PESTS That Affect Human Health

K-STATE Kansas State University

Fleas Infesting Pets & Homes

What are fleas?

Fleas are small, flat, wingless insects that infest the hair coats of mammals or plumage of birds. Adult fleas use their piercing-sucking mouthparts to feed on the host's blood. There are more than 2,400 species of fleas worldwide, but only a few regularly feed on dogs and cats. This publication is primarily concerned with the cat flea, *Ctenocephalides felis*, which is by far the most common flea species found on dogs and cats. Control methods discussed in this publication are effective against most flea species.

Adult male cat fleas are only about 1/12- to 1/8-inch long (2 to 3 mm). Blood-engorged females range up to 1/5-inch long (4 to 5 mm). Newly emerged fleas are dark brown. Actively reproducing females are light brown to orange.

How do fleas develop?

Like the butterfly, housefly and beetle, the life cycle of the flea involves an egg, larva, pupa (cocoon) and adult. This process, called complete metamorphosis, is illustrated in Figure 1 on page 2. The reproductive cycle of the female flea begins 20 to 24 hours after her first blood meal when she lays her first egg. A female cat flea can lay as many as 40 to 50 eggs per day and more than 2,000 eggs in her lifetime. Egg numbers vary because the reproductive capacity of the flea depends on the host's grooming and the temperature and humidity of the environment.

Flea eggs are pearly white, oval and about 1/50 of an inch long (0.5 mm), roughly the size of a grain of sand. Eggs are laid in the host's hair coat. Because they are not sticky, they fall off the pet and hatch in the environment. Flea eggs usually hatch in one to 10 days, depending on temperature and humidity. Humidity of 50 percent or less will dry and kill the eggs.

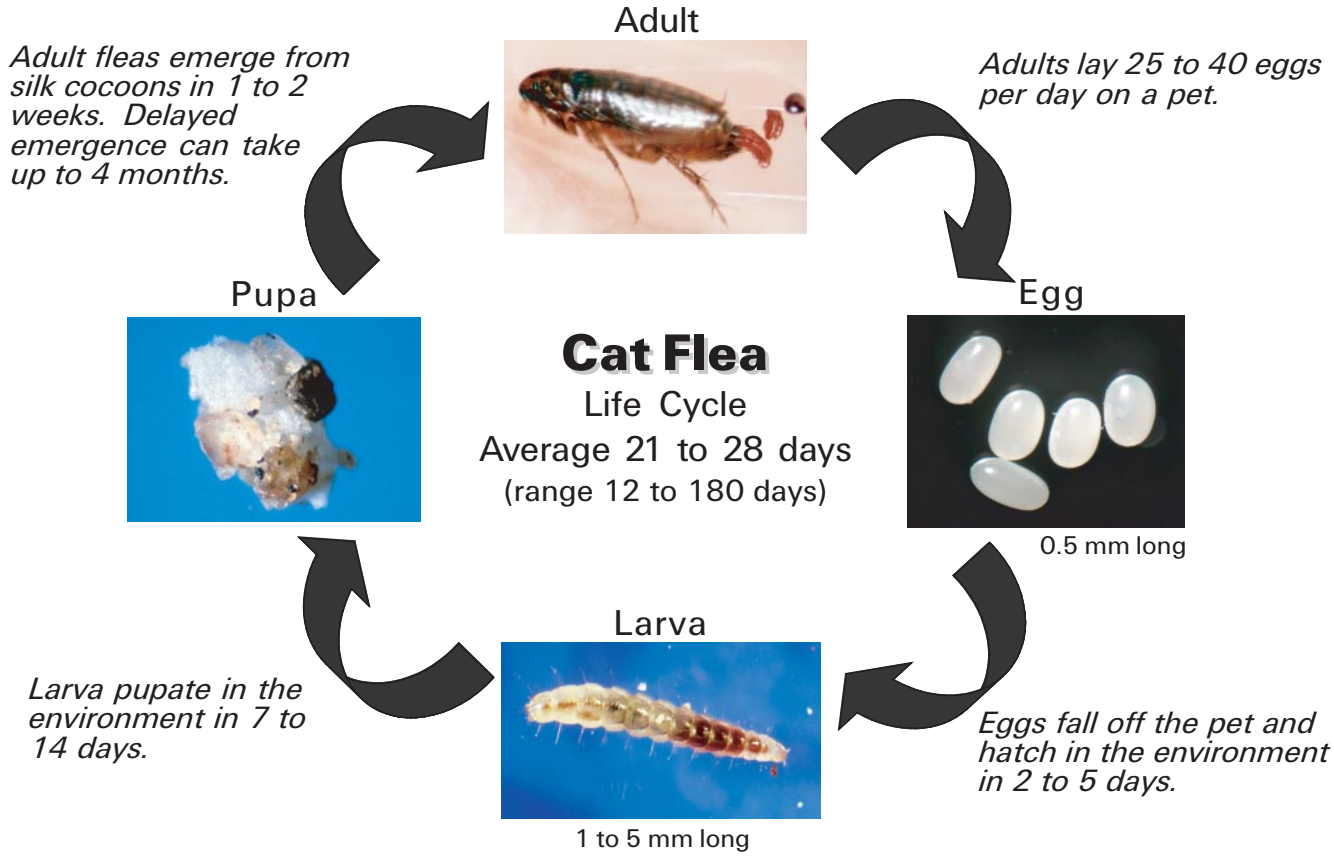
Flea larvae are slender, yellow, segmented, maggot-like and 1/12- to 1/8-inch long (2 to 3 mm). Larvae are independent and feed on organic debris found in the environment. They also feed on adult flea feces, which is partially digested dried blood. Once the larvae have ingested adult flea feces, they become darker in color. Larvae do not like direct light and move deep in carpet fibers or under organic debris searching for food. The larval stage usually lasts five to 11 days, depending on food availability and environmental conditions. Temperatures below 65 to 70 ^{0}F and relative humidity below 70 percent prolong larval development. Once developed, the mature larva, which is 1/6 to 1/5 inches long (4 to 5 mm), moves to an undisturbed site to produce a silk-like cocoon and pupate.

The cocoon is oval, about 1/4-inch long (7 mm), whitish and loosely spun. Because the cocoon is sticky, it quickly becomes camouflaged with debris from the environment and is difficult to see. Flea cocoons can be found in soil, on vegetation, in carpets, under furniture, and on animal bedding.

The pupal stage lasts for eight to nine days on average, but fleas can survive in the cocoon for up to six months. Adult fleas are stimulated to emerge from the cocoon by heat, vibrations of the substrate caused by the host's movement, and exhaled carbon dioxide. The flea's entire life cycle can be completed in as little as 12 to 14 days, or as long as 180 days. Under typical household conditions, the entire life cycle takes three to six weeks.

Newly emerged fleas are attracted to the warmth and movement of an animal's body, changes in light intensity and exhaled carbon dioxide. Fleas have tremendously powerful back legs they use for jumping onto the host. Cat fleas can jump as high as 13 inches. When stimulated, the flea will jump toward the source

Figure 1.



of the stimulus and try to attach to a suitable host. Fleas are found in the carpet and most often bite humans before finding their preferred host (dog, cat, ferret, raccoon, opossum, etc.). Newly emerged fleas can survive for one to two weeks without feeding, but as soon as they find a suitable host, they will feed and mate, and females will begin producing eggs within 20 to 24 hours.

Female cat fleas consume up to 15 times their body weight in blood daily. Adult cat fleas are permanent ectoparasites. Actively reproducing adults remain on the host, feeding and laying eggs, while immature stages are found in the host's environment. An adult cat flea that is removed from its host will usually die within two to four days if it is unable to find another host. While feeding, fleas deposit large quantities of partially digested blood, which appears as dark reddish to black feces. The flea feces can be found in the hair coat of the pet and on the pet's bedding.

What problems do fleas cause?

In the United States, fleas are the most common ectoparasites on dogs and cats. Infestations commonly occur in homes, and the irritating bites of fleas are well known to many pet owners. During feeding, fleas inject saliva into the skin. The saliva contains proteins that cause allergic skin reactions. Flea allergy dermatitis is the most common skin disorder of domestic dogs in the United States. Not only are fleas major nuisance pests that produce irritation and allergic dermatitis, they also transmit *Dipylidium caninum*, or double-pore tapeworm, the most common tapeworm of dogs and cats. The cat flea is a principal carrier of murine typhus, a disease that affects humans, rodents, and other small mammals along the Pacific and Gulf coasts. In addition, cat fleas can transmit the bacterium *Bartonella hensalae* between cats. This bacterium causes cat scratch disease.

How can fleas be controlled?

A traditional flea control program involves applying topical insecticides to the infested pet and all animals they come in contact with, along with thorough mechanical and chemical environmental control. However, modern insecticide and drug technology has reduced the need for environmental flea control. Environmental flea control is necessary only in cases of severe flea infestations where pets or their owners

are suffering from numerous flea bites and allergic dermatitis. The goals of flea control are to eliminate fleas on pets, eliminate existing environmental infestation, and prevent subsequent reinfestations.

Elimination of fleas on pets

The first step in a flea control program is to kill fleas on the pet to eliminate discomfort. Speed of action is a concern when discussing flea kill on a pet. A spot insecticide applied topically can take 12 to 36 hours for the compound to spread or reach sufficient concentrations to eliminate existing fleas. If a more rapid kill rate is desired, a pyrethroid flea spray may be used on dogs only, or the flea pill nitenpyram may be given to dogs and cats. Several spot or spray insecticides provide good flea control on pets. These include topically applied products, such as fipronil (Frontline), imidacloprid (Advantage), and selamectin (Revolution), and the orally administered pill nitenpyram (Capstar). Natural pyrethrum and pyrethroids often do not perform as well as topical insecticides because of insecticide resistance.

Elimination of existing environmental infestation

Existing infestations can be eliminated by administering residual insecticides such as fipronil, imidacloprid, or selamectin once a month to kill adult fleas; administering topical, oral or injectable insect growth regulators to stop flea reproduction; repeated application of insecticides and/or insect growth regulators to the premises; or a combination of these practices. In addition, fipronil/(s-methoprene) (Frontline Plus) or selamectin can kill adult fleas and prevent flea reproduction. Many of the new topical and systemic compounds can eliminate existing flea populations without the need for premise treatments. But as previously mentioned, treatment of the premises may still be necessary in cases of massive flea infestations or severe pet or human allergy to fleas.

Preventing subsequent reinfestations

After the initial infestation has been eliminated, pets should be placed on a preventive program. Residual insecticides or insect growth regulators (IGRs) should be administered monthly. If IGR preventive programs are used, short-acting adulticides such as nitenpyram may be used periodically.

If environmental flea control is necessary, a thorough understanding of the biology and habitat of fleas is essential for success. Flea eggs will be deposited anywhere the flea-infested pet has access. Sites where the pet spends most of its time will have the greatest number of flea eggs and are where control measures should be concentrated.

Indoor environment

Mechanical control procedures can enhance the effectiveness of a control program. Mechanical controls also can be used by pet owners who do not wish to use insecticides inside their homes. A vacuum cleaner with a rotary beater bar can remove 15 to 20 percent of the larvae and 32 to 59 percent of the flea eggs in the carpet. Shampooing and or steam cleaning the carpet will reduce the number of fleas but rarely will eliminate a problem without additional control measures. Cleaning the carpet before applying insecticides lifts carpet fibers to allow for maximum penetration of the insecticide.

After vacuuming, it is important to dispose of or freeze the vacuum bag immediately because eggs and larvae will continue to develop inside the bag, resulting in a reservoir of fleas.

The pet's bedding should be washed weekly along with other material the pet might sleep on such as throw rugs or blankets. Thorough mechanical control should precede the use of insecticides indoors. While resistance can be a problem, synthetic pyrethroids such as permethrin may offer adequate adulticidal activity for several days. One or two applications at seven- to 14-day intervals is sufficient if the on-animal recommendations are followed. In an environmental control program, the combined use of a residual insecticide and an insect growth regulator (methoprene or pyriproxyfen) will produce the best results.

Insect growth regulators (IGRs) are compounds that inhibit the development of immature stages of insects and disrupt the flea life cycle. In 2003 the only IGRs registered for flea control in the United States were methoprene, pyriproxyfen and lufenuron. These compounds inhibit egg development and kill developing flea larvae. Adult fleas are not killed by IGRs.

While IGRs are highly lethal to immature stages of insects, they are extremely safe for mammals. Methoprene and pyriproxyfen mimic the effect of a natural insect hormone and prevent insects from developing. They can be found in topical and area products. Both methoprene and pyriproxyfen are extremely stable when applied indoors, and they prevent flea development for six to 12 months. When applied on the animal, they prevent fleas from laying viable eggs.

Another type of IGR is lufenuron, which prevents normal development of flea eggs and larvae. Lufenuron works by preventing the immature insect

from forming a hard external body wall (exoskeleton). Lufenuron (Program) is administered orally once a month by pill to dogs. For cats, there is a liquid (one month) or injectable (six months) formulation available. Female fleas feeding on treated animals produce either nonviable eggs or larvae that hatch and die within a few days.

Methoprene and pyriproxyfen can be found in foggers and premise sprays alone or in combination with a variety of insecticides. After the initial application of insecticide and insect growth regulator to the home, the adult flea population usually will be drastically reduced or eliminated for several days. But fleas will often reoccur within a few days.

Reoccurrence of fleas is due primarily to the inability of currently available compounds to kill flea pupae developing deep within the carpet. After applying flea control products to the environment, pupae will continue to develop to adult fleas. Those fleas will then emerge for the next three to six weeks. Be persistent and do not give up too quickly on a flea control program. Occasionally, a second application of an insecticide to the entire home will be necessary.

Outdoor environment

Elimination of fleas in the yard can be an important aspect of flea control. Only areas protected from direct sunlight where the soil is moist will provide adequate conditions for flea development. When treating a yard, efforts should be concentrated around bushes, mulch or other moist, shaded areas. Spraying insecticides over the large expanse of a shade-free lawn generally will not be beneficial. Synthetic pyrethroids such as cyfluthrin and fenvalerate are available in convenient sprays and usually are effective.

Are shampoos, dips and collars still necessary?

For general flea control, these older formulations provide less benefit over the more modern oral and spot application products. While shampoos and dips often are less expensive, their efficacy is usually lower, they have to be applied more frequently and pets may resist applications. Flea collars containing just insecticides often do not provide effective flea control.

Alternative control measures

Controlled on-animal and off-animal studies have shown that ultrasonic flea collars and other ultrasonic devices do not repel fleas, affect jumping rates, interfere with reproduction or alter flea development. The use of brewers' yeast, garlic, B-complex vitamins and elemental sulfur products as flea repellents is common practice. Controlled studies have shown that these materials are not effective flea repellents.

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