

Chemical and Nonchemical Management of **FLEAS**



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The cat flea, *Ctenocephalides felis* (Figure 1), is the most common flea found on cats and dogs in Tennessee. These fleas are about 1/16 inch long and are reddish-brown in color. Fleas have bodies flattened from the sides with backward projecting spines so they can easily walk through animal hair. Parts of the legs are enlarged for jumping, which allows an adult flea to jump almost 200 times its height.

Most of us are well aware of the flea and the itch produced by its bite. Not only are flea bites irritating, but fleas can also transmit several disease-causing organisms to humans. The organisms that cause plague and flea-borne typhus are transmitted to humans by fleas that have fed on infected rodents, such as rats. Fortunately, these two diseases are seldom encountered in Tennessee. Cat fleas, however, are a medical concern because they are able to transmit dog tapeworm, *Dipylidium caninum*. The flea larvae ingest the tapeworm eggs which were dropped from the dog's anus by the adult tapeworm. Cats and dogs can also be infected if they groom and consume an adult flea infected with tapeworms. Humans can be infected as well if they accidentally consume an infected adult flea.

Fleas are obligate ectoparasites, meaning they must stay on or close to a host to survive. Fleas will not stray far from host resting areas. Cat flea hosts include cats, dogs, opossums, raccoons, skunks, foxes, and occasionally rats and other urban animals. Although adult fleas prefer to feed on dogs, cats or other small animals, they will attack humans when pets are not available. Cat fleas do not develop very well on human blood and a population will soon die out if no preferred hosts are present.

Life Cycle

Like butterflies, fleas have an egg, larval, pupal and adult stage (Figure 1). Flea eggs, which are white, oval and 1/50 inch long, are laid on the pet, but soon roll off because the eggs lack any spines or stickiness that would hold them to the pet's hair. This explains why most fleas are found where the pet rests.

Adult flea feces, which contain partially digested blood, also drop off the pet. This partially digested fecal blood is seen as dark specks when a flea-infested cat is combed. After hatching from eggs, flea larvae feed on the partially digested blood and other organic matter found in a house or yard. Larvae are usually hidden deep in carpet fibers, under furniture cushions and in other protected spots.

The small, white, worm-like larvae complete development and spin a pupal cocoon. Materials such as carpet fibers or grains of soil, which are present in the larval environment, are incorporated into the cocoon.

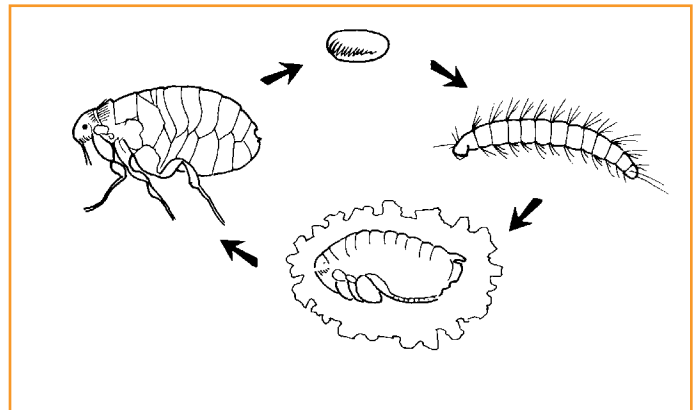


Figure 1. Life cycle of the cat flea.

This camouflages the pupa and protects it from predators. Larvae are the most susceptible stage to drying. The cocoon is highly resistant to drying out as well as to insecticide penetration. Development continues inside the cocoon where the pre-emergent adult waits for a stimulus which causes it to emerge. Such stimuli can include pressure, vibration or heat, indicating the presence of a host. Preemergent adults can persist in the cocoon for up to 20 weeks. Estimates of development time from egg to adult are given in Table 1.

The male and the female feed and mate on the host. The sucking mouthparts of an adult are formed by three stylets that probe the skin for a small blood vessel. The tip of the tube enters the blood vessel cavity while the other two stylets intermittently inject saliva. Adults

Temperature in Fahrenheit	Development time	Range in development time
89.6	17 days	12-22 days
80.6	24 days	16-50 days
69.8	40 days	26-140 days

Table 1. Time at each temperature for 50 percent of a cat flea population to go from egg to adult at 75 percent relative humidity.

live from four to 25 or more days during which time a female may lay from 158 to 420 or more eggs.

The goals of flea management programs are to rid the pet and premises of fleas and to prevent future infestations.

Nonchemical Control

Vacuuming areas frequented by pets will provide many benefits to those stricken with fleas. Vacuuming these areas can remove about 60 percent of the flea eggs and 27 percent of the larvae. The worm-like larvae wrap around carpet fibers to prevent being removed by the vacuum. Vacuuming also removes organic matter and fecal blood the larvae need for food in order to mature. Stimulus provided by the vacuum causes the adults to emerge from their cocoons. If not collected with the vacuum, the newly emerged adults, which were protected in the cocoon, will now be exposed to insecticide applications. It is important to dispose of the vacuum cleaner bag immediately after use in an outside garbage can with a tightfitting lid. Lastly, vacuuming will straighten the carpet fibers so that if an insecticide is applied it will penetrate to the carpet base where the larvae are found. Steam cleaning will kill most of the fleas, including those in cocoons, as well as remove larval food.

Pets can be bathed in a mild detergent or shampoo. Fleas will drown in the bath water. Any fleas that survive may die later due to the disruption of their waxy layer caused by the detergents.

Adult fleas can be removed from a pet with a flea comb. If the comb is quickly dipped in soapy water,

the flea will drown. Combing cats is especially helpful because they do not tolerate baths well.

Concentrating control efforts, such as limiting a pet's access to carpeted areas and confining pets to one resting area, are other ways to reduce flea infestations indoors.

Landscaping practices can affect outdoor flea populations. Mow grass, keep weeds down and trim shrubs near animal resting sites to expose flea eggs and larvae to sunlight, which causes them to dry out and die. Irrigating areas surrounding buildings, but not directly against a building, may kill fleas by drowning.

Exclude wildlife, such as opossums, skunks and raccoons, from the area as they may serve as a source of cat fleas. Seal crawl spaces to keep animals from making a nest or den under the house. This is usually the source of fleas for folks who don't have pets. Remove the urban or feral animals' access to pet food by training pets to eat their food in 10 minutes. Never leave pet food outdoors overnight. Talk to neighbors about treating their pets that have access to or live near your yard.

Chemical Control

Insecticides used for flea control can be grouped into two types: insect growth regulators and adulticides.

Insect growth regulators (IGRs) prevent immature stages from completing development to the adult stage

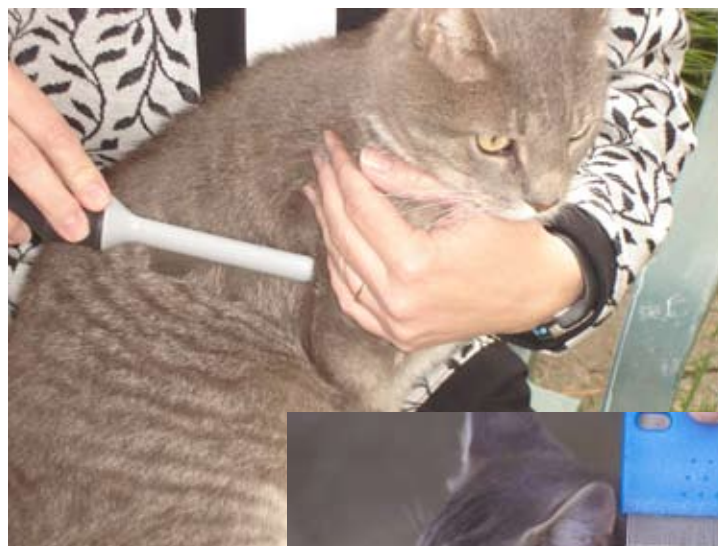


Figure 2. Combing a cat with a flea comb requires daily diligence to rid the pet of fleas.



and prevent the female from laying “healthy” eggs. IGRs, therefore, are important because they break the life cycle of the flea. They will not, however, shorten the life span of the adult flea. IGRs are chemicals that either mimic the hormones that occur in insects or prevent the formation of chitin used in the insects’ outer shell. Some IGRs can be applied to animals or to the pets’ resting places.

Adulticides or contact insecticides are substances that kill the adult fleas. If immature stages are contacted by the adulticide, they may also be killed. Adulticides can be applied to pets or to their resting areas, as specified by the label. Often formulations are made that combine an adulticide and an IGR. Such a combination may be the most efficient formulation to use.

Steps for a Chemical Flea Control Program

The following measures should be performed on the same day to maximize flea control success: (1) treat the pets, (2) vacuum areas visited by pets, (3) exclude other hosts and modify the environment, (4) treat indoors and (5) treat outdoors.

1. Treat the pet

Adult fleas spend most of their lives on the animal — not in the carpet. Untreated pets will continue to be bothered by fleas. They may also bring fleas in from outdoors, eventually overcoming the effectiveness of the insecticide used inside the home.

In the past, ridding a home of fleas required multiple insecticide applications of adulticides and IGRs to the premises and use of sprays dips, dusts or baths to the pet. Now the emphasis is on pet treatments with “long-lasting” IGRs or adulticides that can be fed to or applied to the pet. One researcher referred to this method as a “living flea vacuum.”

Pets can be treated either by a veterinarian or the pet owner. A variety of formulations for pets are available from veterinarians. Cats and some breeds of dogs may be sensitive to insecticides, and some insecticides are not recommended for use on kittens and puppies. Always carefully check the insecticide label before using any product to ensure the product is recommended for safe use on your pet. It is also a good idea to check with a veterinarian before deciding on a pet treatment.

IGRs can be thought of as preventive care because they will not kill the adult flea. Lufenuron, an IGR that is circulated through the pet’s blood, is given in a monthly flavored tablet /feed additive. Lufenuron is also available in an injectable form for cats and in a combination tablet with milbemycin oxima (Senti-

nel®) for control of fleas and other parasites of dogs. When adult fleas feed on the treated blood, subsequent generations are unable to develop properly.

Methoprene, another IGR, can be applied topically to a pet and is usually formulated with an adulticide. The IGR Pyriproxyfen is available as an on-animal spray or as a spot-on for dogs and is usually formulated with adulticides. Pyriproxyfen may be referred to as Nylar®, Biolar™, or (2-[1-Methyl-2-(4-phenoxyphenoxy)ethoxy]pyridine).

Products containing adulticides, such as imidacloprid (Advantage™), fipronil (Frontline®), or selamectin (Revolution®), are available from veterinarians to kill adult fleas on pets. These are applied to the pet between the shoulder blades as a spot-on. Combination spot-ons in which an adulticide is combined with an IGR (Frontline Plus) or another adulticide for other arthropods are becoming more common. Veterinarians also have access to adulticides that are administered orally.

Pyrethrum and pyrethroids may not work as well as the newer chemistry because of the potential of insecticide resistance.

In general the older formulations such as shampoos and dips are usually less expensive than the newer formulations such as spot-ons or pills, but they usually don’t work as well, have to be applied more often and may be difficult to apply to the pet. Collars with just adulticides often don’t work very well. Check label precautions or consult a veterinarian before using a product on your pet!

2. Vacuum flea-infested areas of the home to

- remove eggs and larvae,
- remove fecal blood and other organic matter that serves as larval food,
- stimulate adults to emerge from insecticide-resistant cocoons, and
- straighten carpet fibers to allow pesticides to penetrate to the carpet base where larvae are found.

3. Exclude other hosts and modify the environment. This is explained under nonchemical control.

4. Treat indoors, if necessary.

In most cases, insecticide applications to the indoor environment would be needed only if severe infestations caused pets or owners to suffer from flea bites and allergic dermatitis. If treating the pet does not solve the flea problem, then treating the premises may be necessary.

Besides vacuuming, the pet owner should do the following before treating:

- Allow access to all breeding sites by removing all toys, clothing and stored items from floors, under beds and inside closets.
- Cover fish tanks, and disconnect their air pumps.
- Remove pet food and water dishes.
- Pet bedding should be washed, dry cleaned or destroyed.

Only the person performing the application should be present during treatment. People and pets should not contact treated surfaces until the spray has dried. Drying may take several hours, depending on carpet type, ventilation and method of application. Opening windows and running the fan or air conditioner after treatment will enhance drying and minimize odor.

One way to determine whether the sprayed areas are dry is to use the paper towel test. After the estimated drying period, reenter the house and place a clean paper towel on the treated surface, such as on the carpet. With your shoes still on, step on the paper towel. If the towel remains dry, it is safe to reenter. If the towel is wet, wait a few more hours and repeat the paper towel test. (Creig Manson [Ciba-Geigy-Sandoz] in Oi 1996).

Thoroughly treat all areas likely for flea development, such as carpets, throw rugs, under and behind beds and furniture, and beneath cushions on which the pet rests. Areas where the pet spends the most time or sleeps are where most flea eggs, larvae and pupae will be concentrated. Hardwood and tile floors usually do not require an insecticide treatment but should be thoroughly vacuumed or mopped.

In addition to sprays, boric acid products labeled for flea control can also be worked into the carpet. The larvae are killed by ingesting the boric acid as they feed. Adult fleas are not affected by boric acid because they feed on blood. Treat a small area first to determine whether the product will stain the carpet. Do not use these boric acid products outdoors.

Pet owners may see some fleas for two weeks or more following treatment. If all infested areas were treated initially, these fleas are probably newly-emerged adults that have not yet died from the insecticide. Vacuuming is recommended in this case rather than applying additional insecticide. If adult fleas are seen beyond two to four weeks, retreatment of the premises (and pet), if allowed by label, may be necessary.

5. Treat outdoors.

Most flea problems in Tennessee can be eliminated by treating the pet and the interior of the home.

In cases where the pet spends a majority of its time outdoors, it may also be necessary to treat outdoors. One way to determine whether the yard is infested is to walk around the property wearing white socks, pulled to the knee. If fleas are present, they can be seen against the white background of the socks.

Outdoor flea treatment should focus on areas where the pet rests, sleeps and runs, such as a dog-house and kennel area, under decks, along fences, and next to the foundation. It is seldom necessary to treat the entire yard or open areas exposed to full sun because flea eggs and larvae will dry out and die when exposed to sunlight.

Fleas should be successfully controlled using the techniques described above. Initiate a flea control program no later than April and vacuum infested areas twice a week. Homeowners who lack the time to control fleas themselves or who are uncomfortable applying insecticides may wish to enlist the services of a professional pest management firm.

For specific pesticides to be used for indoor and outdoor flea management, see the UT Extension PB1690 Insect and Plant Disease Control Manual at <http://eppserver.ag.utk.edu/redbook/sections/structural.htm>.

Ineffective treatments?

- Flea traps are effective in detecting the presence of fleas and may provide some control (Oi 1996).
- Ultrasonic devices were ineffective in managing flea populations (Hinkle et al. 1990).
- Leaves of southern bayberry, *Myrica cerifera*, have not been found to be repellent to cat fleas (W.H. Kern and R.S. Patterson unpublished data).
- Fresh bayberry, pennyroyal, eucalyptus, rosemary or citronella have not been documented to effectively control fleas (Oi 1996).

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Precautionary Statement

To protect people and the environment, pesticides should be used safely. This is everyone's responsibility, especially the user. Read and follow label directions carefully before you buy, mix, apply, store, or dispose of a pesticide. According to laws regulating pesticides, they must be used only as directed by the label.

Disclaimer

This publication contains pesticide recommendations that are subject to change at any time. The recommendations in this publication are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. The label always takes precedence over the recommendations found in this publication.

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