Arachnids

**Ticks**
- Blood-feeding ectoparasites
- Dorsoventrally flattened
- Haller’s organ = present
- Hypostome toothed & exposed
  - Tick’s anchor to host
- Adults = macroscopic

**Mites**
- Feed on cellular debris or blood
- Globose to cigar-shaped
- Haller’s organ is **absent**
- Hypostome unarmed & hidden
  - Are **not** anchored to host
- Adults = microscopic (usually)
Ticks vs. Mites

Hypostome exposed & armed
Palps, chelicera & hypostome visible

Hypostome unarmed & hidden
Only palps & chelicera visible
Mites

Life history:
• Egg, 6-legged larvae, nymph, adult
  – Hemimetabolous (no pupa stage)
• 1 to 3 nymphal instars
• Spend entire lives in intimate contact with hosts

Acariasis = mite infestation (+/- normal fauna)
Mange = infestation -> severe dermatitis

Mechanisms of disease:
• Direct damage to epidermis
  → inflammation & crusting
• Cutaneous hypersensitivity reactions
• Loss of blood & other fluids
• Transmission of pathogens
Mites – Important distinctions

- *Superficial burrowing mites*
- *Superficial mites*
- *Intrafollicular mites*
Mites – Important Genera

1. *Sarcoptes*
2. *Notoedres*
3. *Knemidocoptes*
4. *Psoroptes*
5. *Chorioptes*
6. *Otodectes*
7. *Cheyletiella*
8. *Demodex*
Sarcoptes scabiei

- **Disease:** Sarcoptic mange
- **Hosts:** Dogs, foxes, pigs, cattle, sheep, goats, horses, camelids, rabbits, humans...
**Sarcoptes scabiei**

Epizootics in wildlife (FYI)

- **North America** – coyotes, foxes, grey wolves
- **Europe** – arctic foxes, red foxes, grey wolves, lynx, chamois, ibex, wild boars
- **Australia** – red foxes, dingoes & wombats
- **Africa** – lions, cheetahs, mountain gorillas, chimpanzees, impala, hartebeest, wildebeest, buffalo, eland, kudu, gazelles, & sable antelope

**Classes of sarcoptic mange in canids:**
Class I (top), initial infection involving fore and hind limbs, hips/base of tail, and base of ears with ≤5% of the body affected;
Class II (middle); more advanced lesions involving ≤ 50% total body surface;
Class III (bottom) involving > 50% total body surface.


**Sarcoptes scabiei**

- **Disease:** Sarcoptic mange
- **Morphology:**
  - Microscopic (200-400 μm)
  - Round-globose shaped
  - Triangular spines
  - Posterior pair of legs do not extend beyond body margin
  - Short legs with pretarsi having long unsegmented pedicels
**Sarcoptes scabiei**

Life cycle:

- ~17-21 days
- Female burrows into the skin feeding on cellular debris & laying eggs behind her
- Adults live ~ 4 weeks on host
  - Survive off host only a few days
- Highly contagious
- Transmission direct contact or fomites
**Sarcoptes scabiei**

Pathogenesis:

- **Tunnelling & feeding** activities of the mites cause irritation → inflammation, exudation, crusting, alopecia & hyperkeratosis
- **Intense pruritus** → self-trauma (excoriations) → ↑ dermatitis
- Hypersensitivity reactions to the mite secretory & excretory products
- Lots of foreign antigenic material
  - Dead mites, moulted skins of various stages, egg shells...

Skin biopsy of crusted scabies showing mites in the epidermis with hyperkeratosis & inflammation
**Sarcoptes scabiei**

**Host specificity:**

- Varieties appear *relatively host specific*
  - Dogs: *Sarcoptes scabiei* var *canis*
  - Pigs: *Sarcoptes scabiei* var *suis*
  - Cattle: *Sarcoptes scabiei* var *bovis*

- **Can transfer to humans via close contact**
  - Mites can survive & burrow in human skin, they seem unable to breed on the abnormal host
  - Repeated close contact with the infested dog is necessary to maintain human infestation
  - Records of transfer from fox to wolf & dog, rabbit to monkey, goat to man, dog to man...
**Sarcoptes scabiei**

**Dogs (S. scabiei var. canis)**
- Lesions on the lateral margins of ear, head, elbows, & inguinal regions
- Self-mutilation & 2º bacterial infections common
- Infested dogs usually die without treatment

**Pigs (S. scabiei var. suis)**
- Lesions first appear on head, progressing to hind legs, then rest of body
- Reduced growth rate & lower feed efficiency
**Sarcoptes scabiei**

**Cattle** (*S. scabiei var. bovis*)
- **Most important mange mite of dairy cattle & confined beef herds**
- Lesions occur where hair is thin
  - base of tail, brisket, inner thigh, scrotum & udder
- **Weight loss & poor growth in severely affected**
- **Very contagious**
- **Reportable disease**
**Sarcoptes scabiei**

**Diagnosis:**

- Clinical signs & history
- Pinna-femoral reflex is very suggestive
  - Rub the dogs ear & it elicits a violent scratch response with the hindlimb
  - [https://www.youtube.com/watch?v=vv_k3KQ0vbA](https://www.youtube.com/watch?v=vv_k3KQ0vbA)

- **Multiple skin scrapings**
  - Wide superficial scrapings of crusted, papular, or alopecic lesions
  - Scrape the ear (pinna) margins (even if they are minimally involved or unaffected!), elbows, hocks, &/or ventral trunk
  - 10-20+ scrapings may be required (few mites!)
  - **Demonstration of ONE mite is diagnostic**
    - morphological features to ID
  - Papular lesions on household members
    - transient scabies in people is self-limiting
**Sarcoptes scabiei**

**Diagnosis:**

- **Centrifugal fecal flotation** using sugar
  - May reveal mites or eggs

Mite egg in a formalin-concentrated stool specimen. Mite eggs are similar to hookworm eggs but are usually larger (but not always). In this specimen, leg buds can be seen in the lower right area of the egg.
Sarcoptes scabiei

Control & Treatment:
• Treatment should be initiated if mange is suspected despite negative scrapes
• Treat all animals in household (S. scabiei has been reported on cats rarely)
• Dogs:
  – Systemic: macrocyclic lactones (avermectins & milbemycins), Topical or spay (fipronil), Topical (selamectin, imidocloprid + moxidectin)
  – Acaricidal dips (e.g. 2% lime sulfur) every week until lesions resolve
  – Environment should be treated (bedding, kennels, combs...)
• Livestock:
  – Treat entire herd with pesticide dips, repeat in 10-12 days
  – Ivermectin & milbemycin
**Notoedres cati**

**Notoedric Mange**

Head Mange in cats or Feline Scabies

- Burrowing mite of cats (short legs)
  - Occasionally affects dogs & humans
- Occurs in cats & other felids worldwide
  - Ocelots, panthers, tigers, bobcats, lynx, snow leopards & cheetahs
- Other *Notoedres* spp. found on lagomorphs, rodents & bats
- Morphology & life cycle similar to *Sarcoptes*
  - Scales (spines) are less angular
  - Is slightly smaller
  - Anus is on dorsal surface instead of on the posterior body margin
**Notoedres cati**

Clinical signs:
- Tunnelling & feeding activities of the mites cause irritation → inflammation, exudation, crusting, alopecia, and hyperkeratosis
- Intense pruritus → self-trauma → ↑ dermatitis
- Ears, head, & neck usually affected initially
**Notoedres cati**

**Diagnosis:**
- Clinical signs
- Skin scrapings
  - Easier than in sarcoptic mange as a single "nest" in a scraping may yield many mites

**Control & Treatment:**
- Treat all cats in household
- Acarcidal dips (as in canine scabies)
- Ivermectin, selamectin
  - Use only products approved for cats!
Knemidocoptes spp.

• Burrowing mites of birds (short legs)
• Morphologically similar to Sarcoptes
  – No scales & spines on dorsal surface
  – Tarsal segments have claw-like structures & tactile hairs
    (No suckers on stalks)
• Occurs in small barnyard flocks with transmission by bird-bird contact (spreads slowly)
**Knemidocoptes spp.**

**Clinical Signs**

**Scaly leg in passerines**
- Primarily in *canaries*, Gouldian finches & mynahs
- Burrows beneath leg scales & causes them to loosen and rise → hyperkeratosis
- Distorted legs & claws & may appear lame
- Pruritus

**Scaly beak/ Scaly face in psittacine birds**
- Mostly *budgerigars*
- Burrow into lightly feathered areas of the face (+/- body) → loss of feathers & hyperkeratosis
- +/- mild pruritus
Knemidocoptes spp.

- Clinical Signs
  - Often subclinical
  - Infections dormant until bird is stressed or is otherwise immunocompromised
  - Signs are dependent on which mite is present:

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<tr>
<th>Species</th>
<th>Disease</th>
<th>Hosts</th>
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<tr>
<td><em>Knemidocoptes mutans</em></td>
<td>Scaly leg &amp; face</td>
<td>Domestic fowl</td>
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<td>K. gallinae</td>
<td>Depluming itch</td>
<td>Chickens, pigeons &amp; pheasants</td>
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<td>K. jamaicensis</td>
<td>Scaly leg</td>
<td>Passerines (canaries)</td>
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<td>K. pilae</td>
<td>Scaly face/beak</td>
<td>Psittacines (budgies)</td>
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</table>
**Knemidocoptes spp.**

**Diagnosis:**
- Scrape scabs to find mites
- Can loosen scabs first by using emollients (be careful not to plug nares)
  - Vegetable oil, aloe vera gel
- [http://www.youtube.com/watch?v=UqdCqNLQ6Yo](http://www.youtube.com/watch?v=UqdCqNLQ6Yo)

**Control & Treatment:**
- Ivermectin drug of choice & may be given orally, topically, or by injection. Topical or oral dosing is recommended for small birds.
  - Ivermectin may be toxic if given intramuscularly, especially in small birds & death may occur
  - Two large-animal injectable propylene-glycol–based formulations of ivermectin (Ivomec—Merial) are available for extralabel use in birds in 1% (10 mg/ml) & 0.27% (2.7 mg/ml) concentrations
- Pour-on or injectable moxidectin (Cydectin—Fort Dodge Animal Health) is also effective and available in 0.5% and 1% preparations, respectively
**Psoroptes spp.**

- "Scab" or Psoroptic Mange in sheep (Eliminated from NA)
- "Scab" or Psoroptic Mange in cattle (South-West USA)
- Ear canker in rabbits
- Mild otic mange in goats
- Mane mange in horses
  (Mane, forelock, & base of tail = thickly haired areas; rare, eradicated in NA)

**Morphology:**
- Long legs with segmented pedicels
  (long legs = non-burrowing surface mite)
Psoroptes spp.

Outbreaks of Sheep Scab - *Psoroptes ovis*
- Eradicated in New Zealand, Canada & USA
  - Reintroduction by importation of infested sheep is a permanent risk
- In winter months the mites become active → symptoms of sheep scab become apparent
- Infested sheep will start scratching, biting at the fleece & plucking out tufts of wool
- Sheep lose weight due to the continual irritation
- Rams may not mate
- Ewes may reject their lambs
Psoroptes spp.

Pathogenesis & Clinical signs: Cattle Scab:

- *Psoroptes communis ovis, var. bovis (Psoroptes ovis)*
- Range & feedlot beef cattle from central & western USA
  - Texas, New Mexico, Oklahoma, Kansas, Colorado, and Nebraska
- Intense pruritus usually begins on the shoulders & rump
- Feeding activities → pruritus → self mutilation & scab formation
- Papules, crusts, excoriation & lichenification
  - +/- Secondary bacterial infections
- Death in untreated calves, weight loss, decreased milk production & increased susceptibility to other diseases
Psoroptes spp.

Pathogenesis & Clinical signs:
Ear Canker in Rabbits
• *Psoroptes cuniculi*
• Mites in external ears → crusting of car canal
• Can lead to rupture of tympanic membrane
Psoroptes spp.

**Diagnosis**
- Superficial skin scraping at margins of lesion & under crusts
- Pedicels are long & jointed
  (jointed = segmented)

**Treatment & Control**
- Pesticide dips
- Ivermectin
  - Apply pesticide in ear of rabbits
**Chorioptes bovis**

- Non-burrowing mange mite of cattle, horses, goats & sheep

- **Morphology:**
  - Similar to *Psoroptes* except short unsegmented pedicels
**Chorioptes bovis**

Pathogenesis:
Dairy cows in winter
- Minor pathogen with lesions on **neck, tail & lower legs** which usually resolve in spring
  - Leg Mange
  - Foot and Tail Mange
  - “Symbiotic” Mange
  - Barn Itch
- Serum exudation & thickening of the skin characteristically at the base of the tail.
- Infestation may spread udder, scrotum & limbs

Treatment & Control:
- Pesticides applied to affected areas when a problem
- Lesions often resolve spontaneously when cattle turned out to pasture in spring
Chorioptes bovis

Pathogenesis:
Sheep & Goats
• In goats signs can start at the neck then spread to the back, root of the tail & rest of the body.
• 'Foot mange' affects the skin of the pasterns & digital areas
• Chorioptic mange of the scrotum is suspected to cause infertility in rams

Treatment & Control:
• Pesticides applied to affected areas when causing a problem
Chorioptes bovis

Pathogenesis:

Horses

• Irritation & alopecia can occur on feet, fetlocks & hocks
• Moist dermatitis can occur in chronic cases
• Horses may act restless

Treatment & Control:

• Pesticides applied to affected areas when a problem
Large Animal Mange Mites

• Sarcoptic mites
  – Burrow into the skin
  – Short Legs

• Psoroptic & Chorioptic mites
  – Non-burrowing
  – Long legs

• Pedicels used to identify mites
  – *Psoroptes* pedicels - long & jointed
  – *Sarcoptes* pedicels – long & not jointed
  – *Chorioptes* pedicels are short
**Otodectes cyanotis**

**Otodectic Mange:**
- Ear mite of dogs, cats, foxes, ferrets, & other carnivores
  - Occasionally humans
- Otitis externa
  - in cats 85% of cases
  - In dogs ~50% of cases

**Life History:**
- Live on superficial epidermal debris in the ear canal & skin
  - Long legs = non-burrowing
- Life cycle completed in 3 weeks
- Transmission by direct contact

https://www.youtube.com/watch?v=yfzndxIITWl
**Otodectes cyanotis**

Pathogenesis & Clinical signs:
- Mechanical irritation & hypersensitivity reaction
- Intense irritation, pruritus, scratching of ear & head shaking
- 2° bacterial infections can occur → discharge

Diagnosis:
- Black to reddish-black exudate in ear canal
- Otoscopic examination → visualize mites in ear canal
- Microscopic examination of ear swab
Cheyletiella spp.

“Walking Dandruff “

- Dogs (C. yaguri),
- Cats (C. blakei)
- Rabbits (C. parasitovorax)
  - All species can transiently infect humans

Morphology:

- Long legs = non-burrowing mite
- Prominent hook-like accessory mouthparts (palpal claws)
**Cheyletiella spp.**

- **Life History:**
  - Surface dwelling
  - Feed on surface debris & tissue fluids
  - Completes life cycle in 3 weeks
    - Eggs attached to hair
  - Transmitted by direct contact & fomites
  - Can transiently infest humans

- **Clinical signs:**
  - Usually affects young animals
  - Pruritus
  - Severe scaling on dorsal surface
  - Exfoliative dermatitis
Cheyletiella spp.

**Diagnosis:**
- Examination of scales & haircoat with a hand lens for “walking dandruff”
- Superficial skin scraping
  - [http://www.youtube.com/watch?v=zZPFDSmtL5GE](http://www.youtube.com/watch?v=zZPFDSmtL5GE)
  - [http://www.youtube.com/watch?v=dH7f1Elrgq0](http://www.youtube.com/watch?v=dH7f1Elrgq0)
- Examination of scales collected with a flea comb
- Detection of mite eggs in fecal flotation
  - Pruritus → chewing → ingestion of ectoparasite life stages

**Treatment & Control:**
- Sprays, shampoo with pyrethrins dogs
- Topicals (fipronil, imidocloprid+moxidectin)
- Treat all animals in household & treat environment
Demodex spp.

Demodectic Mange
- Demodex canis, very common
- Demodex cati, rare

Morphology:
- Microscopic (100-400 µm)
- Elongate (cigar-shaped)
- Stout legs ending in blunt claws (vestigial legs)

Life History:
- Spend life embedded in hair follicles & sebaceous glands
- Unable to survive off host
- Life cycle completed in 18-24 days
**Demodex spp.**

- Most *Demodex* spp. are considered normal mammalian fauna
  - Acquired at birth by direct contact
  - Considered normal inhabitants of the skin (usually non-pathogenic)

- Overgrowth of normal mite fauna → development of patchy hair loss +/- mild to severe dermatitis in dogs & (less commonly) in cats

- Exceptions:
  - *Demodex sp. “cornei”* (dogs) & *D. gatoi* (cats)
    - Small, blunt-ended demodectic mites
    - Disease caused by infestation rather than an overgrowth
    - Can be associated with pruritus in the absence of pyoderma
  - **Contagious** (vs. overgrowth)
**Demodex spp.**

- **Dogs**
  - *Demodex canis* (180 to 210 µm)
  - *Demodex injai* (330 to 370 µm)
  - *Demodex sp. cornei* (90 to 140 µm)

- **Cats**
  - *Demodex cati* (181 to 219 µm)
  - *Demodex gatoi* (81 to 115 µm)
  - *Demodex sp.* (170-174 µm)

*D. canis* vs. *D. injai*  

*D. cati* vs. *D. gatoi*

*Prevalence is virtually 100%*
**Demodex spp.**

**Pathogenesis:**

- Hereditary predisposition to demodectic mange
  - More common in purebreds
  - Especially terriers, Great Dane, English Bulldog, Alaskan Malamute, Afghan
- Immunosuppression (↓ T-cell function) allows mites to proliferate
- Mites may produce a factor that suppresses T-cell function
- Immunosuppression (e.g. corticosteroid therapy) may predispose dogs to demodecosis
**Demodex spp.**

Two forms of canine demodecosis:

**Localized demodecosis** (90% of cases)
- **Focal** areas of erythema & alopecia
- **Head, neck, & forelegs**
- No secondary problems
- Most (90%) will resolve spontaneously

**Generalized demodecosis** (the other 10%)
- Onset in dogs due to some underlying factor
- Lesions spread from head to rest of body
- Generalized erythema, alopecia, crusting & scaling
- **Secondary infections** can occur (i.e., pyoderma) resulting in oozing exudative lesions with severe crusting
  - Severe cases are accompanied by a foul smelling putrid odor & are difficult to cure
**Demodex spp.**

**Clinical signs in Cats:**

- Clinically affected cats are presented with various degrees of pruritus, alopecia, erythema, scaling, excoriation, & crusting
- Head & neck most commonly affected
- Elbows, trunk, flanks, lower belly & hind legs can also be affected
Demodex spp.

Diagnosis:
Skin scraping
• Squeeze skin to exude mite from the hair follicle then scrape skin
• Deep skin scrapes
  (red tinge = capillary blood)
• Observing only a few mites is not diagnostic (i.e. normal fauna)
• But finding many mites & many life stages is indicative of demodectic mange

Trichogram
• Examination of hair & roots
• Hair plucked from follicle examined for mites
Demodex spp.

Treatment & Control:

• **Localized form:** Good prognosis
  – Likely will self cure in 6-8 weeks (with or without treatment)

• **Generalized form:**
  – Requires supportive care & treatment of pyodermas with antibiotics
  – Relapses may occur
  – Look for possible underlying disease condition

• **Acaricidal dips** (amitraz) +/- pretreatment with benzoyl peroxide shampoo (removes crusts & debris)

• **Extra-label** use of macrocyclic lactones (avermectin & milbemycin) - long term & high doses

• Treatment costly, time consuming & requires commitment from owners
Demodex spp.

- **Horses (FYI)**
  - *Demodex equi*
  - Rare cause of patchy alopecia & scaling
  - Usually eyelids/muzzle (face, neck, shoulders & forelimbs)

- **Hamsters (FYI)**
  - *Demodex aurati*
  - *Demodex criceti*

- **Guinea pigs (FYI)**
  - *Demodex caviae*

Pocket pets: Look for a possible underlying condition (Malnutrition, neoplasia, infection...
Fowl Mites

*Knemidocoptes mutans*: Scaly leg and face in domestic fowl

*Knemidocoptes gallinae*: Depluming itch

*Dermanyssus gallinae*: Chicken Mite

*Ornithonyssus sylviarum*: Northern Fowl Mite
**Dermanyssus gallinae & Ornithonyssus sylviarum**

*Dermanyssus gallinae* - Chicken Mite (= Red Mite)
- **Blood-sucking mite** of poultry in wood-framed houses
- Mites **found on birds only when feeding (at night)** otherwise hide in nests, roosts & crevices

*Ornithonyssus sylviarum* - Northern Fowl Mite
- The **most important & common ectoparasite** of the poultry industry
- **Blood-sucking mite** & is reddish-brown after a bloodmeal
- Remains on bird throughout life
Dermanyssus gallinae

Chicken Mite (= Red Mite)
- A blood-sucking mite of poultry in wood-framed houses
- Mites are found on birds only when feeding (at night) otherwise hide in nests, roosts & crevices
- One of the most serious parasitic diseases of poultry farms in Europe

Life History
- Females produce eggs after each meal
- Generation time of 7 days
- Adults can survive for up to 8 months without feeding

*CHICKEN MITES*
Chicken mites only feed on the birds at night. They can be detected by examining secluded areas of poultry houses. You should look for gray, brown or red mites. There may also be back and white deposits of mite fecal material and cast off skins.
Dermanyssus gallinae
Chicken mite

Pathogenesis & Clinical signs:
• Heavy infestations → severe anemia & can kill nestlings
• Reduced weight gains & egg production
• Mites will readily attack humans

Diagnosis:
• Collect mites from birds at night or poultry house bedding
• Mites are nearly 1 mm & red after feeding

Treatment & Control:
• Prevent transmission to clean houses
• Apply pesticides to premises
Ornithonyssus sylviarum

Northern Fowl Mite
• Most important & common ectoparasite of the poultry industry
• Blood-sucking mite
• Reddish-brown after a bloodmeal

Life History
• Remains on bird throughout life
• Generation time of 5 days
• Mites can survive weeks off the host

NORTHERN FOWL MITES
Look for dark patches in the feathers and on the skin around the vent area. Mites appear as fast-moving, white or dark specks in these areas. They also leave behind a lot of mite fecal material.
Ornithonyssus sylviarum
Northern Fowl Mite

Pathogenesis & Clinical signs:
• Reduces egg production, weight gain & seminal fluid production in roosters
• Birds infested ~ 50,000 mites lose 6% blood volume/day
• May spread Fowl Pox & Newcastle Disease
• Mites readily bite humans

Diagnosis:
• Mites ~ 1mm
• Found around vent area of hens

Treatment & Control:
• Prevent introduction into clean housing
• Pesticide treatment of environment & birds (spray or powder)
<table>
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<tr>
<th>Species</th>
<th>Dogs</th>
<th>Cats</th>
<th>Rabbits</th>
<th>Cattle</th>
<th>Sheep &amp; Goats</th>
<th>Horses</th>
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