CAT AND DOG PARASITICIDES AND THE ENVIRONMENT

Andrea Tarr BPharm MSc (Evidence-based pharmacotherapy) MRPharmS, founder and director, Veterinary Prescriber, outlines the evidence on the ecotoxicity of cat and dog parasiticides and discusses how to balance the need to protect the health of pets with the minimisation and avoidance of adverse effects on the environment

How much do you think about the effects of a parasiticide after it has done its pharmacological work in, or on, an animal? The answer is probably not much or not at all. This is neither surprising or unusual because the fate of pharmaceuticals after they have left the patient's body has not been a concern until relatively recently.[1,2]

Why are we only talking about this now?

Parasiticides have an important role to play in combatting parasites that infest cats and dogs. They have been in use for many years and the range of products available to prescribe has grown to dozens of brands, containing over 20 different parasiticide ingredients (see Table 1) in various formulations: spot-ons, collars, tablets and oral liquids.[3]

The extensive use of pesticides in agriculture is believed to be contributing to the global decline in insect populations.[5] Insects are vital pollinators and a fundamental part of the food chain; their decline can disrupt ecosystems and harm other species, including birds and amphibians. While regulations have become stricter for many pesticides, little attention has been given to the environmental impact that pet parasiticides may be having.

It had been assumed, until recently, that medicines used in pets (as opposed to animals being intensively reared) pose negligible environmental risk because the quantities used are too small to be of concern.[6] Because of this, the environmental risk assessment required before regulatory approval is very limited and there is little information available on the environmental fate or impact of pet parasiticides.

Pet ownership is increasing in Europe.[7] Estimates suggest there are around 75 million pet cats and 63 million pet dogs in the EU/EEA, not counting abandoned and stray animals[7] and over 20 million cats and dogs in the UK.[8] Many cats and dogs receive multiple routine doses of flea, tick and worm treatment throughout the year[9] and it is now clear that the quantity of parasiticides used in pets is substantial.[10,11] This means we can no longer assume that the environmental impact of parasite treatments is negligible.

Ectoparasiticides	Endoparasiticides	Endectocides
afoxolaner	emodepside	eprinomectin
deltamethrin	febantel	milbemycin
dimpylate	fenbendazole	moxidectin
dinotefuran	nitroscanate	selamectin
esafoxolaner	praziquantel	
fipronil	pyrantel	
fluralaner		
imidacloprid		
indoxacarb		
lotilaner		
permethrin		
pyriproxyfen		
sarolaner		
tigolaner		

Table 1: Active ingredients in parasiticides for cats and dogs authorised for use in the Republic of Ireland.[4]

Estimates suggest there are around 75 million pet cats and 63 million pet dogs in the EU/EEA, and over 20 million cats and dogs in the UK. With many cats and dogs receiving multiple routine doses of flea, tick and worm treatment throughout the year, it is now clear that the quantity of parasiticides used in pets is substantial.

Furthermore, parasiticides are often extremely potent (for example, one monthly flea treatment for a large dog contains enough imidacloprid to kill 25 million bees)[2] and they can persist in the environment for long periods of time.[12] Most importantly, recent studies have shown widespread pollution of UK rivers with chemicals used in flea treatments.[10,13]

What is the evidence of environmental contamination?

Studies in the UK have found that many surface waters, such as rivers and lakes, are polluted with fipronil and imidacloprid – both of which are widely used in spot-on flea treatments. One study found that fipronil was detected in 99 per cent of river samples in England, and imidacloprid in 66 per cent of river samples.[13] The levels that are being detected are often concerningly high, posing a risk to aquatic insects such as dragonflies and mayflies.[14,15]

Both fipronil and imidacloprid have been used in applications besides flea treatments. However, increasing evidence is pointing to pet parasiticides as the main source of this pollution. Both were banned for use in agriculture in the UK in 2018 and there is no record of agricultural use after 2016[16], leaving pet parasiticides and household pesticides such as ant and cockroach baits as the only allowed usage.

Cats are more likely to be infested with fleas than dogs.

Until recently, we were unsure how these chemicals reach waterways. However, the UK Water Industry has recently published a report showing high levels of fipronil and imidacloprid in domestic wastewater[17], meaning that parasiticides are likely to be passing down the drains from homes with treated pets.

How can parasiticides get into the environment?

After spot-on application, fipronil and imidacloprid spread over the surface of the skin and accumulate in the sebaceous glands where they are slowly released to coat the hair and skin.[18,19]

From here, they spread into the pet's surroundings through pet hair, shed skin and direct contact.[18] If pets are given repeated monthly spot-ons, the chemicals can build up in the home, particularly in places where pets spend a lot of time such as on bedding.[20] Parasiticides in collars are continuously released from the collar onto the skin and hair over several months while the collar is being worn.

The routes by which parasiticides pass down the drain from the home are still being investigated but one proven route is through bathing of spot-on treated dogs.[21] Other likely routes include washing of owner hands after touching treated pets and washing of pet bedding.

After being washed down the drain, these chemicals pass to sewage treatment works. Very little fipronil and imidacloprid is removed through the treatment process and most passes to rivers through wastewater discharge.[17,21]

Another route to the environment is through treated dogs swimming. Fipronil and imidacloprid spot-on products are effective for at least a month, and, during this time, parasiticides are still present and active in the coat, and can pass into water if the pet wades or swims.

What about other parasiticides – are they safer?

Studies so far have focused on parasiticide products containing fipronil and imidacloprid. These are the two most common ingredients in spot-on flea and tick products[10] and imidacloprid is one of the ingredients in some flea and tick collars.

But, while we are beginning to understand the environmental impact of some parasiticides such as fipronil and imidacloprid, little is known about the impact of any other parasiticides. Because all parasiticides are designed to be toxic to parasites such as fleas and ticks, they have the potential to be toxic to wildlife. Many parasiticides used in worming treatments are excreted in faeces where they can be toxic to insects such as dung beetles.[22]

More research is needed to establish the ecotoxicity of all the different parasiticide products, including those that act systemically, such as the newest ectoparasiticides – the isoxazolines (afoxolaner, esafoxolaner, fluralaner, lotilaner and sarolaner). In general, systemic parasiticides are excreted unchanged and/or as metabolites in faeces. The pathways of these parasiticides into the environment and potential impacts on wildlife have not yet been quantified or understood.

- Instruct owners on how to apply the product correctly.
- The package leaflets or labels that accompany spot-on products specify not to touch or groom animals until the application site is dry. This will help to reduce chemicals transferring onto owner hands, and subsequently washing down the drain.
- Most spot-on flea and tick products state that animals should not be allowed to swim for at least 48 hours after applying the product, as this is when the highest levels are present on the coat.[4] It is important to check the specific product guidelines (which are found on the pack or in the package leaflet) and to inform pet owners of them. However, it is important to be aware that while these guidelines will help to reduce environmental pollution, in most cases the time limits are estimates only and are not based on evidence that it is safe to swim dogs after this period.[31] Monthly spot-on parasiticides are present in the coat for at least a month and research indicates that parasiticides can wash off for at least this long. In a study of fipronil-treated dogs, the amount in rinse water decreased with time, but was still detected 28 days after application.[32]
- Package instructions for flea and tick collars containing imidacloprid do not contain any warnings against swimming, but they do state under "Special precautions for disposal" that the product should not enter water courses as it may be dangerous for fish and birds.[4]
- Never flush unused product or waste material down the toilet.

Table 2. Advice for owners on using parasiticide products.

Balancing the need to protect pet health and the environment

The health and wellbeing of animals, people and the environment are interconnected, and the responsible use of parasiticides involves balancing these different concerns. Parasites can cause irritation and discomfort and can sometimes spread disease. However, parasiticides are contributing to concerning levels of environmental pollution. Like all medicines, they should only be used when necessary, with an understanding of their risks and benefits. By using these products in a careful and considered way and targeting high-risk animals, or those with a confirmed infestation, we can reduce environmental pollution, while also protecting animal and human health. The British Veterinary Association has supported this approach, calling for a move away from blanket treatment (year-round

Washing of owner hands after touching treated pets is one of the likely routes by which parasiticides pass down the drain from the home.

prevention of all common parasites) with parasiticides and toward taking a more targeted approach that considers risk factors for individual pets.[23]

There is much discussion within the veterinary profession and beyond as to what constitutes necessary and appropriate use of these products, especially in light of growing evidence of their potential for environmental harm. There has been a call for more research to understand parasite risk factors and help guide treatment decisions. Our understanding is still incomplete, but some risk factors are now well-recognised:

- There is a clear seasonal pattern for both flea and tick infestations, with both being more likely to occur in summer than winter.[24]
- Young animals, under 12 months of age are more likely than older animals to be affected by fleas, ticks and worms, and cats are more likely to be infested with fleas than dogs.[24]
- Recent studies suggest that fleas and ticks are less common than previously thought,[25] with one UK study finding that fleas were present in 5 per cent of cats[26] and 2 per cent of dogs, and ticks were present in 0.7 per cent of dogs.[27]
- Diseases that are spread via parasites to pets or from pets to people do occur but data indicates that these are relatively rare.[28,29,30]

Using a risk-based approach will help target use and avoid over-treatment and unnecessary parasiticide ending up in the environment.

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Further information

- BVA/BSAVA/BVZS Five-point plan for responsible use of parasiticides, www.bva.co.uk/resources-support/medicines/responsible-use-of-parasiticides-for-cats-and-dogs-the-five-point-plan/
- The University of Liverpool SAVSNET flea activity dashboard tool gives the most recent data on flea risk, https://public.tableau.com/app/profile/savsnet.at.liverpool/viz/. Fleaactivitydashboard/fleadashboard
- Information for owners of dogs that swim is available at: www.veterinaryprescriber.org/safedogswimming

Fipronil and imidacloprid spot-on products are effective for at least a month. This means that parasiticides are still present and active in the coat during this time, and can pass into water if the pet wades or swims.

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READER QUESTIONS AND ANSWERS

1. THERE ARE MORE THAN 20 DIFFERENT CHEMICAL INGREDIENTS IN PARASITICIDE PRODUCTS LICENSED FOR USE IN CATS AND DOGS. WHICH CHEMICALS HAVE BEEN LOOKED FOR SO FAR AND FOUND TO BE POLLUTING RIVERS AND LAKES?

A. Febantel and indoxocarb
B. Fipronil and imidacloprid
C. Fluralaner and lotilaner
D. Fluralaner and selamectin
E. Sarolaner and permethrin

2. FIPRONIL SPOT-ONS ARE INTENDED TO REMAIN ON THE ANIMAL'S COAT FOR AROUND ONE MONTH AFTER APPLICATION. THE PRODUCT INFORMATION USUALLY ADVISES THAT DOGS DO NOT SWIM FOR AT LEAST TWO DAYS HOURS AFTER APPLICATION BECAUSE THE PRODUCT CAN WASH OFF. HOWEVER, A STUDY DESIGNED TO COLLECT WATER FROM TREATED DOGS (TEERLINK ET AL, 2017) FOUND THAT FIPRONIL CONTINUES TO WASH OUT FOR AT LEAST HOW LONG AFTER APPLICATION?

A. Five days
B. One week
C. Two weeks
D. Three weeks
E. Four weeks

3. WHICH ORGANISATION HAS CALLED FOR A MOVE AWAY FROM BLANKET PARASITICIDE USE IN PETS (THAT IS, YEAR-ROUND PREVENTION OF ALL COMMON PARASITES)?

A. Health Products Regulatory Agency (HPRA)
B. Royal College of Veterinary Surgeons (RCVS)
C. Veterinary Ireland
D. Veterinary Council of Ireland (VCI)
E. British Veterinary Association (BVA)

4. WHICH ORGANISATION PUBLISHES AN UP-TO-DATE ONLINE FLEA ACTIVITY DASHBOARD?

A. World Small Animal Veterinary Association
B. Animal and Plant Health Agency
C. University of Liverpool Small Animal Veterinary Surveillance Network (SAVSNET)
D. Health Protection Surveillance Centre
E. Department of Agriculture, Food and the Marine

5. FIPRONIL AND IMIDACLOPRID WORK BY REMAINING ON THE PET'S SKIN AND COAT AND KILLING FLEAS AND TICKS THAT COME INTO CONTACT WITH THEM. BY WHAT ROUTE MIGHT THEY END UP IN WASTE WATER AND RIVERS?

A. Stroking the pet followed by hand washing
B. Laundry of the pet's bedding and other textiles
C. Swimming dogs
D. Bathing pets
E. All of the above

ANSWERS: 1B; 2E; 3E; 4C; 5E