

MITES

General introduction to **BURROWING MITES** (*Sarcoptes*, *Notoedres*, *Demodex*, ...), morphology, life cycles. Consideration of the pathogenic significance of burrowing mites including mange in cattle, sheep, pigs, dogs and cats.

Outline of the life cycles, epidemiology and pathogenic significance of the **NON – BURROWING MITES** (*Psoroptidae*, *Cheyletiellidae*, ...).

Subclass: ACARI (MITES)

Order: Ixodida (METASTIGMATA)

Family: Ixodidae (*Amblyoma*, *Anacantor* (*Baophilus*), *Dermacentor*, *Haemaphysalis*, *Hyalomma*, *Ixodes*, *Rhipicephalus*)
Argasidae (*Argas*, *Carlois*, *Ornithodoros*, *Otobius*)

Order: Gamasida (MESOSTIGMATA)

Family: Dermomyiidae (*Dermomyssus*, *Lipanyssoides*)
Macronyssidae (*Ophionyssus*, *Ornithonyssus*)
Halarachnidae (*Pneumonyssoides*, *Pneumonyssus*, *Railletia*)

Order: TROMBIDIFORMES (PROSTIGMATA)

Family: Demodecidae (*Demodex*)
Cheyletiellidae (*Cheyletiella*, *Ornithocheyletia*)
Trombiculidae (*Neotrombicula*, *Trombicula*)

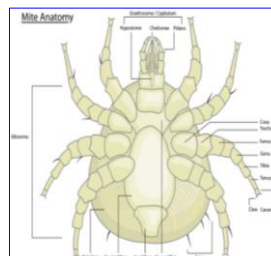
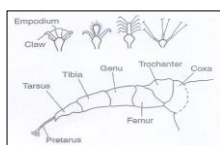
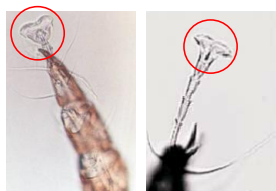
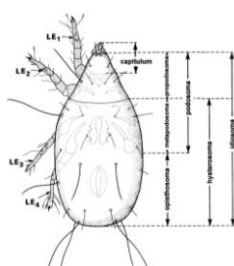
Order SARCOPTIFORMES (ASTIGMATA)

Family: Psoroptidae (*Chorioptes*, *Otodectes*, *Psoroptes*)
Sarcoptidae (*Notoedres*, *Sarcoptes*, *Triacarus*)
Knemidocoptidae (*Knemidocoptes*)
Cytodidae (*Cytodites*)
Laminosioptidae (*Laminosioptes*)

Order: ORIBATIDA

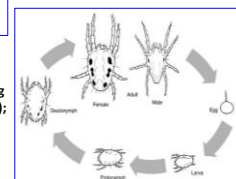
Family: Scheloribatidae (*Scheloribates*); Oeratozetidae (*Trichoribates*); Galumidae (*Galumna*, *Pilogalumna*)

Mites – morphology, life cycle, significance.



Life cycle

➤ egg-larva-nymph-adult, 1-3 nymphal stages (egg → adult, 8 days to several weeks, average 4 weeks);



Significance

Mite infestation can result in:

- Direct epidermal damage leading to inflammation (**SCAB/MANGE**) – results in skin erythema, pruritus, scale formation, lichenification (thickening), crust (inflammatory exudate) formation; ...
- The production of **cutaneous hypersensitivity**; cause of strong allergic reactions;
- **Loss of blood** or **other tissue fluids**;
- Mechanical or biological **transmission of pathogens**;

ACARIASIS - infestation with mites

Possible sites of infestation:

- skin;
- external, inner and middle ear;
- muscles;
- respiratory passages and lungs;
- nasal passages;
- lymphatic tissue;

SCAB (MANGE)

The **SCAB (MANGE)** is a **chronic contagious animal dermatitis** characterized by typical changes in the skin:

- The formation of massive yellowish scabs;
- Wet blood squeezed excoriations;
- Falling wool, hair, feathers;
- Strong pruritus;
- and weight reduction.

It is caused by ten species of mites - ***Psoroptes***, ***Chorioptes***, ***Sarcoptes***, ***Notoedres***, ***Trixacarus***, ***Knemidocoptes***, ***Demodex***, ***Cheyletiella***, ***Trombicula*** and ***Psorergates***, which can also induce a scab or pseudoscab in humans.

MANGE - transmission

- **Highly contagious diseases** (except demodicosis).
- **Chorioptic mange** and **demodicosis** – localised lesions (can remain unnoticed for long period)
- **Direct contact between animals**
- **Environment** – premises, fences, equipment (survival of the mite in the environment - weeks to months); eggs are resistant;

PATHOGENESIS

- **hypersensitivity skin conditions**
- **allergens** (present in mite faecal material) and **other metabolic products** are deposited to skin; = diffuse through the dermis = local immune system and induce **HYPERSENSITIVITY REACTIONS**;

BURROVING MITES – stationary, permanent parasites, whose morphology is adapted to living in the epidermis.

Sarcoptidae (*Sarcoptes scabiei*, *Notoedres cati*)

Knemidocoptidae (*Knemidocoptes mutans*, *K. gallinae*, *K. pilae*)

Demodecidae (*Demodex phylloides*, *D. folliculorum*, *D. canis*, *D. bovis*, *D. equi*...)

Cytoditidae (*Cytodites nudus*)

Laminosioptidae (*Laminosioptes cysticola*)

NON BURROVING MITES – stationary, permanent, long-legged and large mites, which do not penetrate the skin, but live superficially on the skin in the coat or in the ear.

Psoroptidae (*Psoroptes ovis*, *P. equi*, *P. cuniculi*, *Chorioptes bovis*, *Otodectes cynotis*)

Cheyletiellidae (*Cheyletiella yasguri*, *Ch. blakei*, *Ch. parasitivorax*)

Psorergatidae (*Psorergates ovis*, *P. bos*, *P. simplex*)

Trombiculidae (*Trombicula akamushi*, *Neotrombicula autumnalis*)

Family: Sarcoptidae

Genus: Sarcoptes

Sarcoptosis (sarcoptic mange) and notoedrosis of mammals

➤ *Sarcoptes scabiei* var.; *Notoedres cati*, *N. muris*, *N. musculli*

Species	Variety	Host	Disease	Prevalence in Central Europe
<i>Sarcoptes scabiei</i>	bovis	cattle	Sarcoptes mange	+
	equi	horse		(+)
	ovis	sheep		(+)
	caprae	goat, chamois		goat (+), chamois ++
	camel	camel		++
	cf	new world camels		+
	stus	pig		++
	canis/vulpes	dog, fox, other canids, lynx, racoon, mustelids		dog (++), fox ++, mustel +
<i>Notoedres cati</i>	–	cat ¹	Notoedrosis	(+/-)
	–	rabbit ²		+
	–	rat		+
<i>Notoedres muris</i>	–	rat		+
<i>Notoedres musculli</i>	–	mouse ³		+
<i>Trixacarus caviae</i>	–	Quinea pig	Trixacarosis	+

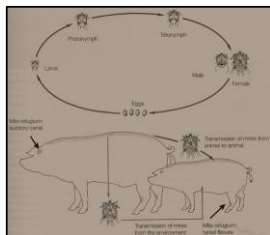
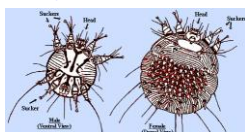
++ = very common, ++ = common, + = rare, (+) = very rare

¹ = unknown

² = rat and mouse rarely also S. scabiei

³ = rabbit rarely, also S. scabiei var. canis

Sarcoptes scabiei var.



CLINICAL SIGNS

CATTLE

- oedema
- Inflammation
- formation of **vertical skin folds**
- scratching – extensive mechanical lesions
- hyperkeratosis
- extensive alopecia

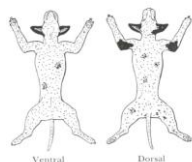
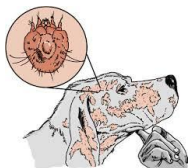


Sheep and goats

- lesions on head, legs
- thick crusts
- pruritus



Clinical signs - dogs



Diagnosis

- Based on history, clinical signs; microscopic confirmation
- **Skin scrapings – microscopical examination**
- Serology – EUSA testing – raised allergen-specific IgE and IgG
- Skin biopsies – histopathology

Differential diagnosis

- Cheyletiellosis, trombiculosis, otodectes skin infestations, atopic dermatitis, flea allergy dermatitis, malassezia dermatitis and bacterial folliculitis;

Prognosis and treatment

- Good or less in chronic mange

Treatment

Antiparasitic therapy:

Selamectin

Moxidectin:

5% amitraz:

Environmental treatment

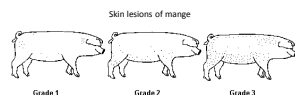
Infested bedding should be disposed of and antiparasitic sprays should be used in the environment, e.g. **permethrin**.

Glucocorticoids may be useful in **severely pruritic** animals but should not be given until a diagnosis is made. **Prednisolone** 1 mg/kg p.o. for 7–10 days can be given.

Pigs

Sarcoptic mange is irritant and uncomfortable for the pig, causing it to rub and damage the skin which becomes unsightly. It significantly depresses growth rate and feed efficiency.

- very common
- erythema and papules
- itching
- small abscess-like crusts
- chronic**
- hyperkeratosis
- Thick adherent crusts are localised on the legs, the back and inner aspect of the ear canal
- itching is moderate
- hypersensitivity



Diagnosis

- Clinical
- Microscopical – laboratory diagnosis – **Deep skin scrapings (capillary bleeding)**
- Serology

Control

Acaricides: wide range of products – choice depends on:

1. Type of mange
2. Animal species
3. Cost of acaricides and labour
4. Potential effects on the environment
5. Number of animal treated
6. Presence of other ectoparasites
7. Withdrawal period of the acaricide

Mode of administration

- dipping tanks (sheep scab)
- spraying
- topical application „pour on“ (or „spot-on“ – dogs, cats)
- systemic treatment – drugs – orally or parenterally or through the skin: drugs persist in tissues – long with-drawal periods for milk and meat

Drugs

1. Amidines – amitraz. **It should not be used in equines!**
2. Pyrethroids; fenvalerate, deltamethrin, flumethrin;
3. Avermectins and milbemycins (macrocyclic lactones) = withdrawal period are usually very long for meat and milk;

Prevention

- no vaccines available for immunoprophylaxis;
- premises occupied by infected animals must be left empty for three weeks at least;
- newly purchased animals must be examined, treated and maintained in quarantine for at least 14 days;
- all animal must be treated as soon as a clinical case of mange is observed;
- hygienic measures – cleaning and disinfection of animal accommodation;

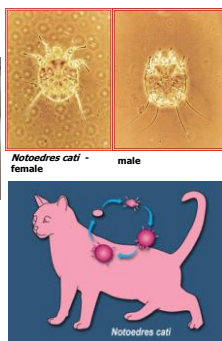
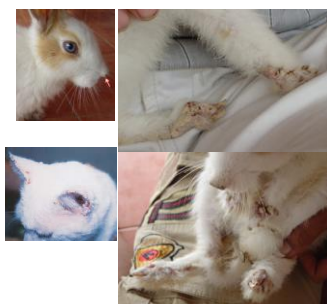
Zoonoses

Papular rash caused by *Sarcoptes scabiei*

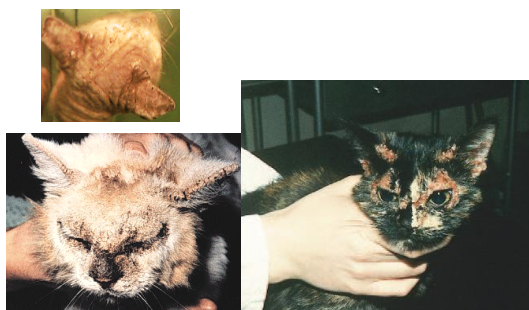


Notoedric mange (feline scabies), of rabbits and rodents

Notoedres cati, *N. cuniculi*, *N. muris*, *N. musculi*



NOTOEDRIC MANGE



Facial excoriation due to *Notoedres cati*.

Diagnosis

- History and clinical signs.
- Microscopy in the form of deep scrapings.
- Mites easier to find than scabies mites but are small and best identified under low power with reduced light.
- Biopsy will occasionally reveal signs of mites.
- Pattern is non-specific of superficial perivascular dermatitis often with heavy eosinophilic infiltrate. Areas of focal parakeratosis are common.

Differential diagnosis

- Allergy – atopy, food, fleas
- Cheyletiellosis
- *Otodectes cynotis*
- Pediculosis
- Autoimmune skin disease especially pemphigus foliaceus

Treatment

2–3% lime sulphur
5% amitraz
Selamectin (off label use)
Fipronil

Glucocorticoids may be useful in severely pruritic animals but should not be given until a diagnosis is made. Prednisolone, 2 mg/kg po sid for 7–10 days, can be given.

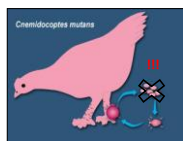
Pyoderma can occur as a rare secondary complication. Appropriate systemic antibiotics should be given for 3–4 weeks.

Cnemidocoptosis and cytoditosis of birds.

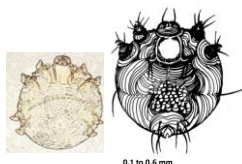
Bird diseases caused by **burrowing** and **penetrating mites** of family **Cnemidocoptidae** (acarinosis of legs, beaks and skin) and **Cytoditidae** (acarinosis of the respiratory organs and subcutaneous tissue);

Family: Cnemidoptidae

- *Cnemidocoptes mutans* – keratinisation of the legs (scaly leg)
- *C. gallinae* – loss of feathers (depluming itch); feather follicles
- *C. pilosae* – scaly face, tassel foot
- *C. prolificus*



- Morphology – similar in general to *Sarcoptes scabiei*, but have no spines or sharp pointed scales, and no anterior vertical setae.
- Females are viviparous (1 larval and 2 nymphal stages before the adult)



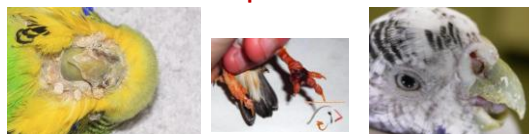
Acarinosis of respiratory organs and subcutaneous tissues of birds

➤ Cytoditosis – *Cytodites nudus*

- Trachea, bronchi, lungs, air sacs, but also liver and kidney serosa;
- Without clinical symptoms, breathing difficulties, granulomatous bronchitis;
- Dg: only post mortem
- Te: is not elaborated



Cnemidocoptosis of bird



Dg: microscopic

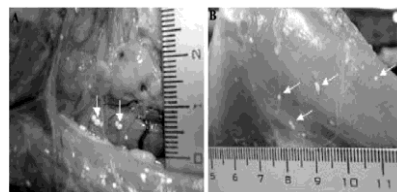
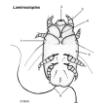
Te:

- removing the shield with glycerine;
- acaricides based on pyrethroids, amitraz, dimylate and also ivermectin (intramuscularly, 0.2 mg / kg);
- Supportive vitamin A;
- Treatment - repeated in 8-10 days;



➤ Laminosioptosis – *Laminosioptes cysticola*

- Localization - subcutaneous tissue of the neck, chest, thigh, chest and abdominal organs;
- Without clinical symptoms;
- Hygiene of meat;
- Dg.: post-mortem - **yellow-white nodes (1 mm)**
- Therapy: not elaborated



Demodetic mange (demodicosis) of dogs and cats, cattle, sheep, goats, and pigs

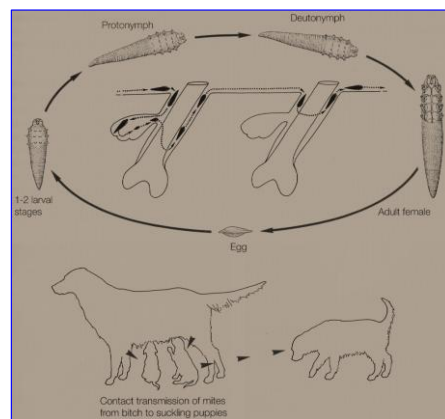
Demodex canis – inhabitant of canine pilosebaceous unit (hair follicle, sebaceous duct and Gland);

Demodex injai – inhabitant of canine pilosebaceous unit (hair follicle, sebaceous duct and Gland);

Demodex cornei – inhabitant of the stratum corneum

Demodex cati, D. gatoi

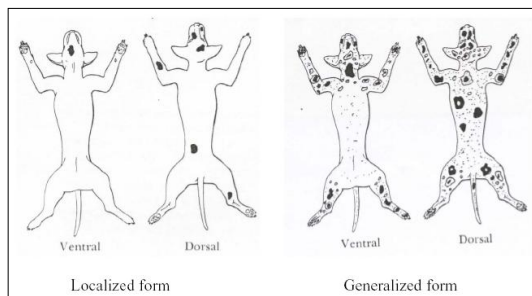
Demodex phylloides - pig
Demodex folliculorum – man
Demodex bovis - cattle
Demodex equi - horse



➤ Three forms of demodicosis are recognized in dogs: **localized demodicosis**, **generalized demodicosis**, and **pododemodicosis**.

➤ **Not contagious (or zoonotic)** - part of **normal flora in 80%** of most healthy canines. *Demodex spp.* found in other animals (even people).

➤ **Demodex occurs in animals with depressed immune systems !**



Types of demodicosis:

Localised (squamous):

- Cutaneous – less than 5 patches
- Pododemodicosis – single foot
- Demodectic otitis

Generalised:

- Juvenile onset – greater than 5 patches
- Pododemodicosis – 2 or more feet involved
- Adult onset



Localised demodectic mange showing periorcular scaling.



Generalised squamous demodicosis showing numerous alopecic patches over the trunk and legs



Puppy with generalised demodicosis



Chronic pododemodicosis



Demodicosis in an English bull terrier showing severely infected haemorrhagic lesions



Diagnosis

- History and clinical signs.
- Skin scrapings from predilection areas, i.e. areas of comedone formation to reveal the mites, larvae, nymphs and ova.
- Deep scrapings from areas of comedones
- Squeeze skin to extrude mites from follicles before scraping.
- Hair plucking: Useful for follicular mites in pododemodicosis, which are pulled out with the hairs.
- Biopsy reveals perivascular dermatitis with mites present in stratum corneum and follicles.

Treatment

Localised form:

Most cases resolve spontaneously after 6–8 weeks provided that glucocorticoids are not prescribed.

Topical therapy: lime sulphur, selenium sulphide or follicular flushing agents, e.g. benzoyl peroxide.

Anti-parasitic therapy is rarely required

Antiparasitic therapy:

5% amitraz:

Ivermectin;

Milbemicin

Demodicosis of cattle

- clinical outbreaks are observed mainly in tropical areas
- small nodules (1–10 mm) localised on the neck and dewlap
- thick yellowish substance in nodules containing large numbers of mites
- pruritus is absent
- economic – downgrading of the leather

Demodicosis of Sheep and goats

- *Demodex ovis*, *Demodex aries*, follicular mange.
- rare and of little importance
- small nodules on the lips and on the lower jaw

Demodicosis of horses and pigs

- rare (clinical picture as in cattle)



NON – BURROWING MITES (*Psoroptidae*, *Cheyletiellidae*, ...).

Family: PSOROPTIDAE

Genus and species ¹	Hosts	Disease	Prevalence in Europe ²	Distribution
Genus <i>Psoroptes</i>		<i>Psoroptes</i> mange		
<i>Psoroptes ovis</i> (syn. <i>P. bovis</i> , <i>P. equi</i>)	sheep cattle	body mange body mange	+++ ++++	cosmopolitan
<i>Psoroptes cuniculi</i> (<i>P. ovis</i> var. <i>cuniculi</i>)	equids, camel and others rabbit	body mange ear mange	+ +++	cosmopolitan
<i>Psoroptes ovis</i> var. <i>cuniculi</i>	goat, horse, sheep	ear mange	+	
<i>Psoroptes natakensis</i>	water buffalo, cattle, horse	body mange	?	southern Africa, (Europe)
Genus <i>Chorioptes</i>		<i>Chorioptes</i> mange		
<i>Chorioptes bovis</i>	cattle horse, sheep	tail mange foot mange	+ ++	cosmopolitan
<i>Chorioptes texanus</i>	goat	back mange	+	
<i>Chorioptes texanus</i>	cattle ³	tail, foot mange	+++	Eurasia; America
Genus <i>Otodectes</i>		<i>Otodectes</i> mange		
<i>Otodectes cynotis</i>	dog, cat, other	ear mange	++	cosmopolitan

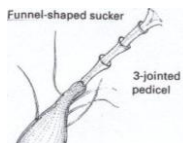
¹ The validity of the species concept within the genus *Psoroptes* is questionable.

² ++ very rare, + rare, +++ common, ++++ very common.

³ *Chorioptes texanus* has been described in goats in Florida and Israel, but so far not in small ruminants in Europe.

Psoroptosis (Psoroptic mange) of animals

Type of mange	Species	Mites			Lesions	
		Longevity of life cycle (days)	Production of eggs by female	Length of body (mm)	Primary localisation	Characteristics
Psoroptic common scabies/mange	<i>Psoroptes ovis</i>	10-21	15-25	♀ 0.6-0.8 ♂ 0.5	Lambos, arms, belly	Abrasive yellow scabs, confessed skin (flaking wool/fell)



Psoroptes

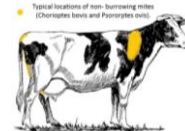
Funnel shape ambulacrum

3-segments pedicel

Mouth part - pointed

abdominal tubercles of male rounded

Psoroptes ovis, *P. bovis*, *P. cuniculi*, *P. equi*



SHEEP SCAB

CLINICAL SIGNS

- most severe ectoparasitic infection of sheep
- extremely contagious (sheep scab)

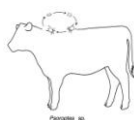


DIAGNOSIS

- Clinical signs of sheep scab provide a good indication that sheep scab is present;
- however definitive diagnosis requires the visualisation of the lesion and confirmation of the presence of mites;
- Superficial skin scrape (without capillary bleeding);

TREATMENT/CONTROL

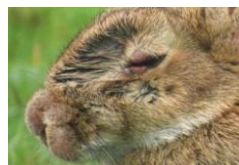
- Treatment is by dipping, or by the use of the macrocyclic lactone injectables.
- The use of synthetic pyrethroid (SP) dips (cypermethrin)
- injectable drugs for scab, namely ivermectin, moxidectin and doramectin.

CLINICAL SIGNS**CATTLE***Psoroptes bovis***HORSES***Psoroptes equi*

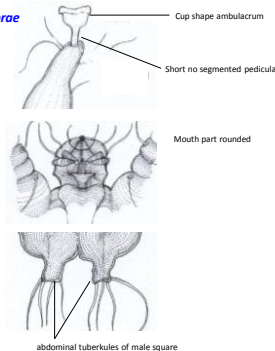
Infestation of the skin of the ears causing a droopy, lop-eared posture. The margins of the ears showed extensive scaling and thickening.



Psoroptes spp. mites which caused extensive tail-rubbing and severe self-inflicted trauma.

**RABBITS***Psoroptes cuniculi***Therapy**

- Pyrethroids baths, repeated after 7 - 14 days;
- The best efficacy is the administration of avermectins - **ivermectin, doramectin, moxidectin** in the form of injection or pour-on;
- In horses - EQUALAN;
- In rabbits: **ivermectin** is administered at a dose of 0.4 mg / kg bw and is repeated in 4 weeks;
- Control of the environment;

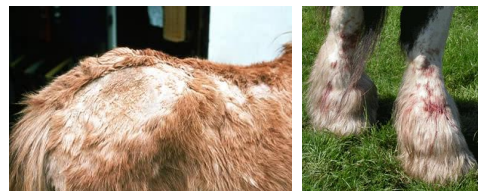
Chorioptosis (chorioptic /tail, foot mange) of animals*Chorioptes bovis*, *Ch. ovis*, *Ch. equi*, *Ch. caprae***CHORIOPTIC MANGE** *Synonyms: Chorioptes bovis, chorioptic mange, foot mange, scrotal mange.*

- *Chorioptes* mites infest the woolless areas, particularly the **lower parts of the hind legs and scrotum**, and can decrease fertility by causing inflammation of the scrotal skin.
- *Ch. bovis* does not pierce the skin, but **feeds on skin debris** leading to a **yellow-brown lesions with haemorrhaging fissures** resulting from allergic reactions to the mites or mite by-products.
- **Intensive itching** causes foot stamping and biting. The complete life cycle takes about 3 weeks.

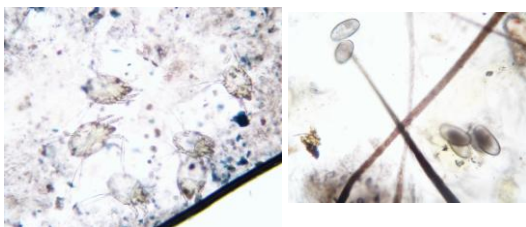
***Chorioptes equi***

- Sticky scales
- Strong pruritus, restlessness, stinging, limb cracking

- **Control** – oral **ivermectin** is effective at **reducing** mite populations but cannot eliminate them. Effective topical treatment include a series of three whole-body baths, 5 days apart, using 1% **selenium sulphide shampoo** and two treatments, 2-3 weeks apart with 0.25% **fipronil spray**.



Diagnosis (*Chorioptes*)



Treatment/control (*Chorioptes equi*)

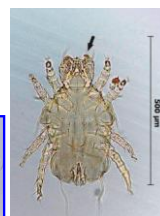
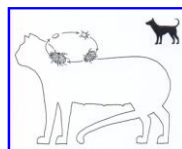
- Careful clipping of long hair;
- **Removal of scabs** followed by scrubbing of all affected areas with appropriate insecticidal shampoo or powder;
- Oral **ivermectin** paste (at 0.1 mg/kg daily for 7–10 days or 0.2 mg/kg twice at 2-weekly intervals) or **moxidectin** paste (at 0.4 mg/kg q 14 days);
- However *Chorioptes* living in the environment for up to 69 days.
- **Topical washes of the affected horse and the in-contact animals are the main approach.**
- Affected animals should be clipped out.
- A preliminary **warm wash** with a **selenium sulphide shampoo** is a very helpful measure prior to the application of **fipronil spray**;



Otodectosis and cheyletiellosis of carnivores.

Cheyletiella (Walking Dandruff) Cheyletiellosis

Zoonosis II - All species of mite can be transmitted to other animals or to humans;



- *Cheyletiella yasguri* - most commonly found on dogs
- *Cheyletiella blakei* - most commonly found on cats
- *Cheyletiella parasitovorax* - most commonly found on rabbits
- Scaling, pruritic dermatitis
- Most severe on dorsum
- Overpopulation, poor sanitation



- **Ingest keratin debris and fluids.**

Clinical signs



Diagnosis: Transparent adhesive tape (for fast-moving parasites); Glue on a slide;

Treatment

- **Lime-sulphur** and pyrethrin rinses – cats, kittens, puppies and rabbits;
- **Pyrethroids** – dogs;
- **Environmental treatment** – frequent cleanings and insecticide sprays – important for eliminating infestation;
- **Topical therapy** – **amitraz**, **ivermectin**;
Amitraz – use on dogs (4 rinses at 2-week intervals)
Ivermectin – **highly effective** (0.3 mg/kg, SC, 3-times at 2-week intervals)

Ear mite - *Otodectes cynotis*

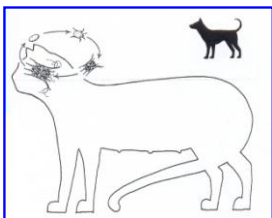
Cause and pathogenesis

➤ *Otodectes cynotis*

- It is a non-burrowing mite that lives and feeds on the surface of the skin especially in the ears.
- A common disease in dogs and cats, especially in kittens.
- It is highly contagious between animals, **potential zoonosis**.
- **Highly contagious**
- **Not species specific**
- **Pruritic, erythematous otitis**
- Dark, dry, "coffee-grounds" exudate



- Common cause of **otitis externa** in dogs, cats and ferrets.
- Occur primarily in the **external canal**, ear mites may be found anywhere on the body.
- A common infestation site is the tail and head.
- Mites are spread by **direct contact**.
- Transmissible among and between canines and felines.



Clinical signs

Otitis externa:

Ectopic infestation: Usually seen in cats.



Ceruminous discharge from ear canal

Otodectes - Diagnosis

- Direct otoscopic examination
- Microscopic demonstration on ear smear – no stain needed
- Skin scrapings
- Scotch tape impressions



Prevention and therapy

- Regular examination of ear canal;
- Cleaning - salicylic alcohol, borax, oil, etc.;
- Application of acaricidal preparation - special ear drops (Oto-Paragal gtt), **amitraz**, **selamectin**, **ivermectin imidacloprid + moxidectin**;

