drinking water in the field.











# PARASITIC MITES

Class: Arachnida

Subclass: Acari

Order: Astigmata

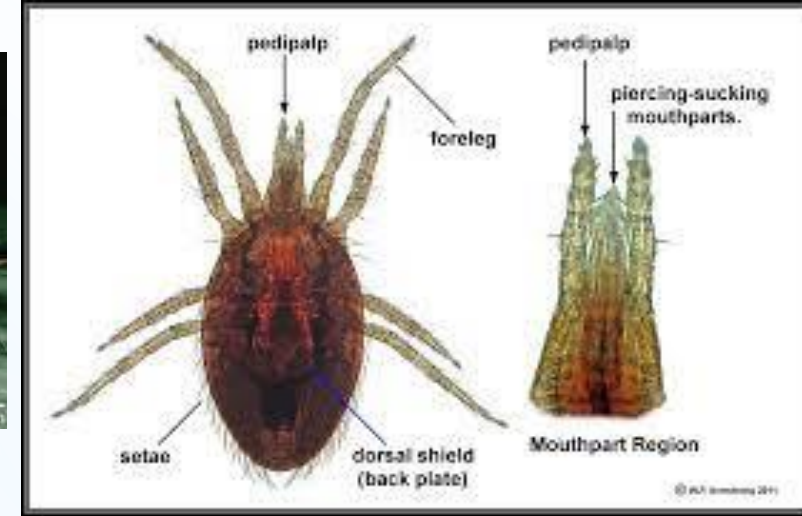
Family: Pyroglyphidae

Genus: *Dermatophagoides* (Dust mites)

Family: Sarcoptidae

Genus: *Sarcoptes* (Scabies mites)

The sarcoptic itch mites, *Sarcoptes scabiei*, infest the skin of a variety of animals including humans.



- \* Human scabies mites are very small and are rarely seen. They commonly attack the thin skin between the fingers, the bend of the elbow and knee, the penis, breasts, and the shoulder blades.
- \* The mites burrow into the skin, making tunnels up to 3 mm (0.1 inch) long. When they first burrow into the skin, the mites cause little irritation, but after about a month, sensitization begins. A rash appears in the area of the burrows and intense itching is experienced.
- \* Scabies mites are transmitted by close personal contact, usually from sleeping in the same bed.
- \* Bedridden individuals in institutions (e.g., nursing homes) may also pass the mites from caregiver to patient.
- \* The adult fertilized female mite is usually the infective life stage. She adheres to the skin using suckers on her legs and burrows into the skin where she lays her oval eggs. In 3 to 5 days these eggs hatch into larvae and move freely over the skin. Soon they transform into nymphs and reach maturity 10 to 14 days after hatching.
- \* A scabies infestation should be handled as a medical problem and is readily diagnosed and treated by most physicians. (Confirmation requires isolating the mites in a skin scraping).
- \* The first step to control a scabies infestation usually involves softening the skin with soap and water to make sure the pesticide treatments can penetrate well.

- \* *Sarcoptes scabiei* is a parasitic mite responsible for scabies, which is one of the three most common skin disorders in children.
- \* *Demodex* mites, which are common cause of mange in dogs and other domesticated animals, have also been implicated in the human skin disease rosacea, although the mechanism by which *demodex* contributes to the disease is unclear.
- \* Chiggers are known primarily for their itchy bite, but they can also spread disease in some limited circumstances, such as scrub typhus.

- \* The house-mouse mite is the only known vector of the disease rickettsial pox. House dust mites, found in warm and humid places such as beds, cause several forms of allergic diseases, including hay fever, asthma and eczema, and are known to aggravate atopic dermatitis
- \* Among domestic animals, sheep are affected by the mite *Psoroptes ovis* which lives on the skin, causing hypersensitivity and inflammation. Hay mites are a suspected reservoir for scrapie, a prion disease of sheep



- \* An evening bath followed by overnight treatment works best. A total body (neck-down) application of topical pesticide medication should remain for 8-12 hours before showering in the morning.
- \* Because the symptoms of scabies mite infestations are delayed by about a month, other members of the household besides those showing symptoms may be harboring the mites. It is important that everyone in the infected family or living group go through the treatment regime.
- \* A second treatment may be necessary to eliminate an infestation of scabies mites, but patients should avoid overzealous pesticide treatment since itching may persist for a week or more after treatment and does not necessarily indicate treatment failure.

Scabies mites cannot live off of a human host for more than 24 hours. Therefore, insecticide treatment of premises is not warranted. It is recommended, however, that coincident with treatment, the clothing and bedding from infested individuals be washed in hot water or dry cleaned.



## PARASITIC TICKS

Ticks are small parasitic organisms that live in wooded areas and fields. These arachnids need blood from humans or animals to survive.

Ticks tend to be carriers of various serious diseases, which they may transmit to the people they bite.

- \* Examples of diseases that ticks may transmit include:
- \* Lyme disease (especially transmitted by adult deer ticks)
- \* Rocky Mountain spotted fever
- \* tularemia
- \* babesiosis (a malaria-like illness transmitted by certain ticks)
- \* ehrlichiosis
- \* anaplasmosis
- \* tick-borne relapsing fever

Symptoms vary among the different diseases, but they may include fever or chills, body aches, headaches, rashes, and nausea. These symptoms can occur in a person years after they were bitten.

### \* What causes tick infestations?

- \* Tick infestations can occur when just one tick is brought into the home.
- \* It's possible for you to come into contact with a tick if there are wooded or brushy areas near your home and you're outdoors when the weather is warm. The tick will attach itself somewhere on your body and bury its head into your skin.
- \* Ticks can attach themselves to any part of the body, including: the groin, under the arms, inside the ears, in the hair, inside the belly button, behind the knee

- \* Ticks can also attach themselves to your pets, especially dogs. Since ticks are usually small, it can be hard to see them on your body or in your pet's fur.
- \* After a tick is brought into your home, a tick infestation may occur once the tick reproduces. Ticks can lay their eggs in different parts of the home. However, they typically lay their eggs near baseboards, window and door surrounds, furniture, edges of rugs, and curtains.
- \* During a tick infestation in your home, you might find a large number of ticks on yourself or on your pet. Since ticks require blood from people or animals to survive, they will attach themselves to you, your family members, or your pet.
- \* Ticks move quickly across the body, but they prefer areas that are warm and moist. They are often found in the armpits, groin, or scalp. Once the tick has found a place it likes, it will bite you and burrow its head firmly into your skin. Unlike other insect bites, this bite is painless.
- \* You should always check your body – and that of your children and pets – after being in an outside area known to have ticks. Make sure to examine any brown or black spots. Don't just focus on the areas where ticks are commonly found. Ticks range in size from 1 to 2 millimeters (mm) in diameter (the size of a poppy seed) to as large as 10 mm in diameter (the size of a pencil eraser).
- \* You may also have a tick infestation in your home if you or one of your family members develops a tick-borne illness. The effects of these illnesses can range from mild to severe. Many of them have similar symptoms, such as:
- \* Fever, chills, body aches and pains similar to the flu, headaches, fatigue, a rash.

- \* You may also use spray or powder pesticide to help kill ticks inside your home.
- \* Although it's possible to control a tick infestation once it occurs, it's far better to prevent an infestation from happening in the first place.
- \* If you live or spend time in an area where ticks are common, you should check yourself and your children before returning indoors. You can also wear long-sleeved shirts and tuck your pants into your socks while hiking on trails or in wooded areas. Try to use insect repellent that works on ticks. You may also buy certain types of clothing that contain insect repellent in the fabric.

- \* To remove a tick that is already biting you or a family member, grasp the tick as close to the skin as possible using tweezers or a tissue. Then pull it out slowly and steadily without twisting. Before pulling the tick from the skin, don't use Vaseline, oil, or alcohol to try to kill the tick. These methods may cause the tick's mouth to remain in your body, which can lead to infection.
- \* After removal, the tick can then be drowned in rubbing alcohol, suffocated in a sealed bag or between layers of tape, or flushed down the toilet for extermination.



- \* To prevent ticks from infesting areas near your home, try to make the surrounding property unsuitable for ticks. Ticks don't like sunny, dry environments and can't thrive in short vegetation. Keeping weeds and brush away from your home and maintaining your lawn will help you get rid of ticks near your property.
- \* If your home is surrounded by heavy brush or wooded areas where ticks are commonly found, you can spray these areas with pesticides to help eliminate ticks. Most pesticides will be effective with one or two applications. You should also clean up any areas around your home that may attract rodents (such as mice and rats), since they often carry ticks.
- \* Regularly check your pets for ticks and apply tick prevention. Ticks are more commonly found on animals that are allowed to roam outside. If you find a tick on your pet, remove it and call your veterinarian. Your pet may need treatment for a tick bite. You can also buy certain medications for your pet that prevent ticks from attaching.

## \* When should you contact your doctor?

You should call your doctor if a tick bites you and you develop symptoms of a tick-borne illness. One of the first signs will be a rash, accompanied by a fever. Antibiotics are typically used to treat tick-borne illnesses, as many are bacterial. Your doctor will be able to give you the correct diagnosis and prescribe the right antibiotic for treatment.