

School IPM

University of Florida

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IPM for Fleas in Schools

Introduction

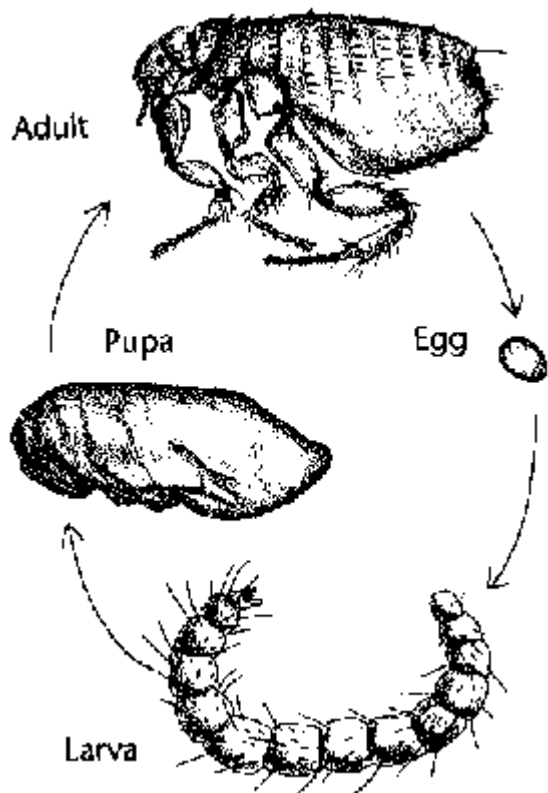
Fleas can be a problem in all parts of the country except in very dry areas. The most common species in school buildings is the [cat flea](#) (*Ctenocephalides felis*). This flea feeds on cats, dogs, and humans, as well as rodents, chickens, opossums, raccoons, and other animals. The dog flea (*C. canis*) and the human flea (*Pulex irritans*) are less commonly encountered.

Identification and Biology

Adult cat fleas are small (1/16 inch long), wingless insects possessing powerful hind legs that are adapted for jumping and running through hair. The adult body is reddish-brown to black, oval and compressed laterally. Unlike many other flea species, adult cat fleas remain on their host. After mating and feeding, adult female fleas lay oval, white eggs. These smooth eggs easily fall from the host into cracks, crevices, carpet, bedding, or lawn covering. A mature female flea can lay up to 25 eggs per day for three weeks.

Small, worm-like larvae (1/16 to 3/16 inches long) hatch from the eggs within 48 hours. They are eyeless, legless, and sparsely covered with hairs. The larval body is translucent white with a dark colored gut that can be seen through their skin. They feed on adult flea feces, consisting of relatively undigested blood, which dries and falls from the host's fur. They will also eat dandruff, skin flakes, and grain particles. Larvae develop on the ground in areas protected from rainfall, irrigation, and sunlight, where the relative humidity is at least 70% and the temperature is 70° to 90°F. This stage lasts eight to 24 days, depending on the temperature and humidity.

These immature fleas will eventually spin silken cocoons in which they will develop (pupate) into adult fleas. Cocoons are sticky, attracting dirt and debris which will easily camouflage them. Under optimal conditions, new adults are ready to emerge from their pupal cocoons within two weeks. They can, however, remain in their cocoons up to 12 months in the absence of a host or unfavorable climatic conditions. Vibrations and/or elevated temperature stimulate adults to emerge. This ability of flea pupae to wait until a host arrives can result in a sudden increase of adult fleas when they emerge simultaneously from many accumulated flea pupae.



As soon as the adult fleas emerge from the pupal case, they look for a host for their first blood meal. Adults can live one to two months without a meal and can survive up to six months with one. They are the only stage that lives on the host and feeds on fresh blood.

These variations in flea development time account for the sudden appearance of large numbers of adult fleas in "flea season," usually in the late summer and early fall. The flea population has been building up all year long in the form of eggs, larvae, and pupae, but rapid development into biting adults cannot be completed until the temperature and humidity are optimal and host cues signal for adult emergence from the pupal cocoon.

Associated Problems

Flea bites cause irritation, but also serious allergies in animals and humans. Other more serious and less common problems are associated with the cat flea. Cat fleas can carry or transmit various organisms, such as *Yersinia pestis*, which causes bubonic plague; *Rickettsia typhi*, which causes murine typhus; and *Dipylidium caninum*, the double-pored dog tapeworm, which can live in dogs, cats, or humans. Tapeworms are transmitted to a vertebrate host via ingestion of an adult flea carrying a tapeworm cyst.

Detection and Monitoring

Fleas can be a problem in schools even when no pets are kept in the buildings. Adult fleas can be brought in on the clothing of staff, students, or visitors. Other possible sources include urban wildlife such as rats, feral cats, raccoons, opossums, chipmunks, squirrels, or birds that may live in unused parts of the buildings. Detection is as simple as seeing fleas or noticing bites around the ankles of people in the building. Flea dirt, the adult flea feces that dries and falls off the host to serve as food for larvae, may be visible. Tapeworms, transmitted to a human via ingestion of an infected flea, would also signal a flea infestation.

Areas to Monitor

- in and around the cages of pets kept in [classrooms](#) (also check the pets themselves for signs of fleas)
- places where animals might find harborage, such as basements, crawl spaces, attics, eaves, roof top structures, and secluded shrubbery near buildings

Monitoring Traps

Flea Sock Traps

These are homemade, knee-high, white flannel booties that fit over the shoes and lower pant legs. When you walk through a flea-infested area, fleas will jump onto the flannel and become temporarily entangled in the nap where you can easily see and count them. Long, white athletic socks worn over the shoes and trouser legs will also work, as well as wide strips of sticky-backed paper wrapped around the lower legs (sticky side out). Socks can also provide protection from bites if a person must enter a severely flea-infested area for a short period of time.

Light Traps

These compact (roughly 4x6-inch) traps are composed of a small electric light and a sheet of sticky paper. Adult cat fleas looking for a host may be attracted to the warmth and light of the trap. Research has shown that fleas are most sensitive to green light and are more attracted to light traps if the light is turned off for 10 seconds every five to 10 minutes; therefore, it is important to choose a trap with a green light that can flicker on and off.

Light traps are especially useful for monitoring in office situations where no animals are present and the flea population is likely to be small. Check the traps once a week. If no fleas are caught by the second week, move the trap to another location or remove it. If the traps catch only a few fleas, the infestation is very small and can probably be controlled by the traps alone. In this case, leave the traps in place until no additional fleas have been caught for a week. If 20 or more fleas are caught per trap in a week, this probably indicates a more serious infestation, and time must be devoted to finding the source of the infestation (such as an animal living in or under the building).

Persistent Flea Problems

Persistent flea problems in buildings where there are no pets may indicate the presence of rodents or other wildlife. In this case it can be useful to have the fleas identified by a professional. When the flea species is not the cat flea, its identity can help determine the host animal and where to search to find the animal or its nest.

Management Options

An integrated management program for fleas can be designed by selecting from the following strategies and tactics. A [sample emergency flea control plan](#) is available.

Non Chemical Control

Wild Animal Removal

Wild animals can be removed with traps by trained animal control technicians. Consult your Yellow Pages or talk to your county Cooperative Extension Service agent for a recommendation. Make appropriate repairs to the building to exclude animals.

Vacuumping

- Vacuuming on a regular basis throughout the year will keep developing flea populations low by picking up adult and egg-stage fleas.
- Vibrations caused by vacuum cleaners will stimulate new adult fleas to emerge from their pupal sacs. These new adults will either be exposed to any residual insecticide on the floor or captured in the next vacuuming.
- Vacuuming is not very effective at capturing flea larvae in carpeting because they coil themselves around the fibers. Vacuuming does, however, pick up the dried blood that larvae feed on.
- Use vacuum attachments to clean cracks and crevices. Caulk or seal these openings permanently.
- Most fleas will be killed when dust in the vacuum bag blocks their breathing apparatus, but to be sure, you can vacuum up a tablespoon of cornstarch. The used vacuum bag should be disposed of immediately.
- Vacuum badly infested areas thoroughly every day until the infestation is controlled.
- When infestations are severe, you may need to supplement vacuuming with steam-cleaning or other controls.

Steam-Cleaning

The services of a steam-cleaning firm may be warranted when flea populations are severe. This process kills adult and larval fleas and probably some eggs as well; however, since the warmth and humidity from the steam also stimulates the remaining flea eggs to hatch a day or two after the cleaning, some fleas may reappear. If the other steps recommended in this chapter are followed (regular vacuuming, washing, etc.) the few fleas that hatch after steam-cleaning should represent the last of the flea population.

Flea Combs

Classroom pets in a flea-infested room should be combed regularly with a special flea comb that can be purchased at a pet store. Fleas and eggs removed from the animal should be dropped into soapy water.

Laundry

Wash removable floor coverings, such as rugs, located in areas where there are known infestations. Any bedding for classroom pets should be washed regularly.

Ultrasonic Devices

Ultrasonic flea collars have been proposed for use to keep fleas off pets, but are completely ineffective.

Heat

Tests have indicated that cat flea larvae die after exposure to 103° F for one hour, and researchers have developed techniques to raise the temperature in a room enough to provide this exposure. The heating process uses a common heating unit modified to include special blowers and flexible ducts.

Companies have been using heat to kill termites and woodboring beetles for a number of years, and now some companies are experimenting with heat to control fleas. One potential problem with this technique is that fleas can burrow down into carpets and upholstery, and perhaps escape lethal temperatures.

Drying or Flooding Infested Areas Outdoors

Outdoors, organic matter can temporarily harbor flea larvae. Either drying out these areas or saturating them with water will kill the eggs and larvae. You can also treat these areas with insect-attacking nematodes (see Biological Controls, below) or with an insecticide labeled for outdoor use (see Chemical Controls, below).

Biological Controls

Beneficial Nematodes

Insect-destroying nematodes, (*Steinernema carpocapsae*), are applied to the lawn as a spray and do not affect people, pets, or plants. These microscopic, worm-like organisms live in the soil and kill insects by entering their bodies, feeding on tissue, and releasing harmful bacteria. When they have eaten all they can of the insect, the nematodes leave to search for other prey. They cannot move far (only an inch or two) and die if they find no other insects. The nematodes sold for flea control are native to the United States and are found naturally in the soil all over the country; they will not adversely affect beneficial soil organisms, including earthworms.

Tips for Using Nematodes

- Use the number of nematodes recommended by the manufacturer.
- Treat areas outside where you have found evidence of animals sleeping or areas that you know are regular travel routes for animals.
- Moisture is critical to the effective use of nematodes, so water the area before and after the application.

Chemical Controls

If non-chemical methods alone prove insufficient to solve the problem, then integrating a pesticide into your management program may be warranted.

Pesticides must be used in accordance with their EPA-approved label directions. Applicators must be certified to apply pesticides and should always wear protective gear during applications. All labels and Material Safety Data Sheets (MSDS) for the pesticide products authorized for use in the IPM program should be maintained on file. Do not apply these materials when buildings are occupied, and never apply them where they might wash into the sanitary sewer or into outside storm drains.

Diatomaceous Earth and Silica Aerogel

These are insecticidal dusts that can be used for flea control. Diatomaceous earth is made from fossilized diatoms, and silica gel is produced essentially from sand. Both these products kill insects by desiccation; they absorb the wax and oil from the insect's outer covering which causes dehydration and death. Although these materials are not poisonous to humans directly, the fine dust travels freely through the air and can be irritating to the eyes and lungs; therefore, use a dust

mask and goggles during application. Silica gel and diatomaceous earth are also formulated with pyrethrins (discussed below).

How to Use Diatomaceous Earth and Silica Aerogel

- Apply a light dusting to upholstered furniture that is suspected of harboring fleas. Be sure to get into the cracks and crevices.
- Apply a light dusting to rugs or pet bedding.
- Apply to infested carpeting, leave for a couple of days, and then vacuum up.
- Dust into crawl spaces, wall voids, attics, and other similar spaces where you suspect animals of nesting or resting.
- Do not use in moist environments; neither material works well when wet.

Citrus Oil Extracts (D-Limonene/Linalool)

D-limonene and linalool are citrus-peel extracts that have been used for years as food additives. Products that contain d-limonene kill larval and adult fleas, while those containing both ingredients kill all flea stages. EPA-registered citrus shampoos are mild enough for use on young animals, but veterinarians caution that some cats may suffer if the material is applied in excessive concentrations. Citrus sprays can also be applied to animal bedding but should not be used to spray entire rooms, nor should they be used outdoors.

Borates

Borate products worked into the nap of the carpet can be used to control fleas. This treatment works as an intestinal poison upon ingestion by flea larvae and will continue to kill them for as long as a year. Application of borate treatment by a professional pest control company is recommended, although this product is also sold through veterinarians.

Imidacloprid and Fipronil

Both imidacloprid (Advantage) and fipronil (Frontline) are available through veterinarians as spot-on oils which are applied to the shoulder area of a cat or dog and distribute over the body within a few hours. (Consult a veterinarian before using either of these products on a pet other than a cat or dog.) They are non-toxic to mammals and kill almost all the fleas on the pet within 24 hours of treatment. Both products continue to kill fleas for at least 30 days after treatment. However, fleas may feed and mate before their deaths. This means that while these two products will help reduce a flea population, the fleas are still able to reproduce and lay eggs before they die.

Pyrethrins and Synthetic Pyrethroids

There are a number of flea control premise sprays, foggers, and pet treatments containing pyrethrins and synthetic pyrethroids. These products should be used as a last resort in areas where fleas problems are severe.

Insect Growth Regulators

Insect growth regulators (IGRs) inhibit the development of immature fleas, but do not kill adult fleas. Use of an IGR product (or a borate product) in conjunction with an adulticide (imidacloprid, fipronil, pyrethrins, or pyrethroids) prevent development of immature fleas and kill adult fleas. Methoprene (Precor, Ovitrol) and pyriproxyfen (Nylar, BioSpot) are available in pet sprays, pet collars, and premise treatments. Fenoxycarb (Logic, Torus) is available through professional pest

control companies and is for outdoor use only. Lufenuron (Program) is orally administered to the pet.

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