The Arachnids

Introduction:

Adult arachnids are eight-legged arthropods with anterior body segments fused into a cephalothorax bearing walking legs, sensory structures and the feeding apparatus, which is capable only of fluid feeding. Arachnids develop by a pattern of punctuated growth and molting similar to simple metamorphosis in insects. A number of specialized forms have evolved a dependency on feeding upon vertebrate animal blood or tissue fluid and may be temporary or permanent inhabitants of the skin or other tissues in wild and domestic animals and humans. Such arachnids may act as transmitters of pathogens (eg. the Lyme disease agent), as agents of dermatosis (mange, scabies) and systemic disease (eg. tick paralysis) and as sources of blood loss and annoyance sufficient to impact production in food animals and the general welfare of companion animals and their owners.

Objectives:

The order Acarina of the class Arachnida includes the ticks and mites and thus, many important ectoparasites of domestic animals. On completing this exercise, we would like for you to:
1.) Be able to recognize on sight the important families of burrowing and non-burrowing mite parasites.
2.) Be able to recognize on sight the tick families Ixodidae and Argasidae (the hard and soft ticks respectively).
3.) Be familiar enough with the morphological characters of ticks to use the pictorial key (Figure 7) to identify a tick specimen to the genus level.

Checklist of Objectives:

Be able to recognize a representative mite from each of the following 5 families:
- Dermanyssidae
- Chyletidae
- Psoroptidae
- Sarcoptidae
- Demodicidae

Be able to:
- Use the pictorial key to identify an unknown tick specimen to the genus level.
- Recognize *Rhipicephalus, Ixodes, Dermacentor, Amblyomma* ticks without using a key.
At the Bench
1) Slides from the student slide box:

A. *Dermanyssus gallinae* (Family Dermanyssidae) – Student Slide #91 (Foreyt, pg. 150). This is the chicken mite, also called the “red mite” of poultry. The “red mite” is a lair ectoparasite, visiting the birds only to feed. The “red” in its name refers to the mite’s color when engorged with blood. This mite may also attack mammals if birds are not available.

B. *Psoroptes ovis* (Family Psoroptidae) – Student Slide #87 (Foreyt, pg 99). Found on sheep and cattle, this is the cause of “sheep scab” (Psoroptic mange). Other members of the genus cause mange in horses and rabbits. Note the elongate legs (compared to *Sarcoptes* slide #88). Legs I, II, and IV bear a segmented pretarsus (Figure 2).

C. *Sarcoptes scabei* (Family Sarcoptidae) – Student Slide #88 (Foreyt pg 38). Host-adapted physiologic races of this mite species are found on all domestic animals as well as on humans. It causes sarcoptic mange (or “scabies” in humans). Note the small size and the globular body shape with very short legs. The coxae of legs II and III are widely separated. In contrast to *Psoroptes*, the pretarsi of legs I and II are in the form of simple (unsegmented) stalk with terminal suckers. There are long trailing setae or hairs (Figure 3).

D. *Demodex canis* (Family Demodicidae) – Student Slide #90 (Foreyt pg. 38). This is the ubiquitous follicular mite of dogs. This mite, although usually a harmless commensal organism, can cause mange (demodicetic mange) especially in immuno-compromised animals. Student slide #90 is a section of skin showing the effects of demodicetic mange. Note the thickened dermis, you may or may not see a mite in this section.

E. *Dermacentor variabilis* – The American Dog Tick – Student Slide #96 This three-host tick is ornate with the scutum more or less covered with irregular white markings. Note the “short” mouthparts (not much longer than the basis capitulium - see figure 6). The short mouthparts and the ornate scutum are enough to identify this tick when it is removed from a dog, cat, horse or human in Pennsylvania.

F. *Rhipicephalus sanguineus* – The Brown Dog Tick – Student Slide #95 (Foreyt pg. 44) This inornate (no markings), three-host tick is another common parasite of dogs. All of its life stages occur on dogs. Like *D. variabilis* it has short mouth parts. Note the festoons (indentations along the posterior margin), these are common in many ticks and may be a feature used to differentiate between ticks. The short mouthparts and the inornate scutum are enough to identify this tick when it is removed from a dog in Pennsylvania.

G. *Rhipicephalus (Boophilus) annulatus* larva - Cattle Tick - Student Slide #93 Note that tick larvae have only 6 legs. The larval ticks may not key out using the key in Figure 7 which was developed for adult ticks. The genus *Boophilus* was recently made a subgenus of *Rhipicephalus*, but the label of slide #93 and the key in Fig 7 do not reflect this.

2) Tick keying exercise

There are unidentified ticks on the center bench. Take one and try your hand at keying it to the genus level with the pictorial key (Figure 7). NOTE: Views of the capitulae are dorsal. For
locations of diagnostic structures (palpi, basis capituli, eyes, festoons, anal pore, etc.) refer to Figure 6. (Please return the specimen as soon as you are finished).

**TIP:** Don’t mistake an engorged hard tick for a soft tick.

Also on the center bench are dishes with the 4 tick species common in Pennsylvania/NJ. You must be able to recognize this ticks without a key. Since these ticks carry different pathogens, knowing the tick species will prepare you to deal with subsequent disease in the pet. Being able to respond immediately to an owner’s questions about the tick they remove from their pet will save you time (and impress the client). The key provided in Fig. 7a will allow you to tell these ticks apart, but the key will not be available on any test.

**Demonstrations**

Check list material:

**NON-BURROWING MITES**

1) **Family Dermanyssidae**

These are tick-like mites with an ovoid body shape. They have a pair of spiracles between the third and fourth coxae. In life, they use their long legs to move about both on the host and in its nest or bedding. Many are lair ectoparasites.

   a. *Ornithonyssus sylviarum*, the northern fowl mite. Characters are evident in the generalized mite diagram (Figure 1).
2) **Fam. Cheyletiellidae**

This family has palptibial claws curved ventrally and usually greatly enlarged. Parasites of birds and small mammals.

a. *Cheyletiella parasitivorax* – *(Foreyt, pg. 39)*. This is the “rabbit mite”. Other members of this genus can be found on dogs and cats. **Note**: The body has a “waist”; the legs end in combs, and the large palpi have pincers on their ends.

3) **Fam. Psoroptidae**

Legs III with long terminal setae, legs IV may be reduced, usually with claws; males with anal suckers. Skin parasites of mammals.

a. *Psoroptes ovis* – *(Foreyt, pg 99)*. Found on sheep and cattle, this is the cause of “sheep scab” (Psoroptic mange). Other members of the genus cause mange in horses and rabbits. **Note**: the elongate legs (compared to *Sarcoptes*). Legs I, II, and IV bear a segmented pretarsus (Figure 2).

![Figure 2. Segmented pretarsus](image)

**BURROWING MITES**

4) **Fam. Sarcoptidae**

Rounded or sac-like; legs short.

a. *Sarcoptes scabei* – *(Foreyt pg 38)*. Host-adapted physiologic races of this mite species are found on all domestic animals as well as on humans. It causes sarcoptic mange (or “scabies” in humans). **Note**: the small size and the globular body shape with very short legs. The coxae of legs II and III are widely separated. In contrast to *Psoroptes*, the pretarsi of legs I and II are in the form of simple (unsegmented) stalk with terminal suckers. There are long trailing setae or hairs (Figure 3).
5) **Fam. Demodicidae**

Elongated, annulated, worm-like species found in hair follicles, and the surface glands and ducts of vertebrates.

a. *Demodex canis* – *(Foreyt pg. 38)*.

This is the ubiquitous follicular mite of dogs. Note the elongate shape of the body and the 4 pairs of stumpy legs (Figure 4). This mite, although usually a harmless commensal organism, can cause mange (demodectic mange) especially in immuno-compromised animals.

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Figure 3.

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Figure 4.
Ticks

6) *Ixodes scapularis* – The deer tick (AKA: the black-legged tick) – This is the vector of *Borrelia burgdorferi* (the agent of Lyme disease) in the eastern and midwestern United States. To learn more about Lyme disease, check out the following Web sites: http://www3.niaid.nih.gov/topics/lymeDisease/PDF/LymeDisease.pdf and http://www.cdc.gov/ncidod/dvbid/lyme/

Note the following about *I. scapularis*.

i. The elongate mouthparts with tips or palpi converging (in the female).

ii. The preanal groove (characteristic of genus).

iii. The inornate (plain brown) scutum

iv. The prominent, posteriorly-directed spine on coxa I

The long mouthparts and the inornate scutum are enough to identify this tick when it is removed from a dog, cat, human, or horse in Pennsylvania.

7) *Amblyomma americanum* – The Lone Star Tick – This is an ornate tick. The male has white spots on its back (mainly along the posterior margin of the scutum), while the female has a single white spot (“lone star”) on its scutum. Note the long mouthparts and the eyes on the lateral margin of the scutum. Ticks’ eyes are simply translucent patches of cuticle overlying photoreceptors. The long mouthparts and the ornate scutum are enough to identify this tick when it is removed from a dog, cat, human, or horse in Pennsylvania.

8) *Dermacentor variabilis* – The American Dog Tick – This three-host tick is also ornate with the scutum more or less covered with irregular white markings. The larval and nymphal stages of this tick are found on rodents and other small mammals and the adults on a variety of middle-sized to large mammals including dogs and humans. Note also the rectangular basis capitulum and the festoons on the posterior margin (see Fig. 6). The short mouthparts and the ornate scutum are enough to identify this tick when it is removed from a dog, cat, human, or horse in Pennsylvania.

Figure 6.
9) *Rhipicephalus sanguineus* – The Brown Dog Tick – This inornate, three-host tick is another common parasite of dogs. All of its life stages occur on dogs. Note that the basis capitulum is laterally produced (roughly hexagonal in shape). There are eyes, and festoons may be visible along the posterior margin of the body. The short mouthparts and the inornate scutum are enough to identify this tick when it is removed from a dog in Pennsylvania.

**Other related mites:**

1.) *Pneumonyssus caninum* – **Family Dermanyssidae**
   
   This mite lives in the nasal cavity and sinuses of dogs. Note the family characteristics: its tick-like appearance with ovoid body.

2.) *Chorioptes bovis* – **Fam. Psoroptidae**
   
   (Foreyt, pg. 99) This mite is found on sheep, cattle, goats and horses. It resembles *Psoroptes* sp. Since it causes little disease in sheep it should be distinguished from *Psoroptes*. Although you are not responsible for differentiating these 2 mites it can be done by noting the pretarsi of *Chorioptes* spp. are short and unsegmented, and there are suckers on legs I, II and III in contrast to *Psoroptes* spp.

3.) *Otodectes cyanotis* – **Fam. Psoroptidae**
   
   (Foreyt, pg. 39) This is the most common mite ectoparasite of dogs and cats, and it normally lives in the ear. It resembles *Psoroptes* and *Chorioptes* in its general appearance (body-shape and legs). The pretarsi are unsegmented.

4.) *Notoedres cati* – **Fam. Sarcoptidae**
   
   (Foreyt, pg. 54). This mange mite of the cat is similar in appearance to *Sarcoptes* but is smaller. *Sarcoptes* is rare on cats.

5.) *Knemidocoptes* – **Fam. Sarcoptidae**
   
   The “scaly-leg” mite of poultry. This mite also resembles *Sarcoptes* in shape but the legs have claw-like structures instead of suckers (*Sarcoptes* is not found on poultry).

**Other Ticks:**

Try keying these ticks out using the key in Figure 7.

**Family Argasidae – The Soft Ticks**

Ticks of this family lack the scutum (the hard shield-like plate on the dorsal surface) and have a leathery cuticle. The mouthparts are not visible from the dorsal side (Figure 5),
being recessed ventrally. These ticks feed moderately and often, and, therefore, they do not engorge to the extent seen in the hard ticks.

1.) *Argas persicus* – The fowl tick –

*(Foreyt, pg. 150)* Note the oval shape of the body, the well-defined lateral margin and the ventrally located mouthparts (Fig. 5A)

2.) *Otobius megnini* – The spinose ear tick –

These spiny soft ticks are found primarily in the ears of dogs. Note the ventral mouthparts and the spines on the dorsal surface (Fig. 5B). The adult is not parasitic so only larvae and nymphs will be found on the animal. Note that the key in figure 7 will not work for stages other than adults, thus you can not key out the parasitic stages of this tick!

**Family Ixodidae – The Hard Ticks**

These ticks possess a rigid, chitinous scutum on their dorsal surface, and their mouthparts appear at the anterior end of the body when viewed from the dorsal aspect (Figure 6).

1.) *Haemaphysalis leporis-palustris* - The rabbit tick -

A common tick of rabbits, it is inornate. Note the laterally produced second papal segment that is the key feature used to key out this tick (Fig 7). When using the key this tick is commonly confused with *Rhipicephalus* which has a laterally produced basis capitulum. Note that the basis capitulum of *Haemaphysalis* spp. is not laterally produced.
Figure 7a. A short key for identifying the common hard ticks of domestic animals that are seen in the Pennsylvania, New Jersey, Delaware area.

1. A. Scutum is a plain brown in color (inornate) .................................................................2
   B. Scutum has a white dot(s), or white lines/pattern on it (ornate) .................................3

2. A. Short mouth parts, festoons present* ..............................................\textit{Rhipicephalus}
   B. Long mouth parts, festoons absent* ..............................................\textit{Ixodes}

3. A. Short mouth parts, complex white pattern on scutum ............ \textit{Dermacentor}
   B. Long mouth parts, one white spot (female)
      or several white spots (male) .........................................................\textit{Amblyomma}

* If the mouth parts are broken off and the tick is an inornate engorged female on which festoons are not evident you will have to use the key in Fig 7 to insure a correct identification.
Figure 7

PICTORIAL KEY TO GENERA OF ADULT TICKS IN UNITED STATES

FAMILY ARGASIDAE – SOFT TICKS

- Capitulum inferior, scutum absent
  - Margin of body with definite sulural line.
  - Hypostome with well developed teeth, integument mamilated
  - Hypostome vestigial or without effective teeth, integument tuberculated or granulated
  - Argas

- Capitulum anterior, scutum present
  - Margin of body thick, rounded, without definite sulural line.
  - Hypostome vestigial or without effective teeth, integument tuberculated or granulated
  - Ornithodoros

FAMILY IXODIDAE – HARD TICKS

- Female, dorsal
  - Second segment of palpi not laterally produced
  - Second segment of palpi laterally produced
  - Ixodes

- Male, dorsal
  - Second segment of palpi laterally produced
  - Haemaphysalis

- Capitulum inferior, scutum absent
  - Scutum with eyes
  - Basis capituli laterally produced
  - Amblyomma

- Capitulum anterior, scutum present
  - Scutum without eyes
  - Basis capituli not laterally produced
  - Aponomma

- Mouthparts much longer than basis capituli
  - Mouthparts as long as basis capituli

- Palpi ridged dorsally and laterally
  - Festoons absent
  - Festoons present
  - Boophilus

- Palpi not ridged
  - Festoons present
  - Rhiccephalus

- Festoons eleven
  - Dermacentor

- Festoons seven
  - Anocentor (id: Odocentor)