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# CHAPTER 3

## MITES AND TICKS

### LEARNING OBJECTIVES

After you finish studying this chapter, you should be able to:

- Describe how mites and ticks differ from insects.
- Understand the ways that mites can negatively affect animal health.
- Explain what mange is and how it occurs.
- Explain the generalized life cycle of mites.
- List several mites that affect agricultural animals.
- Know where mites and ticks are typically found on agricultural animal's bodies.
- Describe integrated programs for controlling mites and ticks.
- Understand the basic life cycles of ticks.
- Describe the appearance of a tick.
- List some of the important tick pests of animals.

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Chapter one of this manual gives specific information on biology and identification of pests including insects and other arthropods. Review that information to learn arthropod external characteristics, life cycles, and ways that they cause damage and act as pests.

### MITES

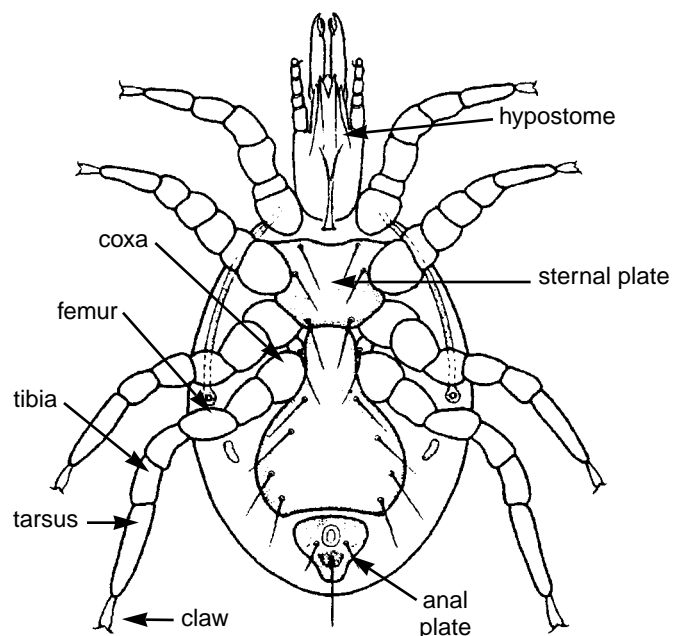
There are more than 200 families of mites and many thousands of species. Most mites are free-living and feed on plant juices or prey upon other arthropods. Some mites have evolved to become important ectoparasitic pests of animals. Some species of mites have even become endoparasites, invading the ears, bronchi and lungs, nose and other tissues of animals. More than 50 species of mites live on or in the bodies of domestic animals.

In general, mites can affect the health of animals in four ways:

- Damage tissues and cause dermatitis.
- Cause blood or body fluid loss.
- Cause allergic reactions.
- Create conditions for secondary bacterial infection.

Mites are tiny arthropods, usually less than 1 mm in size, and can be difficult to see and identify without the aid of a strong microscope or at least a

hand lens. Figure 3.1 shows a schematic view of the general anatomy of a mite. Note that the feeding apparatus of a mite is called the **hypostome**. It contains the **chelicerae** and the paired **palpi** (singular, palpus). The four pairs of legs are segmented, and each joins the body at the **coxa**.



**Figure 3.1 General anatomy of a mite.**  
Source: Centers for Disease Control.

The body of a mite consists of two major units – the cephalothorax and abdomen. The body is made of various hard plates of cuticle connected together by softer cuticle.

Mites breathe directly through their cuticle, in the smaller species, or through pores in the cuticle (called stigmata), which are connected to internal air tubes. Although the figure does not show it, mites are often rather hairy looking because of the presence of spines. Mites can vary greatly from this generalized body design, as figures and descriptions given below demonstrate.

The generalized veterinary term for an infestation of mites in an animal is **acariasis** (pronounced ack-uh-RYE-uh-sis). **Mange** or **scabies** is one of the most common problems that mites cause in animals. Mange is a deterioration of the skin's condition (pathology), leading to hair or feather loss, a rash, skin discoloration (inflammation) and, in severe cases, lethargy and weakness. The USDA defines scabies and mange as it relates to cattle as "any skin condition of man or animals associated with a mite; scabies is a particularly serious, debilitating, reportable mange condition." The nature of the skin effects are determined by the location of the mites on the animal's body.

## Life Cycle

The generalized life cycle of mites can be described as follows. Mites mate and the females lay eggs. The eggs hatch and six-legged **larvae** emerge. These larvae feed and molt to the eight-legged **nymph** stage. Later, after feeding, the nymphs molt and become **adult male** or **female** mites. This entire life cycle can take as little as eight days to as long as four weeks, depending on the species of mite, and the temperature and humidity.

Some mites transmit disease causing microorganisms through biting. Other mites are **intermediate hosts** of tapeworm parasites that infect cattle and sheep. An intermediate host is an animal that harbors the asexual or immature stages of a parasite which do not mature until transferred to the next host. For example, if sheep eat the intermediate hosts containing these parasite stages, they can become infected with the parasite. This is in contrast to the definitive host of the parasite which is the host in which the parasite undergoes sexual reproduction; there is no intermediate host required for progression to maturity.

## Mite Pests of Animals

Table 3.1 lists the common mite pests of domestic animals, both livestock and companion ani-

mals. In general, the important mites that can be controlled with insecticides (or more properly, **miticides**) include the following groups:

- **Burrowing mange mites** (including the sarcoptic mange mites, notoedric mange mites and knemidocoptic mange mites).
- **Non-burrowing mange mites** (the psoroptid mange mites).
- **Ear mites** (psoroptid ear mites and otodectic ear mites).
- **Demodectic or hair follicle mites.**
- **Fur mites** (cat, dog and rabbit fur mites).
- **Chicken roost mite.**
- **Northern fowl mite.**

These mites all cause adverse skin conditions on their host animals.

The mites that cause scabies in cattle can create severe injury to skin. Infestations are contagious and animals are required by law to be quarantined and treated.

## Burrowing Mange Mites

Sarcoptic mange mites cause sarcoptic mange. Sarcoptic mange mites belong to one species, *Sarcoptes scabiei*, with host-adapted varieties (species-specific) that do not cross-infect other animals. This means they usually infect only one species of animal host. There are at least seven varieties infecting horse, cattle, sheep, goat, swine, dog and fox. Cats, rabbits and fowl are not sarcoptic mange mite hosts.

The life cycle of sarcoptic mange mites is similar on different host animals. The mated female mites burrow deep into the skin and form a tunnel over an inch long where she feeds on lymph fluid (a clear body fluid) by piercing the skin. She lays 40 to 50 eggs in the burrow and then dies. Tiny, six-legged larvae hatch from the eggs, leave the female's burrow and wander on the animal's body. The larvae form new pocket-burrows in the skin, where they feed and molt to two succeeding nymphal stages. The nymphs may also move about and make new tunnels. Nymphs molt and become adult males or females, which mate. Figure 3.2 shows a sarcoptic mange mite life cycle.

Sarcoptic mange mites, because of their burrowing behavior and feeding, cause intense itching and dermatitis. Affected animals may scratch so heavily that liquid exudes from the affected skin, causing skin crusts, and skin cracking and thickening. Secondary infection is common in scratched areas.

**Table 3.1 Common ectoparasitic mite pests affecting animal health in the U.S.**

<b>Host Animal</b>	<b>Common Name</b>	<b>Scientific Name</b>	<b>Tissue Affected</b>	<b>Mite Activity</b>	<b>Pathological Condition</b>
<b>Cattle</b>	Follicle mite	<i>Demodex bovis</i>	hair follicles	live in hair follicles, feed on sebum	demodetic mange
	Sarcoptic mange mite	<i>Sarcoptes scabiei</i> var. <i>bovis</i>	skin	mites dig tunnels, live in skin	sarcoptic mange
	Chorioptic mange mite	<i>Chorioptes bovis</i>	skin	live on skin or under scabs	leg, foot and tail mange
	Psoroptic mange mite	<i>Psoroptes ovis</i>	skin	live on skin or under scabs	scabs, scaly mange
<b>Swine</b>	Follicle mite	<i>Demodex phylloides</i>	hair follicles	live in hair follicles, feed on sebum	demodetic mange
	Sarcoptic mange mite	<i>Sarcoptes scabiei</i> var. <i>suis</i>	skin	mites dig tunnels, live in skin	sarcoptic mange
<b>Sheep</b>	Follicle mite	<i>Demodex ovis</i>	hair follicles	live in hair follicles, feed on sebum	demodetic mange
	Sarcoptic mange mite	<i>Sarcoptes scabiei</i> var. <i>ovis</i>	skin	mites dig tunnels, live in skin	sarcoptic mange
	Chorioptic mange mite	<i>Chorioptes bovis</i>	skin	live on skin or under scabs	leg, foot and tail mange
	Psoroptic mange mite	<i>Psoroptes ovis</i>	skin	live on skin or under scabs	scabs, scaly mange
	Itch mite	<i>Psorergates ovis</i>	hair follicles	live on skin	scaly mange
<b>Goat</b>	Follicle mite	<i>Demodex caprae</i>	hair follicles	live in hair follicles, feed on sebum	demodetic mange
	Sarcoptic mange mite	<i>Sarcoptes scabiei</i> var. <i>caprae</i>	skin	mites dig tunnels, live in skin	sarcoptic mange
	Ear mite	<i>Psoroptes cuniculi</i>	ear canal	live on skin or under scabs	psoroptic ear mange
	Chorioptic mange mite	<i>Chorioptes bovis</i>	skin	live on skin or under scabs	leg, foot and tail mange
<b>Horse</b>	Follicle mite	<i>Demodex equi</i>	hair follicles	live in hair follicles and feed on sebum	demodetic mange
	Sarcoptic mange mite	<i>Sarcoptes scabiei</i> var. <i>equi</i>	skin	mites dig tunnels, live in skin	scabies, mange
	Chorioptic mange mite	<i>Chorioptes bovis</i>	skin	live on skin or under scabs	leg, foot and tail mange

*Continued on next page*

**Table 3.1 Common ectoparasitic mite pests affecting animal health in the U.S., *Continued***

<b>Host Animal</b>	<b>Common Name</b>	<b>Scientific Name</b>	<b>Tissue Affected</b>	<b>Mite Activity</b>	<b>Pathological Condition</b>
<b>Cat</b>	Follicle mite	<i>Demodex cati</i>	hair follicles	live in hair follicles, feed on sebum	demodetic mange
	Notoedric scabies mite	<i>Notoedres cati</i>	skin	mites dig tunnels, live in skin	notoedric scabies, mange
	Ear mite	<i>Otodectes cynotis</i>	skin surface in ear canal	live in ear canal, feed on skin debris	ear mite infestation
	Cat fur mite	<i>Cheyletiella blakei</i>	skin	punctures skin & sucks lymph	scaly dermatitis
<b>Dog</b>	Follicle mite	<i>Demodex canis</i>	hair follicles	live in hair follicles, feed on sebum	demodetic mange
	Sarcoptic mange mite	<i>Sarcoptes scabiei var. canis</i>	skin	mites dig tunnels, live in skin	scabies, mange
	Ear mite	<i>Otodectes cynotis</i>	skin surface in ear canal	live in ear canal, feed on skin debris	ear mite infestation
	Dog fur mite	<i>Cheyletiella parasitivorax</i>	skin	punctures skin & sucks lymph	scaly dermatitis
<b>Rabbit</b>	Notoedric scabies mite	<i>Notoedres cati</i>	skin	mites dig tunnels, live in skin	notoedric scabies, mange
	Ear mite	<i>Psoroptes cuniculi</i>	ear canal	live in skin or under scabs	psoroptic ear mange
	Rabbit fur mite	<i>Cheyletiella yasguri*</i>	skin	punctures skin and sucks lymph	scaly dermatitis
<b>Chicken, turkey, pheasant, caged birds</b>	Chicken mite	<i>Dermanyssus gallinae</i>	roosts (free-living)	feeds on blood through skin	dermatitis, blood loss
	Northern fowl mite	<i>Ornithonyssus sylviarum</i>	skin,, feathers	feeds on blood, through skin	dermatitis, blood loss
	Scaly-leg mite	<i>Knemidokoptes mutans</i>	skin	burrow beneath epidermal scales	scaly leg lesions
	Depluming mite	<i>Knemidokoptes laevis var.</i>	base of feathers	burrow beneath epidermal scales	skin irritation, feather loss

Although all parts of an animal's body may be affected, usually the less hairy areas become infested. In swine, the primary infested parts of the body are the neck, shoulder, ear, withers, and back to the tail. Sarcoptic mange in horses usually occurs on the chest and at the base of the tail. In dogs, sarcoptic mange occurs on the face, but can spread to other parts of the body.

Detecting and identifying sarcoptic mange mites can be difficult because the mites live in the skin burrows. Deep skin scrapings that cause blood to ooze from the scraping are required to scoop mites out of the burrows. The scrapings are then examined with a microscope because these mites are too small to be seen with the naked eye. Figure 3.3 shows a sarcoptic mange mite to illus-

trate general features. To properly detect and identify these mites, consult a veterinary dermatologist, parasitologist or entomologist. Although, veterinary manuals contain information on identification and detection, a trained professional can make the best diagnosis.

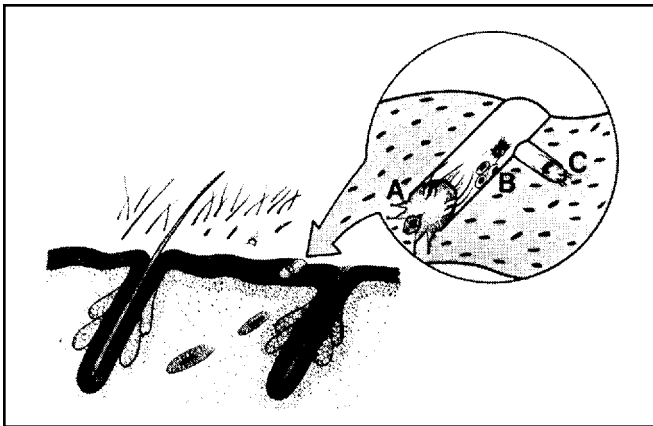


Figure 3.2 “Sarcoptic mange mite life cycle, which is completed in the skin: Adult (A) lays eggs (B), which develop into immature nymph stages (C).

**Notoedric mange mites** are similar to the sarcoptic mange mites in biology, pathology, detection, and identification, except that they are smaller. They occur in cats and rabbits, but also occasionally in dogs. These mites infest skin primarily on the back of the neck, ears, face, and paws, but may cover the whole body, especially in young animals. Detection and identification is done in the same manner as with the sarcoptic mange mites.

The third group of burrowing mange mites affects domesticated fowl, including chickens, turkeys, pheasants, and caged pet birds. This group includes the scaly leg and depluming mites. The scaly-leg mite, *Knemidokoptes mutans*, forms burrows under the epidermal scales on the toes, feet, and legs of birds. The burrowing and feeding activity of the mites causes inflammation, disfiguration of the skin with crusts, scale and scab formation and swollen legs and feet. The skin hardens and exudes fluid. Sometimes, these mites also infest the comb and neck. Heavily infested birds may die because of hypersensitive allergic reactions.

The depluming mite, *Knemidokoptes laevis* var. *gallinae*, usually occurs only on chickens. Rather than infesting the skin of the legs and feet, the depluming mites form burrows at the base of feathers in the skin. When mite burrowing and feeding irritates the birds and they scratch, the feathers fall out and the bird becomes deplumed in the affected areas of the body. All of these mites have similar life cycles and detection methods similar to the other burrowing mange mites.

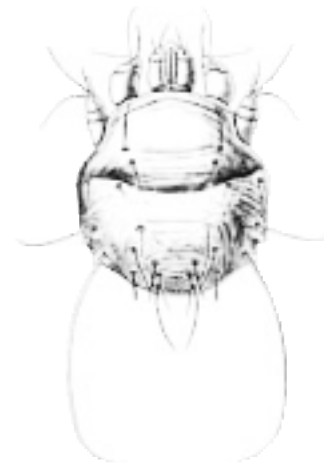


Figure 3.3 Sarcoptic mange mite general features.  
Source: Peter Carrington

## Non-Burrowing Mange Mites

The non-burrowing mange mites, in contrast to the burrowing mange mites discussed above, do not form burrows in the skin. However, they do infest animal skin and cause mange. These mites feed on lymph (clear body fluid) by puncturing the skin, or they feed on skin scales and debris. Mite feeding causes fluid to exude from the skin and form scabs, which turn into yellowish crusts if not treated. The mites live at the edge of these scabs or underneath them. These mites’ life cycle can be as short as nine days.

There are two important species of non-burrowing mange mites. *Psoroptes ovis* infests the skin of horses, cattle and sheep causing infestations commonly called sheep scab or cattle scab. The veterinary term for infestation by these mites is **psoroptic mange**. The entire body may be infested, but usually the hairier areas are affected, particularly the back, shoulders and sides.

The other important species of non-burrowing mange mite is *Chorioptes bovis*, which infests horses, cattle, sheep and goats. The veterinary term for infestation by these mites is **choriopic mange**. Usually, the legs of these animals are affected, causing stamping and leg-biting in horses. In cattle, the mites often infest the base of the tail. Choriopic mange mites appear to mainly feed on epidermal (skin) debris. Yet, infestation by these mites still may lead to mange in some animals. Animals may often be infested with choriopic mange mites but show no mange symptoms. Figure 3.4 shows a choriopic mange mite.

Detecting and identifying non-burrowing mange mites requires skin scrapings by a trained professional. These scrapings do not need to be as deep as those for burrowing mange mites, but a proper diagnosis of burrowing or non-burrowing

mange mites may require a deep scrape and a shallow scrape. Scraped material should be spread or applied onto glass microscope slides and examined under a microscope at high power.



Figure 3.4 Chorioptic mange mite.  
Source: Peter Carrington

## Ear Mites

Ear mites are closely related to the non-burrowing mange mites but they live on the skin of ear canals instead of on the outer skin. There are two species of ear mites of importance. *Otodectes cynotis* causes ear mange and lives in the ears of carnivores including dogs, cats and ferrets. *Psoroptes cuniculi* lives in the ear canals of rabbits, horses, cattle, sheep and goats. It also causes ear mange. The life cycle of these two mites is similar to the non-burrowing mange mites. The swarming, reproduction and feeding activity of these mites causes inflammation and intense itching in the ears of affected animals. Crusts form on the skin. An infested animal will often shake its head, carry the head to the side, scratch the ears and show signs of disequilibrium or dizziness by turning in circles. The ears may exude pus. Sometimes, in cases with extreme infestation and secondary infection, the ear drum perforates, allowing the middle and inner ear to become infected with bacteria.

Detecting and identifying ear mites is accomplished by ear scrapings or sampling with an oil-soaked cotton swab and then examining with a microscope. In some cases, an otoscope (ear examining instrument) may be used to search for mites, but infested animals with sensitive ear canals may not tolerate its use and may need to be restrained. With other animals, examining the ear with an otoscope may reveal mites crawling about in the ear canal. If mites are detected, no ear swabbings are necessary.

## Hair Follicle Mites

Follicle mites are tiny, elongate mites that live in the hair follicles or **sebaceous (oil) glands** associated with hair follicles in mammals. The species of major importance to domesticated animals belong in the genus *Demodex* (see Table 3.1).

Follicle mites are common parasites of cats, dogs, horses and other large animals. In healthy animals, follicle mites do not cause any skin deterioration or mange. Animals with severe demodectic mange generally have immune systems that do not function properly. In weak or diseased animals, two skin conditions can develop. In the scaly skin condition, skin thickens and wrinkles and hair falls out. The skin turns color changing from its normal color to red or bruised-looking. In the pustular skin condition, pimples or pustules filled with pus develop. The pustules can develop into severe abscesses or nodules filled with fluid and pus. This skin condition usually develops after the scaly condition and reflects the development of secondary bacterial infections in the follicles. In both conditions, itching occurs. These skin conditions are collectively called **demodectic mange**.

Heavily infested dogs exhibit demodectic mange on several parts of the body, but particularly on the face and paws. Demodectic mange in dogs is also called **red mange**. Secondary bacterial infection, especially by *Staphylococcus*, as part of the overall mange condition can lead to death in dogs. Social stress may contribute to the onset of mange conditions. In other animals, follicle mite infestation is usually asymptomatic (showing no symptoms). However, in swine and cattle, infestations can result in nodules and abscesses resulting in hide damage. Goats and horses can exhibit mild demodectic mange but generally do not develop abscesses or nodules.

Detecting and identifying follicle mites can be done by a trained professional using a deep skin scrape (as with burrowing mange mites), or by expressing pustules or abscesses and preparing slides for microscopic examination. Identification is quite easy after slides have been prepared. There are no other mites that have the elongated appearance of follicle mites, shown in Figure 3.5.

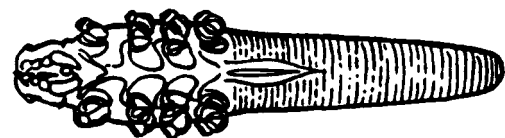


Figure 3.5 Hair follicle mite.

## Other Mites: Chiggers, Chicken and Fowl Mites

Several other kinds of mites bite or infest domesticated animals. Larvae of **chigger mites** normally parasitize wild rodents. The larvae attach to the skin and suck tissue fluids. Larval chiggers seek hosts by clinging to vegetation near ground level and wait for an animal to pass by. Chiggers typically occur in low-lying, humid environments such as stream sides and marsh or lake edges. Pastured cattle or horses may occasionally be bitten by chigger mites in these situations. Chiggers may cause itchy lesions on animals that crust over. They may be found on legs, feet and ears. The larvae attach to the skin and suck tissue fluids.

Diagnosis of chiggers on animals includes the observance of bright orange mites, crusty lesions, skin scrapings, and environmental history of being in woods and fields. Treatment includes dips and shampoos with an insecticidal product according to label directions. Keep animals out of contaminated areas to prevent reinfestation.

Two mites commonly infest poultry. *Dermanyssus gallinae*, the **chicken roost mite** (or just **chicken mite**), infests domesticated fowl as well as wild birds such as pigeons and house sparrows. During the daytime, these mites hide in cracks and crevices in the birds' roosts and in poultry houses. At night, the mites leave their refuge, infest the birds and feed on their blood. Heavy infestations in chicken houses can reduce egg laying, and cause blood loss that may lead to death in chicks and displacement of layers from their nests. In heavily-infested houses, the birds have pale combs and wattles. Birds become droopy and weak and more susceptible to other parasites and to disease.

Chicken mite infestations can be detected by collecting dirt and other material from mite hiding places in the roosts and houses and examining the material for mites. You may see masses of these small mites, their eggs, and silvery skins cast by the immature mites. Chicken mites are more of a warm weather (summer) pest and may go unnoticed unless you examine the birds at night when the mites are blood-feeding.

Sometimes chicken mites leave the nests of pigeons or sparrows and invade houses, biting people. This occurs especially when the adult birds leave their nests after the young have fledged (acquired feathers necessary for flight).

The **northern fowl mite**, *Ornithonyssus sylviarum*, infests poultry and wild birds. Unlike the chicken mite, the northern fowl mite spends most of its time on the host birds, but also occurs

in nests and houses. Northern fowl mites are more of a problem in cool weather (winter), but may be found on birds the year round. Mite populations can rise rapidly after a bird has been infested initially. When conditions are optimal for the mite, newly infested birds may support mite populations in excess of 20,000 per bird within 9 to 10 weeks. Mites do not become established in large numbers on birds until birds reach sexual maturity; birds greater than 40 weeks of age usually do not support many mites. The feathers will darken from the eggs, cast skins, dried blood and excrement of the mites. Scabs may form in the vent area. The mites suck blood and the resultant wounds can develop into dermatitis and become infected with bacteria. Heavy infestations of northern fowl mites are unhealthy for poultry, causing reduced food intake, weight loss, a pale pink comb and decreased resistance to disease and other afflictions. Also, there is a lower egg production in layers. Detection is accomplished by direct examination and handling of the birds and eggs, and skin scraping from potentially infested birds.

The northern fowl mite and the chicken roost mite are similar in appearance, even when viewed with a microscope. Identification should be attempted with help from entomologists or parasitologists.

## Endoparasitic Mites

Some mites occur in the internal organs and tissues of animals, particularly the respiratory passages. These mites are appropriately classified as endoparasites. For example, *Pneumonyssoides caninum* infests the sinuses and nasal passages of dogs. Do not deal with these mites strictly as arthropod pests suitable for control with miticides by a certified applicator, but rather refer to veterinarians for any necessary treatment.

Mites in the family Oribatidae (commonly called **oribatid mites**) are generally free-living and occur in soil. Although these mites are not typically ectoparasitic on domestic animals, some of them are important as intermediate hosts for certain tapeworms (genus *Moniezia*) that infect cattle, sheep and goats. The mites ingest tapeworm eggs found in infected animal feces. Inside the mite, immature stages of the tapeworm (called cysticercoids) develop. Cattle may later ingest the mites as they graze in pasture and become infected with the tapeworms. Environmental control of the oribatid mites to reduce worm load in the pastured animals is not generally recommended.

## **Skin scraping and ear swabbing for mite detection where mange or ear mites are suspected.**

Mites causing mange or infesting the ears may initially be suspected if an animal's behavior or appearance changes to an abnormal condition. Gross changes in coat or skin condition, or excessive licking and scratching can be signs that mites have infested the animal at unhealthy levels.

Detection (or diagnosis) of mite infestations of animal skin and ears can be accomplished by examining the entire body surface using a hand lens. However, mange, ear and fur mites may be more readily and definitively detected by the skin scrapings performed by a professional.

As discussed, skin scraping may be shallow (i.e., not draw blood) or deep (i.e., slightly draw blood) and can reveal non-burrowing, burrowing and hair follicle mites depending upon the depth of the scrape. Veterinarians trained in skin examination and diagnosis of dermatological and ear problems in animals should be consulted for assistance with these detection methods. These experts can help determine if the perceived problem is caused by mite infestation or something else. Be sure that the animal is adequately restrained during these procedures to ensure the safety of the person performing the technique.

## **MANAGEMENT OF MITES ON ANIMALS OR IN ANIMAL ENVIRONMENTS**

Obviously, there are many different species of mites that affect the health of many different kinds of domestic animals. Thus, the measures to control mite problems vary with the species of mite and kind of host animal involved.

The first step in managing mite ectoparasites on livestock is to provide for good herd health because it helps maintain the animals' resistance to mite infestations. Housing, nutrition and sanitary conditions should be at optimal levels. Animals held under crowded conditions, on poor feed rations and in unclean housing are more likely to contract or harbor infestations of mites. Animals in poor health for other reasons also are more susceptible to mite infestations and may be reservoirs of mites, causing infestations of healthy animals. Examine new animal additions to a herd or flock for pests and, if necessary, treat to prevent contamination of animals already present. Quarantining new animal additions is part of good husbandry practices.

Control of mites on animals or in the environment usually requires use of approved pesticides

or drugs. The choice of which pesticide to use, or which drug, varies with the mite that is the pest and the animal infested by the mites. Pesticides that are used to control mites or ticks are called **acaricides**. Note that not all insecticides approved for louse (more than one lice) control on livestock are approved or effective for mange mite control. Consult with your veterinarian.

**Cattle.** The mites on pastured or confined beef and dairy cattle that require control measures are those that cause mange or scabies. These problems usually occur in winter and reach peak outbreaks in winter and spring. Report any infestation of mange or scabies mites in cattle to federal agricultural officials. The presence of a single scabies mite is the infestation level (action threshold) at which animals should be treated. Affected animals should be culled (removed) from the herd and quarantined. Whole herd quarantine and treatment may be required.

For beef cattle infested with scabies mite, the animals twice must be dipped or sprayed in a spray-dip machine at intervals required by the label. There are several approved acaricides for this purpose. Alternatively, cattle may be injected with an ivermectin drug. Non-lactating dairy cattle can be treated similarly, or with a high-pressure spray. In all cases, the applications have slaughter intervals or milk withholding times that must be adhered to.

**Swine.** Producers will need to decide whether to eradicate mange or to control it. Eradication is possible, but expensive, and reinfection may occur. Under the supervision of a veterinarian, injecting all swine on the farm on the same day with ivermectin will eliminate mange infestation. However, if even one animal is missed, it can serve as a source of reinfestation for the entire herd.

Alternately, producers may opt for a program of control that seeks to keep infestation at a very low and tolerable level. Various acaricides can be used effectively in a control program. The frequency of application depends on the initial severity of infestation. Control starts with the breeding herd. Severely affected sows should be culled or injected with ivermectin. The remainder of the breeding herd should be treated thoroughly with a spray-on acaricide either simultaneously for at least three times at weekly intervals, or alternately in segregated groups prior to farrowing. Then a routine program of spraying the sows with a repeat spray in two weeks can be carried out twice a year. If production is in batches, then weaned pigs can be treated when they are moved to the nursery

facility. Treatment at this age and segregation from older animals precludes the necessity of more expensive treatment of older, larger animals in finishing.

Nursery pigs may be treated with spray-ons, ivermectin injection, or ivermectin feed additive. If necessary initially to treat growing, finishing pigs, schedule treatments to prevent conflicts with sales of market animals. Many spray applications have pre-slaughter withholding times and ivermectin must be injected more than 18 days before slaughter.

**Sheep and goats.** Mange mites affecting sheep and goats can be detected by the methods mentioned previously. Mange mites can be controlled on these animals through the use of approved acaricides. Dipping and using pour-ons are the methods of choice for acaricide applications.

**Poultry.** Both the northern fowl mite and the chicken mite are important pests of confined poultry. The best method of northern fowl and chicken mite control is preventing the contact of infested birds with healthy, pest-free birds and keeping the houses clean.

Detecting an initial low mite population that can be controlled effectively and economically is important in a mite-monitoring program. Individuals in flocks should be monitored regularly for mite presence. At least ten randomly selected birds from each cage row (in a caged-layer operations) in the entire house should be monitored weekly. To reveal the mites, examine the vent area under a bright light, and part the feathers. Northern fowl mites congregate on the bird's abdomen or around the vent. The actual decision to treat is influenced by flock age, time of year, and distribution of the infestation in the house. It is usually uneconomical to treat older birds because their mite populations are unlikely to increase. A population build-up is more likely in a young flock. Mite populations can be expected to increase in cooler months and decrease in warmer months. An infestation restricted to one part of a house may not spread, but the infested area must be monitored closely. Detecting mites in broiler-feed operations generally means the entire flock must be treated. Once mites become established on birds, the use of acaricides is an important part of management.

When treatment for mites is necessary, apply the insecticide to the birds in the late afternoon before their eggs have hardened in the oviduct. This reduces the potential for egg cracking and, therefore, lower grading of the egg for market. Chemical control of northern fowl mites in caged-layer operations requires applying the insecticide

directly to the vent region with sufficient pressure (minimum 100 to 125 psi) to penetrate the feathers. The spray will have to be directed upward from beneath the cages to reach the vent. Liquids are preferable to dusts for northern fowl mites. Even though they normally live on the host, northern fowl mites can survive off the host for two to three weeks at room temperature. Therefore, removing birds from an infested house and replacing them two weeks later may not solve the pest problem.

Chicken mites visit the poultry at night to blood-feed and hide in cracks, nests and other protected sites during the day. Thus, sanitation is a very important management method for chicken mite infestations. Acaricide sprays directed into these hiding areas, using liquid formulations, provides the best approach for chemical control of chicken mites. Through the use of premise treatments, chicken mites may be controlled without actually having to treat the chickens.

There are plastic strips impregnated with acaricides that can be placed in the areas where birds nest and congregate. When the birds rub against these strips, the insecticide is transferred to their bodies.

**Horses.** Horses can be infested by mange mites that cause a deterioration of the skin and coat. The mites may severely affect horse health if infestations are unchecked. Mange mite treatment methods for horses are similar to those for beef cattle. Use high-pressure spray applications of approved acaricides at weekly intervals. However, horses' skin is more sensitive to insecticide treatment than is the skin of other animals. Consult a veterinarian for information on the best products for use on horses.

**Companion animals and small animals.** Companion animals (i.e., dogs and cats) and other small animals, such as pet rabbits, can become infested with mange mites or follicle mites, leading to unhealthy conditions of the animals. Dogs can be affected by the scabies mite, *Sarcoptes scabiei* var. *canis*, while cats and rabbits are affected by the burrowing mange mite *Notoedres cati* and the fur mite, *Cheyletiella*. The best treatment for mange mites in these animals is dipping in an approved acaricide. Dusts may be used for light or localized mange mite infestations. These treatments also will kill fur mites.

## TICKS

There are more than 800 species of ticks belonging to two families: the **soft ticks** (family Argasidae, 160 species) and the **hard ticks** (family Ixodidae, 650 species). Ticks are close relatives of mites; many scientists feel that ticks evolved from mites into parasitic associations with animals during the time of the large reptiles (about 200 million years ago).

Ticks are **obligatory** blood-feeders on vertebrate hosts. This means that they depend entirely on blood for food and their survival. They parasitize reptiles, birds and mammals. Unlike mites, there are no ticks that feed on plant juices or prey on other arthropods.

Ticks are of major world-wide veterinary importance for the following reasons:

1. They cause blood loss.
2. Their feeding causes inflammation and irritation of the skin.
3. They may stimulate hypersensitive allergic reactions.
4. They may cause a toxic reaction in the host, complicated by paralysis (called “tick paralysis”).
5. They transmit microorganisms that cause disease.

Arthropods that transmit pathogenic microorganisms are called “vectors” of the diseases that the pathogens cause. For example, *Ixodes scapularis*, commonly called the deer tick, is a vector of Lyme disease.

### Hard Ticks

Ticks are small arthropods, but all life stages can be seen with the naked eye. Figure 3.6 shows an example of a hard tick. The feeding apparatus of a tick, like that of a mite, is called the hypostome. The hypostome allows the tick to suck blood. The legs are segmented. The rest of the body of the tick is the abdomen. On the back of the abdomen of hard ticks is the scutum or shield. The scutum is often colored and has holes and lines in it (called “ornamentation”). The ornamentation of the scutum is important identifying hard ticks. Some hard tick species have ridges or festoons in the abdomen. In female hard ticks, the scutum does not cover the abdomen completely. In male hard ticks, the scutum covers the abdomen. Ticks do not have antennae.

### Soft Ticks

Soft ticks look very different than hard ticks. The hypostome of soft ticks does not project forward — it is tucked underneath the abdomen and



Figure 3.6 The American dog tick (*Dermacentor variabilis*), is an example of a hard tick.

is not visible from above. Soft ticks do not have a scutum, nor do they have elaborate coloration patterns. Instead, the body is covered with bumps and folds.

### Tick Development and Feeding

Biological development of ticks starts with the egg stage and is followed by three more stages: six-legged larva, eight-legged nymph and eight-legged adult. Hard ticks have only one nymphal instar (that is, one molt to the nymph stage, followed by a molt to the adult stage). Soft ticks may have up to seven nymphal molts, depending upon the species of tick and the kind of life cycle involved.

Each stage of a tick must feed on blood. Blood is the sole nutrient source for ticks and allows them to develop and molt to the next stage. For adult female ticks, blood provides the nutrients to develop eggs.

Blood feeding by ticks is a complex behavior and a physiological interaction with the host being fed upon. Ticks usually locate hosts through “questing.” During questing behavior, a tick climbs to a perch (such as a blade of grass or end of a branch) and extends its legs. When an animal brushes against the perch, the tick grabs onto the animal’s fur. The tick then crawls about the body of the animal until it finds a suitable place to attach its mouthparts. The tick inserts its hypostome into the skin and secretes a cement from the salivary glands to hold the hypostome in place. The tick then starts to take blood. For hard ticks blood feeding lasts several days to weeks, depending on the length of attachment. Most species of soft ticks blood-feed for only minutes to hours at a time. Many soft ticks do not quest as described above, but walk to a host to feed.

## Tick Life Cycles

Ticks have complex life cycles involving several blood meals with the same or different animal hosts and may include long periods of time when they are not on a host but living in the environment. Indeed, one of the characteristic features of ticks is that even though they are highly dependent upon blood for food they may survive away from a blood host for long periods. Some species of ticks can live for years without a host.

Soft ticks are usually associated with nests, dens, burrows, or roosts of their animal hosts. Soft ticks usually mate when they are not on a host. Hard ticks are generally not associated so closely with their hosts but are free-ranging and only come into contact with animal hosts for blood feeding. Hard ticks usually mate when they are on a host, oftentimes while the female is blood feeding. Because soft ticks take small blood meals for a short feeding period, the female only lays a few hundred eggs during her lifetime, with eggs laid at intervals. Hard ticks take large blood meals and lay 6,000 or more eggs at one time.

Ticks have four generalized life cycles. These life cycles are related to the number of individual animal hosts a tick will visit and feed on during its life from egg to adult. The life cycles are called **one-host life cycle**, **two-host life cycle**, **three-host life cycle** and **multihost life cycle**. Ticks are often referred to by the kind of life cycle they have, for example, the American dog tick is a three-host tick.

The three-host life cycle has been adopted by about 625 species of the hard tick family and is the most common tick life cycle. The larvae find a host and feed for days, then drop off the host and wait days to weeks for the blood meal to digest. Then they molt to the nymph stage. The nymph finds a new host (of the same or a different species of animal that the larva was feeding upon), blood-feeds, drops off and digests the blood. It then molts to the adult stage. These ticks quest for a new, third host. They feed and mate on this third host. The females drop off after feeding, digest the blood and lay eggs. Males stay on the host, often do not feed, and die after mating.

In the three-host life cycle, the larvae and nymphs typically feed on smaller animals (for example, birds or rodents) than do the adult ticks (for example, deer or cattle). Three-host tick cycles may take years to complete, depending on the environmental and climatic conditions in the area.

The two-host life cycle occurs in 12 of the hard tick species. This life cycle is very similar to the three-host life cycle. Two-host ticks generally do

not occur in North America, though in other parts of the world they are extremely important pests of animals.

The one-host tick life cycle occurs in about 12 species of the hard tick family. Larvae, nymphs and adults all feed upon the same animal host without dropping off of it to molt. One-host ticks are important pests of domesticated animals in North America and elsewhere.

The multihost life cycle is characteristic of nearly all of the species of soft ticks. Multihost life cycles take place in areas where host animals dwell, such as dens, burrows, nests and other shelters. In this life cycle, many nymphal molts occur, and these nymphs are called intermediate stages. Larvae find a host in the shelter and then feed. They detach from the host, stay in the shelter, digest the blood and molt to the first-stage nymph. The nymphs repeat the feeding and other activities of the larvae. Individual nymphs feed and molt several times before molting to the adult stage. Adults quest for and feed on a host in the same shelter as the nymphs and larvae. The adult ticks may feed many times. The female ticks lay small batches of eggs after each blood feeding.

## DETECTING AND IDENTIFYING TICKS

Ticks can be detected on animals by direct examination without use of a hand lens or microscope. Engorged ticks (those filled with blood) are particularly easy to see because they are large and obvious, looking somewhat like a castor bean in shape and color. To find ticks on an animal, ruffle or comb hair or feathers to expose the skin and examine skin directly. Ticks may have preferred attachment sites that protect them to a certain degree from being dislodged by animal grooming. Areas around the head, in the ears, on the shoulders and other parts of the body can harbor attached ticks. On cattle, ticks can be found in highly vascularized areas of the skin (i.e., tail, udder). Unattached ticks can be recovered from the host by combing and examining the comb.

Ticks can be identified using references and biological identification keys. Identification is important because certain tick species transmit agents which cause serious diseases, while others do not. Thus, correctly identifying ticks can help animal health care professionals decide the need for performing diagnostic tests for tick-borne diseases.

A pictorial key to the genera of adult ticks in the United States is given at the end of this chapter. Identification of ticks to particular species often requires contacting experts through local county extension offices or health departments.

Immature ticks, larvae and nymphs, are difficult to identify even with the aid of a microscope. Consult an expert to determine if a particular arthropod is an immature tick and, if so, the species of the immature tick.

## IMPORTANT TICKS AFFECTING ANIMAL HEALTH

There are many species of ticks affecting animal health. Ticks may be found on companion animals, livestock and other animals in agricultural settings and even animals in pet shops or zoos. Additionally, ticks are important ectoparasites of wild animals and may seriously affect the vigor of individuals and the fitness of whole populations.

Table 3.2 lists several important tick species found in the United States, their distribution and common name, which domesticated animals the ticks commonly parasitize and the diseases they are associated with as vectors. The following text provides detailed information about the important ticks of the northcentral part of the United States.

The **American dog tick** *Dermacentor variabilis*, (Fig. 3.6) is widespread in the eastern United States. The American dog tick is brown with white ornamentation on the scutum (shield on the abdomen) in the adult stage. It parasitizes wild, woodland rodents in the larval and nymphal stages, and as an adult it commonly occurs on dogs and wild canines, cattle, horses, raccoons, opossums, and humans.

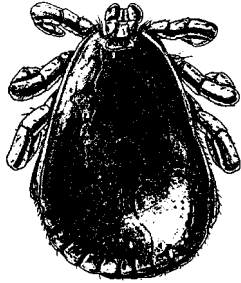
The American dog tick is a three-host tick. It is an important vector of the microorganisms that causes Rocky Mountain spotted fever. This disease is also known as American tick-borne typhus. Dogs and humans can contract Rocky Mountain spotted fever, a serious and potentially fatal disease characterized by unusual spotted rashes and high fever.

The **winter tick**, *Dermacentor albipictus*, (Figure 3.7) is a common tick with an inactive summer period but an active winter time. Though inactive in the summer, larvae quest for hosts in the fall. They find and parasitize large animals (ruminants and horses) during the winter. It is a one-host tick, spending all of the winter on a host. In the northcentral U.S., this tick is a common

**Table 3.2 Common ticks affecting animal health in the northcentral region of the United States**

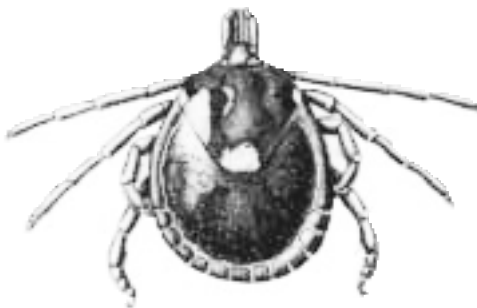
Tick Animals Parasitized	Common Name	Scientific Name	Geographical Distribution	Disease Associations
Cattle, horses dogs, cats	American dog tick	<i>Dermacentor variabilis</i>	Eastern U.S., California	Rocky Mountain Spotted Fever
Wide range of birds, mammals	Lone star tick	<i>Amblyomma americanum</i>	Southern states east of Texas	Rocky Mountain Spotted Fever
Ruminants, horses	Winter tick	<i>Dermacentor albipictus</i>	North America, widespread	
Poultry	Fowl tick	<i>Argas persicus</i>	Southern U.S. & sporadically north	
Rodents, cattle, horses deer, dogs, cats	Deer, bear tick	<i>Ixodes scapularis</i>	Upper midwest, eastern coast states	Lyme disease
Dogs mainly	Brown dog tick	<i>Rhipicephalus sanguineus</i>	Worldwide, indoors	

ectoparasite of white-tailed deer, elk and moose. It will also parasitize cattle and horses that are pastured or ranged in winter. Tick loads can exceed thousands of ticks per animal. The winter tick is not a vector of pathogenic microorganisms, but it can cause problems leading to blood loss and allergic reactions in affected animals.



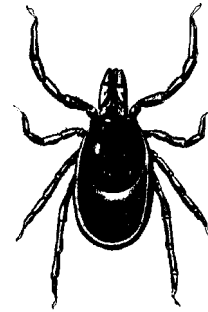
**Figure 3.7 Winter tick (*Dermacentor albipictus*).**  
Source: Peter Carrington

The **lone star tick**, *Amblyomma americanum*, (Figure 3.8) is a common and problematic tick of the southcentral and southeastern United States, but these ticks appear every year in north central states (probably brought up by northwardly migrating birds). The tick gets its name from the bright, lone star-like spot on the scutum. The male and immature ticks lack this spot. Lone star ticks are vectors of Rocky Mountain spotted fever rickettsiae. The lone star tick is a three-host tick. It parasitizes a wide range of birds (particularly by larvae and nymphs) and mammals, including cattle, horses, sheep, dogs and humans.



**Figure 3.8 The lone star tick (*Amblyomma americanum*) is a common and problematic tick of the south central and southeastern United States. These ticks appear every year in north central states (probably brought up by northwardly migrating birds).**

The **black-legged tick**, *Ixodes scapularis*, (Figure 3.9) is a three-host tick with a prolonged two-year life cycle. In the larval and nymphal stages, it quests for woodland rodents, such as mice and chipmunks, but it will also parasitize ground-foraging birds. Adult ticks are found on larger-sized wild mammals, but will also parasitize humans, dogs, cats, horses and cattle.



**Figure 3.9 Black-legged tick (*Ixodes scapularis*).**

*Ixodes scapularis* is the vector (transmitting organism) in the eastern U.S. of *Borrelia burgdorferi*, the bacterial organism that causes Lyme disease. Lyme disease is a chronic, debilitating disease that initially manifests itself as a rash in humans and may later lead to chronic arthritis and possibly heart and nervous system problems. Dogs, horses and possibly cattle show some symptoms of Lyme disease, indicating that they can become infected following an infectious tick bite.

Other ticks of veterinary importance in the northcentral region of the U.S. include *Argas radiatus*, the fowl tick. This tick may infest domesticated poultry, but it is rare and occurs mainly in southern states. If importing animals, isolate and examine the them for ticks.

## MANAGEMENT OF TICKS ON ANIMALS

Management of ticks affecting livestock or companion animals varies with the species of tick and kind of animal that needs protection. For large animals, such as cattle and horses, tick control can be enhanced with vegetation management that modifies the tick habitat. Animals can then be pastured in areas where tick questing areas have been reduced.

On animals, tick control can be achieved using approved acaricides by dipping, spraying the entire animal with high-pressure sprays or whole animal dusts. Insecticide-impregnated ear tags offer some protection and control when ticks are infesting mainly the ears.

When only a single or a few ticks are on an animal, simply remove them using tweezers or fingers. Grasp the tick as close to the skin as possible and pull firmly away until it detaches. Be sure not to squeeze the tick – you could cause any disease organism in the tick to go into the animal. Do not remove ticks by burning, or using materials such as kerosene or diesel fuel. With heavy infestations, animals should be dipped, dusted or shampooed with an acaricide and then combed thoroughly to rid the ticks from the body of the animal.

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## Chapter 3 – Review Questions

**Write the answers to the following questions and then check your answers with those in the back of this manual.**

1. What features of mites and ticks generally distinguishes them from insects?
  - a. Four legs
  - b. Two major body parts
  - c. Three major body parts
  - d. Six legs
2. What four ways do mites affect the health of animals?
  - a. Death.
  - b. Mange.
  - c. Scabies.
  - d. Weight loss.
  - e. b and c.
3. What is one of the most common problems that mites cause in animals?
  - a. Death.
  - b. Mange.
  - c. Scabies.
  - d. Weight loss.
  - e. b and c.
4. Describe the generalized life cycle of mites.
  - a. Eight days to four weeks.
  - b. 24 hours
  - c. Two days
  - d. Two months.
5. How long is the entire life cycle of a mite?
  - a. Eight days to four weeks.
  - b. 24 hours
  - c. Two days
  - d. Two months.
6. Why do sarcoptic mange mites cause intense itching and dermatitis on the animals they infest?
7. Animals affected with sarcoptic mange may scratch so heavily that liquid exudes from the affected skin, causing skin crusts and skin cracking and thickening. (True or False)

8. Secondary infection is common in scratched areas. (True or False)
9. Sarcoptic mange mites typically infest the hairiest parts of an animal's body. (True or False)
10. How can you detect and identify non-burrowing mange mites?
  - a. Observe with a hand lens.
  - b. Comb the animal with a mite comb.
  - c. Skin scrapings.
  - d. a and b.
11. Follicle mites are common parasites of cats, dogs, horses and other large animals. (True or False)
12. In healthy animals, follicle mites normally do not cause any skin deterioration or mange conditions. (True or False)
13. In weak or diseased animals, follicle mites can cause two skin conditions to develop. Describe them.
14. What are the skin conditions caused by follicle mites called?
15. Both endo- and ectoparasitic types of mites exist. (True or False)
16. Describe why ticks are of major worldwide veterinary importance.
17. Each developmental stage of a tick must feed on blood because blood is the sole nutrient source for ticks and allows them to develop and molt to the next stage. (True or False)
18. Ticks can be detected on animals by direct examination without use of a hand lens or microscope. (True or False)
19. If an animal has ticks, what are the control options?