

# 1

## Basics of Fleas

### 1. *What are fleas?*

Fleas are blood-sucking insects (parasites), which live in close proximity to their hosts and the surrounding environment. In the case of fleas infesting dogs and cats, this behaviour can cause severe domestic household infestations. Flea bites can be incredibly itchy, but each animal or human may react differently to the bites. Pets may get fleas from other animals or people bringing them into the home or newly emerged fleas jumping on to the pet while they are outside.

### 2. *What do fleas look like? How big are they?*

Fleas are small (2–5 mm or 1/16–1/8 in), wingless insects that feed on dogs, cats and many other animals. Adult fleas seen on pets are glossy brown/black in colour, flattened from side to side, and have six legs (Fig. 1.1). They have a set of hairs called combs at the junction of the head and thorax (pronotal comb) and near the mouthparts (genal or oral comb).

### 3. *Do all fleas look the same?*

No. While to the naked eye they may look similar, the morphology when viewed under a microscope varies in different species (rabbit fleas, rodent and bird fleas), for example, which may occasionally be found on cats and dogs; fleas' identification can be important therefore in control programmes advised by vets and nurses for flea-infested households (Fig. 1.2).



**Fig. 1.1.** General flea morphology.

**4. How many species of fleas exist? Which are the most common ones?**

Flea infestations are probably the most common ectoparasites of dogs and cats. More than 2,500 species of fleas are known throughout the world. The common household flea is *Ctenocephalides felis*. The common name for this is the cat flea but you will also find this species on dogs, various wild mammals and even some birds. That said, rabbit fleas, while not persistently residing on the pet, are seen regularly in practice, as are household bird flea infestations.

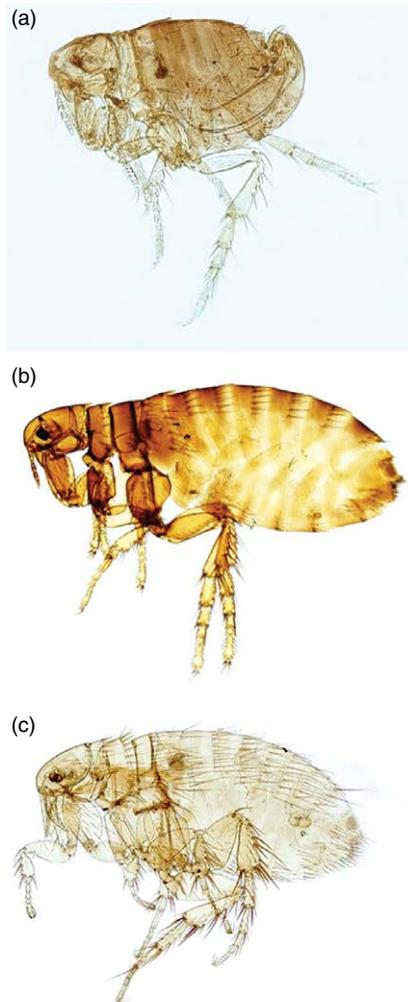
**5. If *Ctenocephalides felis* is also found on dogs, why is it called the cat flea?**

Well, way back in 1835 this flea species was removed from a cat in France and described in the literature for the first time. The describing author (Bouché) gave it the species name *felis* simply because it was removed from a cat. He could have just as easily removed one from a dog, red fox or lynx in France back then and today we might be calling it the dog flea, fox flea or even lynx flea. So, when we use the term ‘cat flea’ we are not necessarily talking about a flea on a cat, we are talking about *Ctenocephalides felis*. It is the most common flea on cats worldwide, but it is also the most common flea species found on dogs in most places in the world. In fact, it has been found infesting over 100 different mammalian and avian hosts worldwide. There is a ‘dog flea’, *Ctenocephalides canis*, but its importance varies widely in the world from rare to non-existent in some areas (tropics and subtropics) to more common in some north temperate areas.

**6. What are flea beetles?**

Flea beetles are small jumping insects found outside that don’t attach themselves to dogs or cats. They are not parasites. Some flea beetle species are

beneficial, feeding on weeds and similar nuisance plants. Other flea beetle varieties can damage flowers, shrubs and even trees. Adult flea beetles are typically small with often shiny bodies and large rear legs that allow them to jump like a flea when disturbed.



**Fig. 1.2.** Different types of fleas. (a) A sticktight flea (*Echidnophaga gallinacea*) of poultry, (b) *Pulex irritans*, the human flea and (c) *Xenopsylla cheopis*, a rodent flea.

### 7. *How do fleas thrive?*

Understanding their unique life cycle (and explaining this to pet owners) is very important before initiating control. Cat and dog fleas produce lots

of eggs while on the pet, and as these are shaken off they may be widely distributed in the household environment. In fact, think of the flea-infested pet as a living 'salt-shaker'. Fleas are laying eggs in the haircoat and wherever the pet has access the small white flea eggs are falling out of the hair. There they develop into larvae which feed on flea dirt originating from adult fleas (excess and partially digested blood) and other detritus. In the infested domestic setting, it is the accumulated larval offspring, which develop over time to new adults, thereby continuously infesting and re-infesting pets. Furthermore, the final 'cocooned' pupal stage is sticky and becomes surrounded by debris and in this way is protected. Once the pupa has fully developed, the pre-emerged adult flea within the cocoon can be stimulated to emerge by vibrations, carbon dioxide and heat.

**8. *What is the length of the flea's life cycle?***

The entire life cycle of cat fleas can be completed in as little as 12 to 14 days, or it can be prolonged for months. Time of development from egg to adult is temperature-dependent. Simply the warmer it is, the faster the flea develops. Optimal temperatures are 26–29°C (about 80–85°F), but cat fleas can develop in conditions as cool as 10°C (50°F). Once development is complete the pre-emerged adult within the cocoon waits until it detects a host (vibrations, carbon dioxide and heat), then it emerges, almost like popcorn popping. But if hosts (dogs, cats, humans or other animals) are not around they may remain in the cocoon for up to 1 year. However, under most occupied household conditions, nearly all cat fleas will complete their life cycle within 3 weeks to 3 months.

**9. *Which factors influence adult flea survival off a host?***

If adult fleas emerge and do not find a host to jump on to immediately their survival is highly dependent on temperature and humidity. One study has shown that, in moisture-saturated air, 62% of adult cat fleas survived for 62 days, whereas only 5% survived for 12 days when maintained at 22.5°C (72.5°F) and 60% RH (relative humidity).

**10. *Can cat fleas survive freezing?***

No. It has been shown that no life cycle stage (egg, larva, pupa or adult) can survive for 10 days at 3°C (37.4°F) or 5 days at 1°C (33.8°F).

**11. *What about humidity?***

Fleas require a fairly high humidity level, ideally around 70% to 85%. But most eggs and larvae will survive between 50% and 90% relative humidity.

It is important to remember that the humidity we might be experiencing at say table top level is not the same as where flea eggs and larvae are found: in cracks and crevices of hardwood floors, at the base of the carpet, in pet bedding or under chair and sofa cushions. These microclimates often have much higher humidity levels.

### **12. *How long can fleas live on a dog or cat?***

Interestingly, that is often not actually up to the flea. If a pet is not allergic to fleas, then they can live, feed and reproduce for over 100 days. But in pets that are allergic to the fleas and are frequently scratching and grooming themselves, fleas may live only 1–2 weeks.

### **13. *How many eggs can fleas lay?***

The cat flea is an impressive reproductive machine. Once fleas jump on a dog or cat, they feed almost immediately, mate and females begin laying eggs about 24 hours later. Initially egg production is low, but within 3 to 4 days they have hit their stride, with female fleas laying up to 40–50 eggs each day, which is twice their body weight. During peak reproduction the female fleas with their large red-orange abdomens are 2–3 times the size of the small brown males. They can continue that level of production for several weeks, before it starts to taper off, but can be producing over ten eggs per day even 100 days later.

### **14. *How can a cat flea lay twice her body weight in eggs each day?***

She does this by consuming 10–15 times her body weight in blood each day. Fleas are not just a nuisance, they are voracious blood suckers.

### **15. *How long does it take for fleas to starve?***

This is dependent on the flea species with some fleas surviving for nearly 3 months without having a blood meal. However, the cat flea is different. Once they emerge from the cocoon, they need to find a host to feed upon in about 1–3 weeks or they will die. Interestingly, once cat fleas initiate reproduction they must feed frequently to survive. Their metabolism is now so ‘geared up’ that if they are removed from the dog or cat, they will die in 1 to 4 days.

### **16. *What do flea eggs look like?***

Flea eggs are pearly white, oval with rounded ends and about 0.5 mm in length (Fig. 1.3).



**Fig. 1.3.** Flea eggs.

**17. *What percentage of infestations are eggs?***

Flea eggs may make up >50% of all flea life stages.

**18. *Where are flea eggs found?***

Flea eggs can be found in any place the flea-infested pet has access. Because the cat flea deposits her eggs in the animal's haircoat, the eggs then drop off the pet wherever it goes. But an important point to remember is that wherever pets spend the majority of their time is where most flea eggs will be deposited: their resting, lounging and sleeping areas. Interestingly, a common place flea eggs are found that is often forgotten is under chair and sofa cushions. How many of us have a dog or cat that sleeps on a chair or sofa in our homes? If that pet has fleas, those eggs are falling off and then rolling under the cushions. Not a pretty picture, but a reality of many flea infestations. Historically, it was a common misconception that fleas on our pets 'jumped off' and laid their eggs in cracks and crevices. That is simply not true. That misconception most likely occurred because that is how most rodent fleas behave. Those fleas take a blood meal then leave their rodent hosts to lay their eggs. Cat fleas are far more permanent parasites, feeding and residing almost continuously on their hosts.

**19. *What do flea larvae look like?***

Flea larvae are small (2–5 mm) and maggot-like. They have semi-transparent bodies, usually white with a yellowish to brownish head, and are sparsely covered with short hairs. As they develop, they undergo two moults before developing into pupae. If they have ingested dried blood (adult flea faeces) they can appear much darker in colour, almost brown (Fig. 1.4).

**20. *What percentage of infestations are larvae?***

Flea larvae make up about 25–35% of infestations.



**Fig. 1.4.** The 2nd and 3rd instar flea larvae, full of dried blood.

### **21. *Where are flea larvae found? What do they eat?***

Flea larvae are found within 20 cm (up to 8 in) from where they hatched from eggs. Therefore, they are found in the same locations that eggs are found. Larvae are considered grazers; they move around almost constantly feeding on debris, flea faeces and even each other. Yes, flea larvae eat adult flea poop; in fact they must eat adult flea faeces to successfully develop. Fleas defecate large quantities of partially digested blood (flea dirt), which falls out of the pet's hair and into the surrounding environment, where residing larvae can consume it (Fig. 1.5).



**Fig. 1.5.** Flea eggs and flea dirt.

### **22. *Why don't we see flea larvae?***

Flea larvae are repelled by light (negatively phototactic). Larvae prefer to crawl at the base of the carpet, and in dark cracks and crannies. Occasionally flea larvae can be observed as they crawl across pet bedding, seeking areas away from light.

**23. *What do flea cocoons look like?***

Once larvae have completed their development, they then spin a silk-like cocoon. Debris adheres to the structures and camouflages them, making them look like lint balls (Fig. 1.6). The oval-shaped cocoons are 4–5 mm long and 2 mm wide.



**Fig. 1.6.** Flea cocoons coated with debris.

**24. *What percentage of infestations are cocoons?***

Cocooned stages make up 10–15% of infestations.

**25. *Where are flea cocoons found?***

Flea cocoons are generally found where larvae live, most commonly deep within carpets, in cracks of hardwood floors or attached to the undersides of chair and sofa cushions (Fig. 1.7).

**26. *How long do pupae live in the cocoons?***

Once larvae form cocoons, they will pupate into adults in 7–19 days. However, the adults may remain inside the cocoons for up to 1 year, as previously described.



**Fig. 1.7.** Flea cocoon incorporating carpet fibers.

**27. *Does vacuuming kill flea pupae in cocoons?***

Depending on the carpet type, regular vacuuming can remove up to 63% of flea cocoons: 100% of those removed will be killed in the process. However, those cocoons spun by larvae at the base of the carpet will not be affected by vacuuming. But vacuuming still can remove over 50% of cocooned pupae.

**28. *Can flea pupae in cocoons drown?***

The cocoon itself isn't a barrier to water. However, cocooned stages are difficult to drown. Most will survive 12 hours of submersion. However, they won't survive a washing machine, due to the agitation action, heat and detergent.

**29. *What's the best way to kill cocooned pupae?***

Please see Chapter 4, 'Sorting Out Flea Problems', for control information. Cocooned stages are the most difficult to kill, because they're protected deep within carpets. Vacuuming can remove some, but patience is required while waiting for the adults to emerge and die.

**30. *Do fleas have to pupate within cocoons?***

No. Sometimes fleas pupate without cocoons. They are called naked pupae and can still reach adulthood successfully. However, the cocoon allows pre-emerged adults to enter into a dormant-like state for up to 1 year. The structure also protects developing fleas from arthropod predators, both physically and by camouflaging them.

**31. *Does washing laundry kill fleas?***

Yes. It is very important to launder all infested items like pet bedding, rugs, carpets, bed sheets, clothes, etc. at at least 50–60°C (120–140°F). This helps to drown the fleas and the heat also kills eggs and larvae.

**32. *Can you drown adult fleas?***

Yes, fleas can drown in hot, soapy water. This is the main reason why you should shampoo all your rugs, carpets and wash all of your pets' bedding in hot soapy water. But trying to drown them in water alone can be very difficult; they may survive for hours.

### 33. *Where do fleas hide away and when are they a problem?*

It is very important to realize that any adult fleas seen on a pet represent the ‘tip of the iceberg’ and that large numbers of immature fleas (environmental biomass) are likely to be undergoing a covert development deep within carpet fibres, in cracks of hardwood floors, under chair and sofa cushions or even in localized areas outdoors (under decks, porches or beneath shrubbery).

Newly emerged fleas, in carpets or from outdoors, will bite most animals including humans, although with the exception of the ‘human flea’, *Pulex irritans*, they will not persistently infest humans. Because *Ctenocephalides felis* is not highly cold-tolerant, it has been postulated that it survives in cold climates in the urban environment, as adults on untreated dogs, cats, wild mammals and as pre-emerged adults within cocoons in houses and burrows. Once on a host, *C. felis* initiates feeding within seconds to minutes. Studies have shown that 25–90% of fleas are blood-fed within 5 minutes, and in another, the volume of blood consumed by fleas was quantifiable within 5 minutes.

When fleas that have been on a host for several days are removed, they die within 1–4 days. Experimental work has shown that when cats are allowed to groom freely, they will ingest or groom off a substantial number of fleas in a few days. When cat fleas were allowed to feed for only 12 hours and then removed from their host, 5% were still alive at 14 days. This is of particular importance, because one study showed that when cats were housed adjacent to each other but physically separated, 3–8% of the fleas moved from one cat to another. However, when cats were housed in the same cage, 2–15% of the fleas transferred. Therefore, it is possible for a few adult fleas to transfer from one host to another. However, it is far more likely that most flea infestations originate from previously unfed fleas emerging from environments that have supported development of immature life stage.

Cat fleas exhibit an extremely prolific reproduction and as a result environmental infestation is difficult to control, often taking 2–3 months or longer to eliminate indoor infestations and if outdoors, e.g. inside kennels, there are additional problems. An infestation in the home may not be obvious until the third generation of fleas has developed.

### 34. *Do adult fleas like light?*

Yes and no. When a cat flea first emerges from the cocoon it is attracted to light (positively phototactic). The cat flea has simple eyes, more like photo receptors. If the flea emerges in a home, it turns towards a light source like a lamp or sunlight coming through a window. Outdoors it simply orients

towards the sun. The reason it turns towards a light source is that it is waiting for a shadow to pass between it and the light source. The flea then jumps in the direction it was facing. That is how fleas acquire a host. At the point the flea jumps it does not know if the shadow was cast by a dog, cat, human or truck. Once it alights on the object then it determines whether it wants to stay. This is the basis for commercial lighted flea traps. You can also easily make a flea trap by placing a dish of soapy water under a night light. They get attracted to the light and then jump into the water. Place a few drops of liquid soap into the dish of water to break down the surface tension so that the flea will drown.

Interestingly, such a trap is only useful for fleas in the environment and not for those residing on the pets. Once a cat flea has initiated reproduction its phototaxis changes. Actively reproducing cat fleas are negatively phototactic. To demonstrate this all you have to do is roll a flea-infested dog or cat on to its back and watch the fleas on the belly scramble back into the hair.

### **35. *Where do you find fleas outdoors?***

Fleas are sensitive to extreme heat and a lack of moisture. They generally will only develop in shaded areas outdoors: under shrubbery, in tall grass, under crawl spaces, decks and porches. Remember, the larvae must also be able to find and feed on adult flea faeces, so these have to be places where flea-infested animals have spent sufficient time for flea faeces to have accumulated. To help control flea development outdoors, keep bushes well-trimmed and mow grass frequently. This will lead to dried-out soil and direct sunlight, which is an inhospitable environment for fleas and ticks. Preventative measures like applying monthly medications to pets, checking for fleas and ticks after being outside, and landscaping outdoor areas thoughtfully are recommended to ward off tick bites and flea infestations. Suburban and rural areas are quite comfortable for both fleas and ticks – your pet could easily catch fleas in a dog park, and ticks can be present in gardens if there are deer or small mammals such as hedgehogs around.

### **36. *How do fleas jump (and how high!)?***

Fleas have especially strong hind legs which enable them to jump very high. Fleas can jump 20–25 cm (8–10 in) high and more than 30 cm (12 in) horizontally. As long as you keep your pet protected, these Olympic-level jumpers will pose no threat. Fleas are some of the most exceptional jumpers on the planet. In relation to the size of their bodies, they are virtually unrivalled in their ability to propel themselves, leaving many to wonder exactly how fleas jump. While they have six legs, their hindmost pair are

the only important set of legs when it comes to jumping. Fleas bend the closest segments of their longest set of legs directly before jumping. Fleas create around 100 times more power than their leg muscles alone could generate, and they always spring their legs at the exact same time. They rely on energy stored in an elastomeric protein, resilin, to perform their spectacular jumps. The resilin in fleas' legs is essentially a stretchy pad of protein that extends and contracts, propelling them great distances. It is elastic enough to withstand the force of the quick, snapping movement that fleas enact while jumping, but is able to resume its original shape after committing to a jump.

### **37. *Which regions have the most fleas?***

Warmer and humid countries and regions within those countries have the most fleas all year round while colder ones see a drop in flea populations during the months of peak winter due to low humidity. In other dry places with low humidity levels, flea populations drop based on the weather conditions. Therefore, flea problems are worst in warm tropical and subtropical environments. Examples of areas with bad almost year-round flea problems are coastal Italy, southern France, Spain and Portugal. Flea problems are especially problematic in the southern Gulf coastal areas of the USA and coastal Australia, and rare or almost non-existent in high-altitude, low-humidity locations such as the Alps or Rocky Mountain region of North America.

### **38. *How fast do fleas spread?***

Fleas can spread quite rapidly because a female flea can lay up to 40–50 eggs per day. These eggs then mature into adult fleas in as little as 3–4 weeks, creating new populations, and before you know it, you have a full-blown flea infestation in your home. Therefore, it is very important to take necessary steps to eliminate fleas as soon as you spot the first one, or better yet, prevent them from ever occurring (which we will discuss later).

### **39. *When is flea season?***

In general, fleas start becoming active in the warmer months, starting as early as the beginning of March in the UK. In the winter months, outdoor fleas, larvae and eggs can die off due to low humidity levels but those indoors can still survive and breed. Therefore, all-year-round flea control is recommended. In the USA, the states with the most fleas are the southern states, as well as Hawaii. Warm and humid weather brings out fleas, and fleas are more prevalent in warm temperatures. Don't assume that because

the spring and summer seasons have passed, you don't need to worry about fleas. In much of the USA flea season lasts most of the calendar year. In fact, in many temperate areas we experience a 'fall flea surge'. Fleas thrive and breed in temperatures of 16°C (60°F) and above. As long as adult fleas have something to feed upon (dogs, cats and certain mammalian wildlife) they can breed. When flea larvae have sufficient humidity, at least 50% of them will hatch. Inside homes where the climate temperatures are controlled, fleas live and breed all year long unless every trace of fleas, flea eggs and flea larvae are eliminated. Fleas are found in just about every location of the world and in warm climates there is no end to flea season. Warm, wet climates have fleas every day, all year long. Flea season fluctuates from country to country and climate to climate. All USA states bordering the Pacific Ocean and almost all of the USA southern states have no seasonal interruption from fleas. Inside homes, where the temperature is above 16°C (60°F), it's always flea season.

#### ***40. Do fleas die in the winter?***

This is a myth and can lead to the temptation for pet owners not to use appropriate flea control during the winter. This can lead to massive infestations with central heating (often with built-in humidification systems) providing a suitable environment for fleas to reproduce and thrive. Fleas usually begin to populate our homes and gardens during late winter and early spring, so waiting until summer to treat your pet means that fleas are more likely to have become established in your home. Therefore, it is important to keep up with flea control throughout winter, especially if you have had a flea problem in the warmer months.