

has been observed only in imported dogs and as a consequence no preventive measures are possible. In areas where the disease is commonly encountered, however, control measures are directed against sandflies, which transmit the parasites. Although phenamidine has been used in the treatment of leishmaniasis, relapses are common and specific medication is generally unsatisfactory.

The only trematode that concerns dog owners in this country is limited in its distribution to the Pacific Northwest. This parasite is responsible for the transmission of rickettsialike organisms that cause "salmon poisoning" of dogs and related carnivores, but it does not produce symptoms of disease by itself. Treatment of salmon poisoning, therefore, is directed against the rickettsia rather than the flukes, for which there is no effective treatment.

The drugs that have been most effective in the treatment of salmon poison-

ing in dogs are sulfamerazine, sulfamethazine, chlortetracycline, penicillin, and chloramphenicol. The prevention of infection with this particular fluke consists in preventing dogs from eating salmon or trout that contain the infective stages of the parasite.

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External Parasites of Dogs and Cats

CARROLL N. SMITH AND F. D. ENZIE

ALMOST everyone who keeps dogs or cats is concerned at some time with their external parasites. Among them are several kinds of mange mites, ticks, fleas, and lice. Fleas are the most annoying. Mange mites and ticks also are common and can quickly reduce an animal to a condition of misery or death. Lice are less common on dogs and cats in the United States.

Mange is an unsightly and painful skin condition caused by the burrowing or feeding of mites, several species of which attack dogs and cats. The mites are related to ticks and spiders. Many are microscopic in size, and the others are barely visible. The condition

is contagious and is spread by contact with infested animals.

Sarcoptic mange of dogs is related to the human infection called scabies and is caused by the mite *Sarcoptes scabiei canis*. The female mite burrows into the upper layers of the skin, where she lays 20 to 40 eggs. The eggs hatch after 3 to 7 days and produce larvae, which are tiny mites with three pairs of legs. The larvae grow to nymphs by molting—shedding the skin—and the nymphs grow to adults in the same way. The nymphs and adults have four pairs of legs, but the nymphs are sexually immature. The entire life cycle requires 2 to 3 weeks. The larvae,

nymphs, and males do not burrow into the skin, but live under crusts or scales on the surface.

Sarcoptic mange may occur on any part of the body, but usually it appears first on the head. It spreads rapidly. Red spots appear and develop into small blisters. The scratching of the animal causes the reddish area to spread.

The burrowing of the female causes the skin to exude serum, which dries in crusts or scabs. The infected part of the skin becomes dry and covered with crusts, the hair may come out, and the skin may thicken and become wrinkled.

Itching is intense. The scratching may give rise to secondary bacterial infections and sores. Bacterial action in the scabs and sores causes an unpleasant odor. If the infection is not checked, digestion and other body functions become impaired, and death may result.

This species of mite can live for a time on people. Unnecessary handling of infected dogs should be avoided.

A related mite, *Notoedres cati*, causes a severe type of mange in cats, which usually starts about the head, forming crusts, until the skin becomes hard, thickened, and creased.

Demodectic, or red, mange of dogs is caused by a long, wormlike mite, *Demodex canis*, which lives principally in the hair follicles of the skin. It has been found also in certain lymph glands and in the liver, spleen, lungs, and other internal organs. The mites are found in typical cases in great numbers in association with bacteria, which cause the most unpleasant symptoms of the infection.

The first evidence of demodectic mange is usually the appearance of bald areas, from which the hair has been lost. Itching becomes pronounced as the spots spread, and the area becomes reddened. After invasion by the bacteria, the infection becomes pustular, the skin becomes thicker, poisons formed by the bacteria affect the general health of the animal, and a dis-

agreeable odor is produced. The infection may last for several years. It usually causes death if it is unchecked.

Ear mange of dogs and cats is caused by the mite *Otodectes cynotis*. The mites do not burrow in the skin but live deep in the ear canal, near the eardrum, and feed through the delicate skin. Irritation results. The ear canal becomes congested. The dog scratches and rubs its ears and shakes its head in an attempt to relieve the itching, or it may run in circles or show other evidence of nervous disturbance.

Mange may be confused with other skin conditions. It can be diagnosed positively only by a microscopic examination of scrapings from the diseased parts.

PREVENTION OF MANGE in dogs and cats is largely a matter of good care and management. A well-balanced, nutritious diet; clean, dry, comfortable quarters; protection from the debilitating effects of internal parasites; and regular, thorough grooming all promote good health and tend to increase resistance to skin diseases of all kinds.

Above all, however, the dog or cat should not be permitted to mingle with many animals or to frequent premises occupied by them, since they are the main sources of infection.

Rational treatment is contingent upon a prompt, accurate diagnosis, because the various types of mange differ in their response to remedial measures. Improper treatment is costly and may cause injury to the patient or permit the condition to reach an incurable state.

Ear mange will generally respond promptly to one or two weekly applications of olive oil containing 1 percent of rotenone or 0.25 percent of lindane. The materials may be applied with cotton swabs or put into the ear canal with a medicine dropper. Accumulations of foreign matter should be carefully removed from the ear canal before treatment. That can be done more easily if the accumulations are soaked first with the medicated oil.

Demodectic mange is difficult to treat. The results often are disappointing. The response to specific medication varies among individual animals and seems to be influenced by the patient's general condition. In addition to the use of chemical agents for the destruction of the mites, therefore, every effort should be made to build up the general health of the animal by improving the diet and combating secondary bacterial infections.

Several chemical agents are available for use against the mites, but none appears to be uniformly effective. Alternative treatments therefore should be tried when little or no improvement is noted after a reasonable period of medication. Among the preparations that have proved most satisfactory are 1 percent of rotenone in vegetable oil; a 25- to 33-percent benzyl benzoate emulsion; 0.15-percent aqueous lindane suspension; 2- to 5-percent tetraethylthiuram monosulfide; and a 0.25-percent chlordane emulsion.

Most of these agents are applied once or twice weekly, as necessary.

The finding of demodectic mites in lymph glands, liver tissue, and other internal organs has suggested the possible need for internal medication to supplement the application of remedial agents to the skin.

Sarcoptic mange may be treated effectively with any of the remedies suggested for demodectic mange. The treatment of sarcoptic mange, however, is less tedious; the disease often responds to a single application of the chlorinated insecticides, such as lindane and chlordane.

Similar response may be had with some of these materials in head mange of cats, although extreme caution must be exercised in the treatment of cats because of their marked sensitivity to most drugs. It is, in fact, advisable in all cases of mange to entrust treatment to a veterinarian.

Ticks of several species may infest dogs, but cats are rarely infested.

Many of the dog ticks are also known

as wood ticks and infest dogs when they run through woods or fields. The brown dog tick is a truly domestic species that feeds almost exclusively on dogs.

The brown dog tick, *Rhipicephalus sanguineus*, is particularly troublesome because it is adapted to life in the relatively dry environments of kennels, heated houses, and apartments. Dogs pick up ticks in infested premises and in turn infest their own living quarters. Yards as well as houses in the southern States may be infested. The ticks may survive the winter outdoors in the extreme South. The brown dog tick is the principle vector in this country of canine piroplasmiasis, a protozoan infection encountered most frequently in Florida and adjacent States.

The adult ticks are about one-eighth inch long when unfed, flat, and reddish brown. Both sexes feed on dogs. Mating takes place on dogs. The males remain about the same size.

The females become engorged with blood, reach a length of about one-half inch, and turn dark gray. After engorging, which takes about 6 days, the females drop from the dog and seek a hiding place. They usually hide in cracks in the woodwork, under rugs, or behind pictures, mirrors, or draperies. They lay 1,000 to 3,000 eggs, which hatch after 3 to 8 weeks into tiny, six-legged larvae, or seed ticks.

The larvae are light brown and about one-fiftieth inch long when unfed. They feed on dogs and become about one-twentieth inch long and slate gray. Feeding requires 3 to 6 days, after which they drop and hide like the females. They molt after 1 to 3 weeks and become eight-legged nymphs, about one-twentieth inch long and flat and brown. The nymphs feed on dogs becoming about one-eighth inch long and slate gray. They drop, hide, and molt to the eight-legged, sexually mature males and females. Engorgement requires 4 to 9 days and molting about 12 to 29 days.

Ticks crawl about the walls, floors, and furniture in heavily infested houses

in search of a host. They very rarely bite people. Their mere presence is annoying. Heavy, continuous infestations on dogs cause irritation and loss of condition. Pulling the ticks off leaves open wounds, which may become infected.

The other ticks that infest dogs also infest other animals. They live outdoors and will not live long in dry, unheated buildings. They pass through the same stages—egg, larva, nymph, and adult—but all stages do not always have the same host.

The American dog tick, *Dermacentor variabilis*, is the most widely distributed species. It is most abundant along the Atlantic and gulf coasts, in the Mississippi Valley, and along the Pacific coast as far north as Oregon. Scattered infestations occur in most other parts of the country, except in the Rocky Mountain region and in the Pacific Northwest.

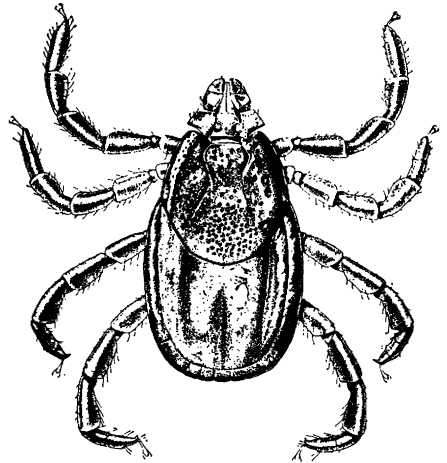
A closely related species, the Rocky Mountain spotted fever tick, *D. andersoni*, occurs in the Rocky Mountain region. Another, the Pacific coast tick, *D. occidentalis*, occurs in California and southern Oregon.

The gulf coast tick, *Amblyomma maculatum*, occurs along the gulf and Atlantic coasts as far north as South Carolina. The lone star tick, *A. americanum*, occurs from New Jersey west to Iowa and south to Florida and Texas.

Adults of all the foregoing species are reddish or dark brown and marked conspicuously with one or more patches of white.

The black-legged tick, *Ixodes scapularis*, occurs along the Atlantic and gulf coasts from Massachusetts to Texas and in the lower Mississippi Valley. A closely related species, *I. pacificus*, occurs along the entire Pacific coast of the United States. These species possess a smoky-black shield. The body of the females behind the shield is yellow or light brown.

All stages of the lone star tick and adults of the other species feed on dogs and other carnivorous or hoofed ani-



The adult female of the brown dog tick, a parasite of dogs and cats. (Magnified about 13 times.)

mals. Larvae and nymphs of the two *Dermacentors* feed on rodents, those of the two *Amblyommas* on rodents or birds, and those of the *Ixodes* on rodents, birds, or lizards.

The American dog tick, Rocky Mountain spotted fever tick, and lone star tick may carry Rocky Mountain spotted fever, tularemia, or other less common diseases from animals to people.

Dogs do not show the clinical symptoms of those diseases, but persons may become infected by picking infected ticks from dogs, particularly if the ticks are crushed.

The distribution of Rocky Mountain spotted fever is sporadic; some suburban or rural communities have a number of cases each year, others only an occasional one or none. Children playing in the woods or overgrown fields, or adults working there, may be bitten by infected ticks which, if not removed within a few hours, may transmit the disease. People living in neighborhoods where wood ticks occur should inspect themselves and their children once or twice each day for attached ticks. The scalp should be examined especially carefully. Any ticks found should be removed imme-

diately. They should be grasped as near the skin as possible with forceps, or the fingers, and removed with a firm, even pull. The bite should be disinfected in the same manner as a small cut. In localities where Rocky Mountain spotted fever is prevalent, a protective inoculation may be desirable, and any fever of uncertain origin should be treated immediately by a physician.

The American dog tick and the Rocky Mountain spotted fever tick may also cause paralysis of dogs or children if the females attach and engorge at the base of the skull or along the spinal column. The paralysis usually begins in the hindquarters and moves toward the front of the body. It is caused by a toxic secretion produced by the ticks while feeding. Recovery is rapid as soon as the ticks are removed, but if they are not removed, death may follow.

CONTROL OF TICKS may require the treatment of the dogs and the infested area as well.

Dogs may be freed of ticks by washing or dusting them with insecticidal preparations containing rotenone (the active principle of ground derris root), DDT, or lindane. Washes or dips are usually more effective than dusts, as they are better able to penetrate the hair and reach all the ticks.

Derris root should contain at least 3 percent of rotenone and should be applied at full strength as a dust or at the rate of 2 ounces per gallon of soapy water as a wash. Commercial formulations of extracted rotenone also are available.

DDT should be used at a concentration of 10 percent in a dust or 1 percent in a wash. The wash is best made by adding 2 ounces of a 50-percent DDT wettable powder to 3 quarts of water. Lindane is used as a 1-percent dust or 0.05-percent wash, using, in this instance, one-fourth ounce of a 25-percent wettable powder to 3 quarts of water.

The treatments should be repeated

every 3 or 4 days if dogs are constantly exposed to reinfestation.

Infestations of brown dog ticks in houses may be eradicated by thorough use of one of the common household sprays that contain 5 percent of DDT, 2 percent of chlordane, or 0.5 percent of dieldrin in deodorized kerosene. The spray should be applied as a wet spray to the woodwork, edges of carpets, behind pictures and draperies, and other possible hiding places of the ticks in all the rooms to which the infested dogs have had access. This will kill the ticks that are active at the time it is applied and will leave a residual deposit that will kill ticks that come out of hiding later. As the residual deposit kills slowly, active ticks that have emerged and are not yet dead may be found in steadily declining numbers for several weeks after treatment. If active ticks persist for more than 3 weeks, a second treatment should be applied.

The outdoor areas infested by wood ticks are often too extensive for practical control measures to be applied. However, it is sometimes desirable to eliminate lone star ticks, American dog ticks, or black-legged ticks from limited areas. That can be done by applying dusts containing 10 percent of DDT or 5 to 10 percent of toxaphene, chlordane, or dieldrin at the rate of 20 to 40 pounds to the acre. These insecticides may also be applied as sprays at the rate of 1 to 2 pounds of actual insecticide per acre. Lindane may be applied as a dust or spray at 0.1 to 0.2 pound of actual insecticide per acre.

FLEAS of four species commonly infest dogs and cats—the dog flea, *Ctenocephalides canis*; the cat flea, *C. felis*; the human flea, *Pulex irritans*; and the sticktight flea, *Echidnophaga gallinacea*.

The first three are quite active and run through the hair when disturbed. The sticktight flea attaches permanently on the less hairy parts, such as the regions around the eyes and ears.

Otherwise the habits of all four species are similar. Cat and dog fleas frequently infest houses in the Eastern States, as does the human flea in the West.

All fleas pass through four stages—the egg, the larva, the pupa, and the adult. The eggs are laid while the female is on the host, and they drop to the ground, where they hatch in a few days into wormlike larvae.

The larvae are not parasites, but live on organic matter in the dust or soil. The dust in habitual sleeping or resting places of heavily infested animals contains dried blood that was passed in the feces of the adult fleas, which makes an especially favorable food for the larvae.

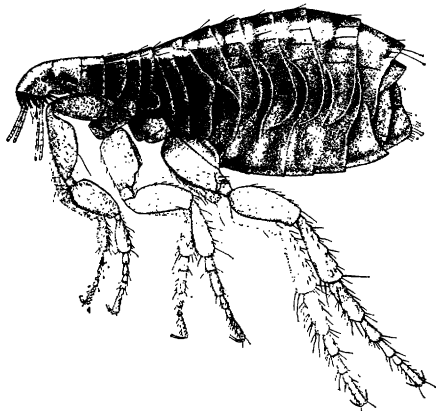
In about 2 weeks the larva becomes full grown and spins a tiny cocoon, in which it transforms to the pupa. The pupa changes to an adult flea after a week or more, but the adult may not emerge for some time unless it is disturbed, as by the presence of a host.

Fleas often breed in tremendous numbers in rooms or buildings where dogs or cats are kept. The larvae proceed with their development even when the hosts are taken away, and the resulting adults may continue to appear for several weeks. If no cats or dogs are present, the fleas become particularly noticeable and annoying to people.

Dogs and cats can be freed of fleas by dusting with derris or cube powder, or commercial products containing 0.5 to 1 percent of rotenone. Since most fleas move about over the animal, it is usually satisfactory to treat only the back, neck, and head.

To kill sticktight fleas, it is necessary to apply the powder directly on the fleas. Rotenone is slow in action, and the fleas will not die for several hours. Furthermore, the residual effectiveness of the powder is not great, and animals that are constantly exposed to reinfestation require treatment every 3 days to 2 weeks.

Pyrethrum powders may also be used to free dogs and cats of fleas. If



The female of the cat flea, a parasite of dogs and cats. (Magnified about 20 times.)

pyrethrum is the only agent present, the powders should contain at least 0.9 percent of pyrethrins, the active insecticidal principle of pyrethrum. Commercial preparations may contain an activator, such as piperonyl butoxide or sulfoxide, with which the content of pyrethrins can be greatly reduced. Pyrethrins cause a quick knockdown, but sometimes, especially with unactivated pyrethrins, the fleas may recover later unless they are collected on a paper and burned.

Neither pyrethrins nor rotenone is considered hazardous to dogs or cats, although cats may be temporarily upset by licking it from their fur.

Powders containing 10 percent of DDT or methoxychlor, or 1 percent of lindane, or 4 percent of malathion will also rid animals of fleas, and are safe for use on dogs. They have also been used satisfactorily on cats, but are not recommended for this use, because the cats may lick off enough of these insecticides to be harmful.

To control infestations of fleas in houses, spray the floors and lower portions of the walls with a commercial household spray containing 5 percent of DDT, 2 percent of chlordane, or 0.5 percent of dieldrin or synergized pyrethrum household spray. Be sure the beds of dogs or cats are cleaned frequently.

To control infestations in yards or under houses, dust or spray with a suspension of wettable powders of the same insecticides or lindane. Where these materials do not provide satisfactory control, malathion dust or spray is recommended.

THREE SPECIES OF LICE may be found on dogs and one on cats, but they are not common in the United States.

The sucking louse of dogs, *Linognathus piliferus*, is a bloodsucking species. It also infests some wild carnivorous animals. The biting louse of dogs, *Trichodectes canis*, has chewing mouth parts and feeds on dead epidermal tissue or secretions from the skin.

A second chewing species, *Heterodoxus longitarsus*, is normally parasitic on kangaroos, but has become established on dogs in several localities in North America.

The cat louse is also a chewing species, *Felicola subrostrata*.

The sucking lice and biting lice are quite different in structure and feeding habits, but their life histories are similar. All pass through the egg stage, several nymphal stages, and the adult. The eggs are fastened to the hair of the host. The nymphs are similar to the adults in appearance except for

size and lack of sexual organs. The entire life cycle may be completed in a few weeks, and is passed entirely on the host, other animals becoming infested by direct contact.

Lice on dogs may be controlled by the thorough application of dusting powders containing 10 percent of DDT or methoxychlor or 1 percent of lindane, and by washes containing 1 percent of DDT or methoxychlor as a wettable powder. DDT is not always fully effective in the control of sucking lice on dogs, however.

Commercial preparations containing pyrethrins or allethrin plus an activator may also be used on dogs, and should be used in preference to the other insecticides on cats, as they may lick off enough DDT or lindane to be harmful.

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Infectious Diseases of Dogs and Cats

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DISTEMPER in dogs, like influenza of the human family, is an acute, infective disease caused by a filterable virus usually complicated by many bacterial secondary invaders.

Distemper occurs throughout the world—even in Iceland and Greenland.

Few unimmunized dogs reach 1 year

without having contracted distemper. It is most common at about 7 months of age, less common after 2 years, and practically unknown in suckling pups. Unconfirmed diagnoses have been reported in dogs as old as 9 years.

A young dog usually begins to show the first symptoms about 5 days after it is exposed to the disease. The eyes be-