CHAPTER 9

MITES AND TICKS

LEARNING OBJECTIVES

After you complete your study of 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 animals.
- 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.

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, by 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 by:

- Damaging tissues and causing dermatitis.
- Causing blood or body fluid loss.
- Causing allergic reactions.
- Creating conditions for secondary bacterial infection.

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, leading to hair or feather loss, skin discoloration and, in severe cases, lethargy and weakness. The USDA defines scabies and mange as "any skin condition of man or animals associated with a mite; scabies is a particularly serious, debilitating, reportable mange condition."

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 9.1 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

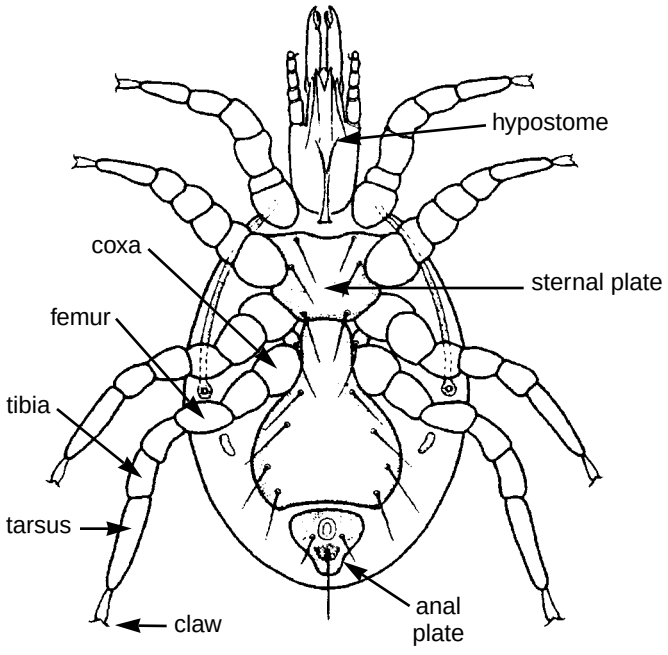

Figure 9.1 General anatomy of a mite.
Source: Centers for Disease Control.

paired palpi (singular, palpus). The legs are segmented, and each joins the body at the coxa. The body of a mite consists 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. Mites may or may not have simple eyes. 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 will demonstrate.

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 f**emale** 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.

Table 9.1 Common ectoparasitic mite pests affecting animal health in the U.S.

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

MITE PESTS OF ANIMALS

Table 9.1 lists the common mite pests of domestic animals. 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).

These mites cause adverse skin conditions on their host animals.

Burrowing Mange Mites

Sarcoptic mange mites cause sarcoptic mange. Sarcoptic mange mites belong to one species, *Sarcoptes scabei,* with host-adapted varieties that do not cross-infest other animals. This means they usually infest only one kind of animal host. There are at least seven varieties infesting dogs, horses, sheep, goats, swine and foxes. Cats, rabbits and fowl are not affected by sarcoptic mange mites.

The life cycle of sarcoptic mange mites is similar on different host animals. The mated female mite burrows into the skin and forms a tunnel over an inch deep where she feeds on lymph fluid (a clear body fluid). 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 9.2 shows a sarcoptic mange mite life cycle. If the mites fall or drop off the host animal, they are susceptible to dehydration (loss of water) and usually die within a few days.

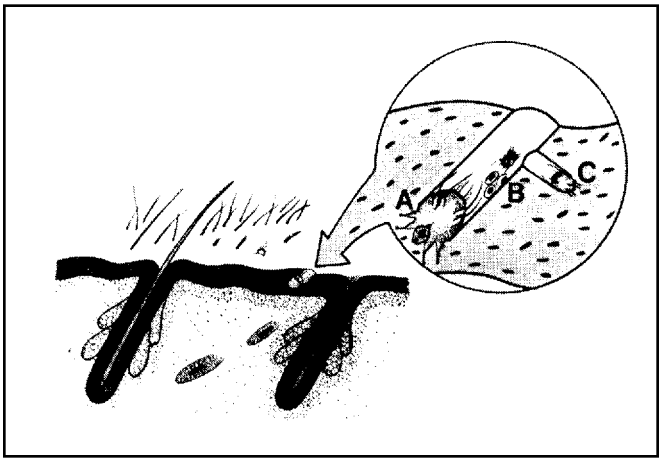

Figure 9.2 Sarcoptic mange mite life cycle: Adult (A) lays eggs (B), which develop into immature nymph stages (C).

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.

Though all parts of an animal's body may be affected, usually the less hairy areas become infested. In dogs, sarcoptic mange occurs on the face but can spread to other parts of the body. Sarcoptic mange is transmissible to other dogs. If one dog is infested, all dogs that it has come in contact with should be treated for mite control. The animal should be dipped with an approved product. In the case of a puppy or stressed animal, a lime-sulfur prep should be used. Repeat the treatments for 4 to 6 weeks according to the intervals listed in the label directions. Treatment may require assistance from a veterinarian. Clip the infested dog's hair if it is a long-haired type. Dispose of all bedding and thoroughly vacuum. Dispose of the vacuum bag when finished cleaning.

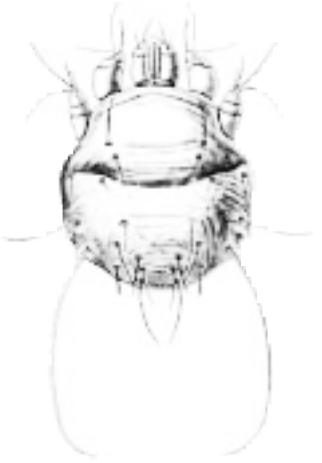

Figure 9.3 Sarcoptic mange mite general features.

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. These mites are too small to be seen with the naked eye. Figure 9.3 shows a sarcoptic mange mite to illustrate general features. Precise detection and identification of these mites usually must be done in consultation with a

veterinary dermatologist, parasitologist or entomologist. Veterinary manuals contain information on identification and detection.

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 and occasionally in dogs. One major species of notoedric mange mite parasitizes these animals, *Notoedres cati*. These mites cause feline scabies and head mange of cats. The mites burrow into the skin and exhibit a life cycle very similar to that of the sarcoptic mites. These mites primarily infest skin on the back of the neck, ears, face and paws, but may cover the whole body, especially in young animals. Detection and identification are done the same way with notoedric mites as with the sarcoptic mange mites.

Treatment for notoedric mange mites will require shampooing the animal with an insecticidal product for approximately four weeks at intervals described on the label. These mites die within a few days if they leave the host. This mange condition can be found in a few areas in the United States but overall it is a relatively rare disease.

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 mites' burrowing and feeding activity causes inflammation, disfiguring 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. A very similar species, called *Knemidokoptes pilae,* causes scaly leg in parakeets. Another very similar species, *Knemidokoptes jamaicensis,* infests canaries.

With all of these mites, life cycles and detection methods are similar to those of the other burrowing mange mites.

Non-burrowing Mange Mites

The non-burrowing mange mites do not form burrows in the skin. However, they do infest animal skin and cause mange. There are two important species of non-burrowing mange mites, but they are not typically pests of companion animals and so will not be discussed here and we will move on to other types of mite pests.

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. Two species of ear mites are important. *Otodectes cynotis* causes ear mange and lives in the ears of carnivores including dogs, cats and ferrets. *Psoroptes cuniculi* lives primarily in the ear canals of rabbits but also in horses, cattle, sheep and goats. It also causes ear mange.

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 turn in circles as a sign of disequilibrium or dizziness. The ears may exude pus. Sometimes, in cases with extreme infestation and secondary infection, the eardrum will rupture, allowing the middle and inner ear to become infected with bacteria.

Detection and identification of ear mites is accomplished by ear scrapings or sampling with an oil-soaked cotton swab and microscopic examination. Infested animals with sensitive ear canals may not tolerate the use of an otoscope (ear examination instrument) and may need to be restrained. Obtain veterinary assistance. With other animals, examination of the ear with an otoscope will reveal mites crawling about in the ear canal. In this case, 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 9.1).

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. Transmission of a mite population from bitch to nursing offspring by direct contact may occur during the first 2-3 days of life. 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.

Certain breeds of dog are more susceptible to generalized demodicosis (demodectic mange) condition. Breeds with predispositions include Old English sheepdog, collie, afghan, German shepard, akita, Staffordshire and pit bull terrier, Boston terrier, dachshund, chihuahua, boxer, pug, Chinese Shar-pei, beagle and pointers. All dogs with generalized demodicosis should be neutered after being successfully treated. This will reduce the continuation of hereditary predisposition.

In other animals, follicle mite infestation is usually asymptomatic (showing no symptoms). Cats and horses can exhibit mild demodectic mange. Feline demodicosis is rare, usually localized and a self-limiting condition. Burmese and Siamese breeds may be more susceptible to generalized (covering much of the body) feline demodicosis. Hamsters and laboratory rodents may also develop mange caused by hair follicle mites. Treatment is often difficult and should be accomplished with assistance from a veterinarian. Carbaryl shampoos and lime sulfur preps used according to label directions may be used to control mange mite problems.

Detection and identification of follicle mites can be done by trained persons by scraping skin deeply (as with burrowing mange mites), or by expressing pustules or abscesses and preparing slides for microscopic examination. There are no other mites that have the elongated appearance of follicle mites, shown below (Figure 9.4).

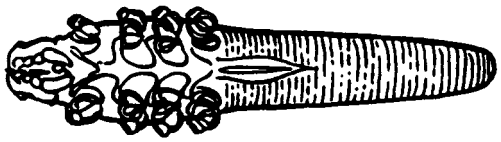

Figure 9.4 Hair follicle mite.

Other Mites: Fur Mites, Chicken and Fowl Mites, Chiggers, Oribatids and House Dust Mites

Several other kinds of mites bite or infest domesticated animals. Larvae of **chigger mites** normally parasitize wild rodents. Two species affect small animals. The North American chigger is bright orange-red in both the larval and adult stage. 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. Larval chiggers seek hosts by clinging to vegetation near ground level and waiting for an animal to pass by. Chiggers typically occur in low-lying, humid environments such as stream sides and marsh or lake edges.

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 animal out of contaminated areas to prevent reinfestation.

Three closely related mites called **fur mites** (all in the genus *Cheyletiella*) infest the skin of rabbits, dogs and cats. Younger animals, primarily kittens and puppies, are affected. These *Cheyletiella* mites cause itching, dermatitis (walking dandruff), weeping skin, mange and severe scaling, primarily along the dorsal midline, but may become generalized (covering much of the body) (see Table 9.1).

The mites suck lymph (body fluid). They spend their entire life cycle on the host but, unlike the burrowing and non-burrowing mange mites, they do not burrow into the skin or cause scab formation. Detection and identification can be accomplished by microscopic examination of skin scrapings and consultation with identification guides or qualified personnel. This mite is relatively easy to kill. Use lime-sulfur preps according to label directions, once weekly for 3 to 4 weeks. Dispose of bedding and thoroughly vacuum. It is usually a self-limiting problem in affected humans.

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.

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). This is not uncommon when the birds roost in the eaves of houses. Identification should be attempted with help from an entomologist or parasitologist.

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. They should not be dealt with strictly as arthropod pests suitable for control with miticides by a certified applicator, but rather should be referred to veterinarians for any necessary treatment.

Mites in the family Oribatidae (commonly called **oribatid mites**) are generally free-living and occur in soil. Though 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 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.

The final group of mites of veterinary importance are the **house dust mites.** These mites are not ectoparasites of companion animals (dogs or cats). The mites live indoors, in bedding and furniture and anywhere dust accumulates. They feed on dandruff and other organic materials in the dust. The cuticle, excrement and molted exoskeletons of the mites can cause allergies in companion animals and humans. Allergies to house dust mites are common and can be a significant dermatological problem for dogs. Use of miticides for control of these mites is not recommended. Instead, environmental sanitation for control is the best approach.

Veterinarians perform skin scraping and ear swabbing for mite detection where mange, fur or ear mites are suspected

Mites causing mange or infesting the fur or ears may initially be suspected if an animal's behavior or appearance changes from normal to abnormal. 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 scraping technique. Skin scrapings must be performed by a veterinarian.

As discussed in several sections above, skin scraping may be shallow (i.e., not draw blood) or deep (i.e., slightly draw blood) and will reveal non-burrowing, burrowing and hair follicle mites, depending on 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 to determine if the perceived problem is caused by mite infestation or something else.

CONTROL OF MITES ON ANIMALS OR IN ANIMAL ENVIRONMENTS

It should be obvious from the information above that there are many kinds of mites that affect the health of many kinds of domestic animals. Thus, the measures to control mite problems will vary with the species of mite and the host animal involved.

The first step in management of mite ectoparasites is to provide for good health, because it helps maintain the animal's resistance to mite infestations. Housing, nutrition and sanitary conditions should be at optimal levels. Animals held under crowded conditions, on poor diets and in unclean housing will be more likely to contract or harbor infestations of mites. Animals in poor health for other reasons are more susceptible to mite infestations and may be reservoirs of mites, causing infestations of healthy animals. Newly acquired animals should be examined for pests and, if necessary, treated to prevent contamination of animals already present.

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, will vary with the mite and the animal infested. Pesticides that are used to control mites or ticks are called **acaricides.** It should be noted that not all insecticides approved for lice (more than one louse) control are approved or effective for mange mite control.

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. Dogs can be affected by the scabies mite, *Sarcoptes scabei* 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 will also effectively kill fur mites.

Follicle mites are present in many dogs and usually cause limited problems. However, some

dogs develop severe infestations of follicle mites that require treatment. The infestations can be localized (in one area of the skin) or generalized (covering much of the body). Treatment consists of cleaning the affected areas with disinfectant scrubs and then applying approved acaricides under the direction of a veterinarian.

Ear mites in small animals. Ear mites in cats and other small animals (e.g., dogs and rabbits) can be detected by the methods described above. After detection, ears should be thoroughly cleaned to remove any waxy buildup. Then, applications of approved drugs or acaricides are given under the direction of a veterinarian.

TICKS

There are more than 800 species of ticks belonging to two families: the s**oft ticks** (family Argasidae, 160 species) and the **hard ticks** (family Ixodidae, 650 species). Ticks are close relatives of the 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 survival. They parasitize reptiles, birds and mammals. No ticks feed on plant juices or prey on other arthropods.

Ticks are of major worldwide veterinary importance for the following reasons:

- They cause blood loss.
- Their feeding causes inflammation and irritation of the skin.
- They may stimulate hypersensitive allergic reactions.
- They may cause a toxic reaction in the host, complicated by paralysis (called "tick paralysis").
- 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 black-legged, is a vector of Lyme disease.

Hard Ticks

Ticks are small arthropods, but all life stages can be seen with the naked eye. Figure 9.5 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 in identifying hard ticks. Some hard tick species have ridges or festoons. In female hard ticks, the scutum does not cover the body completely. In male hard ticks, the scutum covers the body. Ticks do not have antennae.

Figure 9.5 The American dog tick, an example of a hard tick

Soft Ticks

Soft ticks look very different from hard ticks. The hypostome of soft ticks does not project forward— it is tucked underneath the abdomen and 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 on 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 passes by the perch and brushes against it, 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 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 rather 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 on blood for food, they may survive away from a blood host for long periods. Some species of ticks can live for years away from 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 instead are free-ranging and come into contact with animal hosts only 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 lays only 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. Therefore, this is the most common tick life cycle. The larvae find a host and feed for days. They drop off the host after feeding and wait days to weeks for the blood meal to digest. They then 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 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 feed and may feed many times. The female ticks lay small batches of eggs after each blood feeding.

DETECTION AND IDENTIFICATION OF 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 fur 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. Unattached ticks can be recovered from host fur by combing and examining the comb.

Tick identification can be accomplished with the use of references and biological identification keys. Identification is important because certain tick species transmit agents that cause serious diseases; other ticks do not. Thus, correct tick identification can help animal health care professionals make decisions about the need for 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 consultation with experts, who can be contacted through local county Extension offices or health departments. Immature ticks, larvae and nymphs, are difficult to identify even with the aid of a microscope. An expert should be consulted to determine if a particular arthropod is an immature tick and, if so, what species.

IMPORTANT TICKS AFFECTING ANIMAL HEALTH

Many species of ticks affect animal health. Ticks may be encountered on companion animals, 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 9.2 lists several important tick species found in the United States, their distribution and common names, which domesticated animals the ticks commonly parasitize and the diseases they are associated with as vectors. Of these, the important ticks of the north central part of the United States are discussed in detail below.

The **American dog tick**, *Dermacentor variabilis* (Fig. 9.5), 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. As an adult it will commonly occur on dogs and wild canines, raccoons, opossums, cattle, horses and humans.

The American dog tick is a three-host tick. It is an important vector of the rickettsial microorganism 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 American dog tick can also transmit the rickettsial microorganism that causes canine ehrlichiosis. This is a disease of dogs once thought confined to Asia but now documented in areas of the United States.

The l**one star tick,** *Amblyomma americanum* (Figure 9.6), is a common and problematic tick of the south central and southeastern United States, but these ticks appear every year in north central

Table 9.2 Common ticks affecting animal health in the northcentral region of the United States

Tick Animals Parasitized	Tick Common Name	Scientific Name	Geographical Distribution	Disease Associations
Dogs, cats, cattle, horses	American dog tick	*Dermacentor variabilis*	Eastern U.S., California	Rocky Mountain Spotted Fever
Wide range of birds, mammals	Lone star tick	*Amblyomma americanum*	Southern states east of Texas	Rocky Mountain Spotted Fever
Rodents, dogs, cattle, horses, deer, cats	Black-legged tick	*Ixodes scapularis*	Upper midwest, eastern coast states	Lyme disease
Dogs, mainly	Brown dog tick	*Rhipicephalus sanguineus*	Worldwide, indoors	

states (probably brought up by northwardly migrating birds). The tick gets its name from the bright, lone star-like spot on the scutum of the female. 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 the larvae and nymphs) and mammals, including dogs, cattle, horses, sheep and humans.

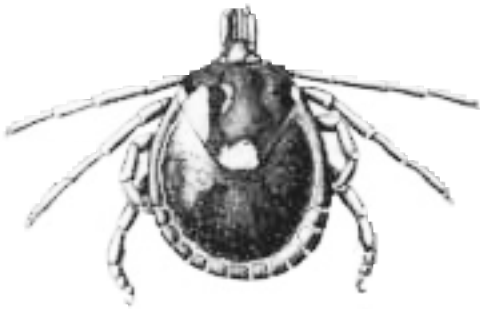

Figure 9.6 The lone star tick is a common and problematic tick of the south central and southeastern United States. These ticks appear every year in north central states (probably brought up by northwardly migrating birds).

The black-legged tick, *Ixodes scapularis* (Figure 9.7), 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.

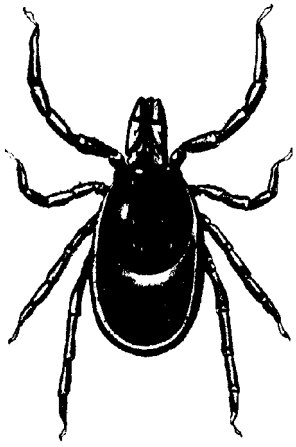

Figure 9.7 Black-legged tick.

Ixodes scapularis is the vector in the eastern United States of *Borrelia burgdorferi*, the bacterium that causes Lyme disease. Lyme disease is a chronic, debilitating disease that may 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 indeed can become infected following a tick bite.

The brown dog tick, *Rhipicephalus sanguineus* (Figure 9.8), is a three-host tick that generally occurs in indoor, doghouse, or kennel situations. The brown dog tick does not occur outside. Though it mainly is an ectoparasite of dogs, it also will parasitize wild animals, zoo animals and, rarely, humans. In northern temperate climates, this tick is exclusively an indoor tick. In some parts of the world, brown dog ticks are vectors of some pathogens of dogs, including Rocky Mountain spotted fever. These ticks also are vectors of the causative agent of canine babesiosis (or malignant jaundice), a malaria-like infection.

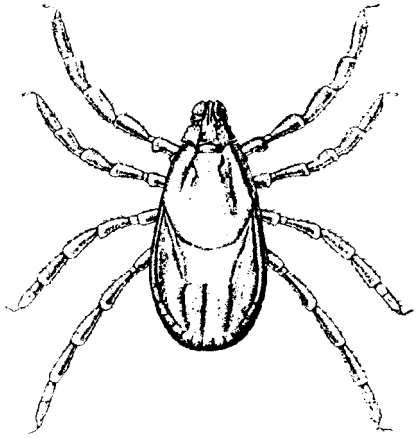

Figure 9.8 Brown dog tick.

MANAGEMENT OF TICKS ON ANIMALS

Management of ticks affecting companion animals varies with the species of tick and the kind of animal that needs protection. When only a single tick, or a few ticks are on an animal, simply remove them using tweezers or fingers. If you use your fingers, be sure to wear protective gloves or a use barrier such as a tissue. Be sure not to squeeze the tick—you could cause any disease organism in the tick to go into the animal. Grasp the tick as close to the skin as possible and pull firmly away until it detaches. Ticks should not be removed by burning or using materials such as kerosene or diesel fuel. Heavily infested animals should be dipped, dusted or shampooed with an acaricide and then combed thoroughly to remove the ticks. Be careful with cats—they are very sensitive to pesticide toxicity.

Tick attachment to dogs and cats can sometimes be prevented with the use of acaricide- or insecticide-impregnated collars. These collars may not be entirely effective, especially when the animals

are large and have a heavy coat. Some animals react negatively to these collars. Observe their behavior closely and remove the collar if they become lethargic or nauseous, or if they act abnormal or sick in any way.

The brown dog tick can be an important indoor or kennel pest of dogs. For this tick, treatment of the indoor environment should be coupled with on-animal tick control. Brown dog ticks live away from the animal in cracks and other hiding places. Approved acaricides should be directed into these areas with dusters or sprayers. Foggers and aerosols can also be used to deliver acaricides to indoor environments. They must also be directed into the tick's hiding places.

Chapter 9 – Review Questions

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

1. What two features generally distinguish mites and ticks from insects?

2. What four ways do mites affect the health of animals?

3. What is one of the most common problems that mites cause in animals? Please describe it.

4. Describe the generalized life cycle of mites.

5. How long does the entire life cycle of a mite take?

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. Notoedric mange mites are similar to the sarcoptic mange mites in biology, pathology, detection and identification, except that they are smaller. What host animals do they infest?

10. How can you detect and identify non-burrowing mange mites?

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. Please describe them.

14. What are the skin conditions caused by follicle mites called?

15. Both endo- and ectoparasitic types of mites occur. True or False?

16. Allergies to house dust mites are not common and are not a significant dermatological problem for dogs. True or False?

17. Describe why ticks are of major worldwide veterinary importance.

18. 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?

19. Ticks can be detected on animals by direct examination without use of a hand lens or microscope. True or False?

20. If an animal has ticks, what are the control options?