

Pesticide – a systemic destruction of health and the environment?

Dr Mark Elliott BVSc VetMFFHom MRCVS MLIHM PCH DSH RSHom

www.markelliott.co.uk

Our Pets are important to us, some for the job they do, others for their being part of our families. The bond between man and beast may never have been stronger. Yet strangely, at such a time, we are applying ever more toxic chemicals to them in the form of pesticides and wormers. And we are doing this ever more frequently with very little concern being raised about the short or long term side effects.

These side effects may be significant for man, beast and the environment – each individually is of concern, together they become a potential catastrophe. The widespread use of these agrochemicals in pets without diagnosis confirming need, and without full resolution of safety concerns, I would argue is certainly imprudent and potentially disastrous and must be reconsidered immediately.

Of course to get the wider community to address concerns there has first to be recognition that there is a problem, and therein lies the rub. There is something of an ostrich mentality when it comes to debate on this issue.

However, the near total ban announced by the EU this month on the use of a class of pesticide called Neonicotinoids for all outdoor use on crops, should force a rethink of what happens with their use in Pets. In the UK then use of these chemicals to prevent infestation with fleas and ticks is arguably now a major source of environmental contamination as highlighted by the charity BUGLIFE (1). Scientific studies have long linked Neonicotinoid use to the decline of Honeybees, wild bees and other pollinators, but they are also highly toxic to aquatic life, and persistent in the environment. BUGLIFE claims that the evidence shows contamination of freshwaters in the UK with these products can be traced back to their use on Pets.

There are also huge profits to be made from marketing of pesticides for pets to a consumer society that is easily manipulated. April sees the annual increase in articles and adverts in the Veterinary Press to get Vets on side. Television campaigns as well as emotive articles in the media of death and dire consequences for our animals if we don't comply with the rhetoric promote public demand. Veterinary practice management software is set up to market these products creating text, email and postal reminders to encourage client compliance. Pet "Healthcare" programmes bind clients into application of these chemicals with supply paid for on easy to manage direct debit. Once hooked you become a valued client, maybe even getting discounts on other services if you comply – all seemingly such a good deal. And then as well, there are articles in the veterinary business journals that encourage "mining" clients data for gold (2) with software that can target the non-compliant - there is little escape for the unwary.

This might be all very well if there was some logic and reason, as well as a sense of proportion, applied to the subject, but is there? With the rise of large corporate practices, some might say financial targets arguably override other aspects of debate these days. My own experience of asking clients who, when transferring from other practices then come in requesting these products, as to whether they are aware of the side effects, the potential environmental concerns, and the actual need to worm, flea and repetitively chemicalise is that they have never been told of these, have rarely read the information on the packaging and are shocked, even angry, at the fact they had not been fully informed that there might even be a problem at all. There was no informed consent, no understanding of the potential for problems, no explanation of the risks to animal and human health in the process of sale, it was just what they were told to do.

But putting aside the financial debate we need to ask more about why we have been treating dogs and cats regularly in the UK with chemicals to try and prevent fleas, worms and ticks? Why are we advised to

try and prevent infestations that may not happen? Is there really any logic and good science behind it? And what are the problems?

Its first always worth looking at what happens elsewhere and why.

In the journal "Companion" published by the British Small Animal Veterinary Association in December 2017 it was notable in a report from Norway that there "We don't routinely worm dogs other than pups and nursing bitches (because there is no need, not because we don't bother..)" (3) Norwegian Vets are not allowed to sell prescription only medicines (POMs), so there is also no financial incentive to prescribe other than for actual need anyway.

Similarly in Denmark prescriptions of POMs are only allowed after a positive diagnosis of infection and there is more awareness of environmental concerns from use of these products. Yes, they do have lots of Lungworm in some areas, but from discussions I have had with Danish colleagues, it is not seen there as such a big deal by Vets or owners as it is marketed to be in the UK. Lungworm can be a serious disease of course (though often subclinical or mild) but it is regional, seasonal and connected to a certain age group of dogs with a certain behaviour. Colleagues there report they split dogs into groups of different risk and recommend testing at different intervals on that basis – treating only if indicated. (4)

In the UK we brought up to believe we must encourage regular worming of adult pets for roundworms and tapeworms due to the risks to pet and human health. One doesn't have to look far to see then that this is just not a sustainable or even an evidence based argument.

Worming of a pet only treats the current infestation and after just a few days new infestations can begin to establish as the eggs and infective forms of these parasites are pretty much endemic in the environment. When I was at University, long prior to the advent of many of the newer chemicals, we were categorically told that to worm too frequently also led to a reduced immunity in the host species and greater levels of worms and egg shedding. Within only a few weeks of worming infestations have often re-established and eggs are being shed into the environment – this certainly happens more quickly than in a month, the now commonly recommended interval now by the pharmaceutical companies for the application of topical pesticides and wormers.

Parasites rarely have lifecycles that compromise or kill their hosts under normal evolutionary conditions. We do create a potential problem for many species by our manipulation of the environmental conditions under which we keep animals, but for pets its not really that intensive. And as adults we, and our pets, have evolved to live with a low level of infection, and there is even some argument that it is important to maintain health. It is at times of reproduction that parasites seek to spread to new hosts and that is why worming of bitches/queens (but not in pregnancy as some of the drugs used can be teratogenic) and young is still important as these are the times of increased risk to life. Ask yourself – if most humans have worms anyway, including tapeworms, why are we not wormed regularly?

Risks to Human health?

So if worming fails to completely prevent, should we then really be concerned over human risk from worms in our pets? Taking a couple of examples:

With the common roundworm – *Toxocara* – of particular concern is ocular toxocariasis where the larva migrates into the eye of small children It can cause blindness along with some other associated conditions such as epilepsy. So obviously very serious if the child is unlucky enough to be affected. However, a very large study in Ireland (5) failed to conclusively show that infection was linked to dog and/or cat ownership, not least because laboratory results showed a high seropositive rate (31%) of children to exposure to the parasite, but only arguably at worst 12 cases per 100,000 of eye problems relating to the worm. What did seem linked was geophagia (earth eating) and there was a suggestion that climatic conditions that supported the survival of the infective larval stage may have an impact on the higher level of cases in Ireland than other areas. Whatever, it is clear, for all the worming of Cats and

Dogs done there is no demonstrable decrease in human risk of this disease, and it is reported there are 34 million Toxocara eggs released per square kilometre per day (6), and yet it is at times described in the veterinary literature as the most common zoonosis to pass from dogs and cats to humans. Whilst exposure levels are clearly very high, also clear is the very low risk of consequent disease from Toxocara. Compare this to Toxoplasma (a protozoan) transmission from Cats which is some 10 times more commonly reported as actually causing eye problems, as well as risking the unborn child (7) And yet we don't preventatively treat for that at all – personal hygiene is the way forward there. Hygiene is arguably the way forward for Toxocara too as the eggs only become infective in the external environment and contaminated food/pica/infected water sources are in fact the main routes to human infection.

In the UK it is said that children can accidentally ingest a flea infected with the larval stage of the Tapeworm, Dipylidium caninum. Infection can lead to diarrhoea and pruritis but is rarely serious in actuality – the stress of seeing tapeworm segments in a child's stool or nappy is probably the main concern rather than it being a significant issue for human health. So again not really an argument for repeatedly chemically exposing everyone in reality.

In Europe and other countries (fortunately not the UK at the moment) there is a serious disease caused by a Tapeworm called Echinococcus granulosus. It is not that long ago I sat in a committee meeting where the Human health risks of Echinococcus granulosus entry into the UK through imported pets was raised. Human deaths occur in Europe, including in young people, from this tapeworm. With an asymptomatic incubation period of 5-15 years before clinical signs are triggered treatment is not always successful even if diagnosed. In dogs it causes no symptoms. Some have concerns (myself included) the Pets Passport scheme rules are not stringent enough to prevent this crossing onto our shores, and that scheme arguably has made the illegal import of dogs into the UK more prevalent. Considering in the UK our pets live in our houses and sleep in our beds, it would be devastating if this parasite ever got over here – if it did then routine tapeworm treatments may well be justified, but these are not really the main chemicals of concern and are a tablet format as well so faeces can be more easily disposed of responsibly. In dogs that travel there would certainly be a legitimate argument for more and targeted worming on return to the UK. Some would say why travel a dog and put it (and us) at risk at all? We certainly need more action on illegal imports and our loose borders before we have a mass panic when the first child dies, there is a press furore, and dogs are abandoned on the streets.

What about Ticks?

Clearly there is growing concern over zoonotic diseases transmitted by Ticks, with Lymes Disease being the most commonly recognised problem. But the dog itself is not going to give its owner the Lymes Disease – that will only happen if the owner is bitten by an infected Tick, and there are plenty of precautions that can sensibly put in place to manage ourselves.

Yes the dog is at risk itself, but there needs to be a logical approach to decrease risk by application of the least level of insecticide at an appropriate time that will kill the tick without it needing to bite the animal to get a lethal dose. Spot-on chemicals that rely on systemic (throughout the whole body) dissemination of the active ingredient with risk of attendant side effects, and which rely on the tick biting, are not logical to my mind. There are now very effective collars with less systemic and environmental risk (with good pet management) and which mostly kill without the need to bite, that can be used in affected regions. Although even these are not without some risk of exposure.

So clearly the Human Risk from parasites of pets is, whilst not nil, negligible and quite arguably resolved in the main by good personal hygiene. Education of pet owners I would argue would go a lot further towards reducing risk to human health than selling chemical products.

Lungworm: Angiostrongylus vasorum

On the surface this appears to be a special case, with reports of it spreading throughout the UK, or at least the reports have increased and are recorded cumulatively as the marketing has raised awareness.

However, the very marketing that seeks to strike fear into our hearts that our beloved pets will die a terrible death also contains the information to calm those fears –or does it? (8)

It is stated that there is a product that effectively resolves infections after just two doses 32 days apart (8). Great news, nothing to fear then? Do I believe that? No, nothing is that perfect, the treatment group was small, and reports are coming in of failures in preventative programmes now (from discussions with a testing laboratory). That said my experience is that it works mostly, and I would prescribe it more frequently to a confirmed infected case as it seems illogical to treat at greater intervals than the pre-patent period of the worm and expect 100% efficacy anyway. It doesn't happen that way in other species, so I don't see why it would in dogs.

At least the number of deaths is not huge. Around 6 every quarter if reports are to be believed (there may be other cases missed diagnostically, or just not reported). From that figure one has to suspect clinically asymptomatic infection is more likely and the Danish approach already discussed is more logical as a way forward. And Compare that to the estimated number of Road Traffic Accidents involving dogs in the UK, at around 100,000 investment in training and a collar might be a better focus for marketing campaigns targeting responsible dog ownership.

The main source of spread is arguably the urban fox. Data shows infection rates of foxes at around 18% (50% in the south east) (8). Keen Springwatch fans will recall the coughing fox that was chased out of its territory in Brighton and travelled miles and miles before disappearing off the radar, presumably spreading infection all along its path? Its perhaps not politically correct to blame the fox, but in my opinion the movement of pets around the country is not enough to explain the spread of a condition where even the Kennel Clubs website explains “Not every snail or slug carries the disease and lungworm's geographical limitations means infection is currently relatively uncommon, but it does rear its head from time to time”.

Logic says do not encourage urban foxes into your garden, if there has been case locally consider how best you protect your pet, but in my opinion the best route to take is to monitor your pet for infection and keep the products that are effective, effective, so they are there when you need them the most. Like antibiotics, if used indiscriminately resistance to currently effective medications is inevitable.

What are the Side effects of these chemicals? What are their impacts on the environment?

There are now so many chemicals on the market that it would be difficult in one article to assess and present them all even if they were all known about and even published. Side effects that can affect the animal, associated animals (including humans) and worryingly also the environment are rarely researched as long term issues, published or even reported. And researching a negative result takes years and massive population cohorts to determine.

Add to that the UK reporting system of reporting adverse reactions is reliant on voluntary engagement, and various surveys in the human field with such systems suggest that as high as 95% of problems are never reported at all (9)

So we have to look at data sheets from manufacturers for acute reactions, and what long term human studies there are for more information. There is also a lot of information on governing agency websites of reports of adverse reactions, and a number of campaigning groups now becoming very active on the internet and on social media over concerns with some of the products being applied to pets.

Perhaps the most commonly used insecticide in spot-on preparations in pets is **Imidacloprid - a Neonicotinoid**.

Neonicotinoids are classified by the United States Environmental Protection Agency as both toxicity class II and class III agents and are labeled with the signal word “Warning” or “Caution.” Because the neonicotinoids block a specific neuron pathway that is more abundant in insects than warm-blooded

animals, these insecticides are more selectively toxic to insects than mammals (10). Note the words – more abundant – not therefore not present....

The most available toxicity data of the neonicotinoids is with imidacloprid. These data indicate that it is less toxic when absorbed by the skin or when inhaled compared to ingestion. It causes minor eye reddening, but is non-irritating to the skin. Signs of toxicity in rats include lethargy, respiratory disturbances, decreased movement, staggering gait, occasional trembling, and spasms. There are no accounts of human poisoning, but signs and symptoms of poisoning would be expected to be those similar for rats (10).

Those are acute symptoms, but there are general population studies in **humans** reporting associations between chronic exposure and adverse developmental or neurological outcomes, including tetralogy of fallot (a developmental heart condition), anencephaly, autism spectral disorder, memory loss and tremors (11). Accepted these studies presented limited and weak data, but enough to raise concerns and a call for more research. Other studies have raised concerns over high dose exposure leading to degenerative changes in the testes, thymus, bone marrow and pancreas. Cardiovascular and hematological effects have been observed. Long term low dose exposure has been associated with effects on the liver, thyroid and weight loss. In rabbits studies have raised concerns over reproductive toxicity, developmental retardation and neurobehavioural deficits. (12) If we think of the problems we are seeing in general practice today, there has to be concern that some of the problems we see might be a consequence of acute and chronic exposure (including of Vets to animals that have had these applied). Remember always absence of evidence is not evidence of absence – it is better in my opinion to adopt a precautionary approach than to find out later one could have avoided the avoidable.

Bees. Perhaps much more importantly than the impact on our Pets, and us, is the fact that to members of the genus *Apis*, the **honey bees, imidacloprid is one of the most toxic chemicals ever created as an insecticide.** Several studies have found that sub-lethal levels of imidacloprid increase honey bee susceptibility to the pathogen Nosema. Research has found that bees consuming the pesticide suffered an 85% loss in the number of queens their hives produced, and a doubling of the number of bees who failed to return from food foraging trips.(13)

In May 2012, researchers at the University of San Diego released a study showing that honey bees treated with a small dose of imidacloprid, comparable to what they would receive in nectar and formerly considered a safe amount, became "picky eaters," refusing nectars of lower sweetness and preferring to feed only on sweeter nectar. It was also found that bees exposed to imidacloprid performed the "waggle dance," the movements that bees use to inform hive mates of the location of foraging plants, at a lower rate. (12)

Researchers from the Canadian Forest Service showed that imidacloprid used on trees at realistic field concentrations decreases leaf litter breakdown owing to adverse sublethal effects on non-target **terrestrial invertebrates.** (14)

Aphids have been found to lead to altered behavior, such as wandering and eventual starvation. Very low concentrations also reduced nymph viability.(12)

And I have heard it said that faeces from pets cause demise of local invertebrate life from some distance if left to rot away (but I cannot find any research to date on that). Clearly though it makes sense to pick up dogs mess and dispose of it responsibly if there has been a recent application of pesticide to the dog as excretion of the chemical is causing toxic levels in the environment as the BUGLIFE report shows

In January 2013, the European Food Safety Authority stated that neonicotinoids pose an unacceptably high risk to bees, and that the industry-sponsored science upon which regulatory agencies' claims of safety have relied might be flawed, (12). Thank goodness the EU has seen sense to phase these chemicals out for crops – now we must do our bit with Pets and reduce, even stop altogether, their use without clear evidence based need.

Beyond insects, Imidacloprid has been shown to be highly toxic to four **bird species**: Japanese quail, house sparrow, canary, and pigeon (12) It is reported that at imidacloprid concentrations of more than 20 nanograms per litre, bird populations tended to decline by 3.5 per cent on average annually. And this is not related to any other land use factor (15). Other reports show birds exposed to these chemicals become disorientated, lose their sense of direction, become unable to migrate

Of the neonicotinoids, imidacloprid is not only the most toxic to birds but also to **fish** (10). Imidacloprid is further highly toxic on an acute basis to **aquatic invertebrates** so it is especially worrying that the 2016 report by BUGLIFE on Neonicotinoid Insecticides in British Freshwaters (1) specifically implicated veterinary topical applications and flea collars as the most likely source of pollution with Imidacloprid in some catchment areas. Neonicotinoids are persistent, stable and long lasting in the environment. They recommended a thorough review of the use of ectoparasite treatments and their use should immediately be suspended in the UK .

According to the European Food Safety Authority, imidacloprid poses a potential high acute risk for herbivorous and insectivorous **birds** and granivorous **mammals**. While chronic risk has not been well established (12) (scientific parlance for – we don't know but we don't want to say its safe).

It is notable that the data sheets that come with spot-on products containing imidacloprid do not routinely carry the warning that the chemical should not be allowed to enter water courses as it has harmful effects on aquatic organisms. Quite arguably (as noted) nor should the pet be allowed to urinate or defecate anywhere where environmental contamination might result (so pretty much everywhere) and waste disposed of responsibly. This is in my opinion a travesty as harm is being done now.

Imidacloprid is just one of the many treatments marketed for regular use in the UK on pets. Controversies over this and other products are growing, with websites and social media sites now picking up on concerns and gathering huge amounts of data on cases (see further reading). So why is more action not being taken to highlight and reduce the use of these products to a situation similar to that mentioned in Norway and Denmark?

And will the use of regular treatments when there is no need produce resistance to the chemical in the fleas, worms and ticks? Speaking to one laboratory recently they are now seeing cases of Lungworm not responding to Imidacloprid so problems may be starting already

So how do we go forward logically and sensibly?

There needs to a common-sense proportionate risk based assessment of the need for control of parasites in pets.

Clearly other countries are leading the way and regard the environmental impacts as more important than occasional infection in pets. Treatment is not prevented, it just must be with correct diagnosis and investigation and the response be proportionate to the risks. This is no different than the current initiatives for antibiotic reduction that are widely recognised as responsible, even if there are individual casualties from time to time.

Consumers in general and the pet-owning public in particular need to be more mindful and questioning rather than trusting what they are told by manufacturers and those with a vested interest in selling products. Vets need to take the lead and educate the public to only use these products when absolutely necessary and only after diagnosis and only in the correct amounts to resolve a problem efficiently and effectively with appropriate disposal of any contaminated waste and fluids (stools, urine, waste from shampooing).

If applying any topical insecticide keep the pet away from children until it can be guaranteed that it is safe for them to be in contact.

Our recommendation (at this time) is

Firstly before putting chemicals on your pet ask yourself - would you willingly apply pesticides and other chemicals to your children on a monthly basis? If not then why are you doing this to your pets? And anyway is the low-level exposure of humans as a result a potential route for harm? And what are the risks for the environment from using that product?

Then consider

1. In Tick areas where the ticks are known to carry disease risk, use effective collars that act both as insecticide and repellent. Take these off on walks if the dog is going into water
2. For ALL worms only to worm adults based on need. Send regular faeces samples to a laboratory for monitoring (2-4 times annually). Treat only for species identified as a concern, and at high levels indicating a problem.
In all cases where worms are found in quantity investigate for concurrent disease that might have an impact on the immune system.
3. Worm Cats and Dogs once they have given birth, and worm puppies and kittens through the at risk period.
4. For Fleas and other ectoparasites, treat on first sign of infestation with an effective product until the problem is resolved. If concerned over long term problems use an effective collar during the spring/summer months, but take these off on walks if the dog is going into water

References:

1. Neonicotinoid Insecticides in British Freshwaters: 2016 Water Framework Directive Watch List Monitoring Results and Recommendations. Shardlow M 14 Dec 2017 available online
2. Data alchemy: discover why your top 20 per cent of clients are pure gold. E Ward Veterinary Business Journal. May 2016
3. Norway and the UK: Compare and contrast. Companion Dec 2017 Pg 19
4. Personal Communication referencing Danish Code of Conduct for Vets
5. Ocular Toxocariasis in Schoolchildren. Good B. et al CID 2004:39 (15 July) 173-178
6. Data in marketing literature for Milbemax wormer from Elanco
7. Zoonotic parasitic infections contracted from dogs and cats: How frequent are they? Schantz P DVM360 01-03-07
8. Data in marketing literature for Advocate from Bayer
9. Drug Safety: Side effects and mistakes, or adverse reactions and deadly errors? Carleton BC and Smith MA BCMJ, 48, 7 Sept 2006 329-333
10. Pesticide Toxicity Profile: Neonicotinoid Pesticides. Fishel MM University of California
11. Effects of Neonicotinoid Pesticide Exposure on Human health: A Systematic Review. Cimino A et al. Environmental Health Perspectives July 2016
12. Wikipedia: Imidacloprid - apologies, I don't usually reference Wikipedia, but there is some good summary data here.
13. Whitehorn, P. R.; O'Connor, S.; Wackers, F. L.; Goulson, D. (2012). "Neonicotinoid Pesticide Reduces Bumble Bee Colony Growth and Queen Production". *Science*. **336** (6079): 351–2. doi:10.1126/science.1215025. ISSN 0036-8075. PMID 22461500
14. Kreutzweiser, DP.; Thompson, DG.; Scarr, TA. (May 2009). "Imidacloprid in leaves from systemically treated trees may inhibit litter breakdown by non-target invertebrates". *Ecotoxicol Environ Saf*. **72** (4): 1053–7. doi:10.1016/j.ecoenv.2008.09.017. PMID 18973940.
15. Hallmann, C.A.Hallmann; Foppen, Ruud P. B.; Van Turnhout, Chris A. M.; De Kroon, Hans; Jongejans, Eelke (2014). "Declines in insectivorous birds are associated with high neonicotinoid concentrations". *Nature*. **511** (7509): 341–3. doi:10.1038/nature13531. PMID 25030173.

Further Reading and information

For regular wormcounts to see if your pet has an infestation go to www.wormcount.com (note I have no financial association with this laboratory)

Veterinary Pharmacovigilance in the United Kingdom Annual Reviews (available online)

European Medicines Agency – Veterinary Pharmacovigilance bulletins (available online)

Conclusions of the Worldwide Integrated Assessment on the risks of neonicotinoids and fipronil to biodiversity and ecosystem functioning. Van der Sluijs JP Environ Sci Pollut Res DOI 10.1007/s11356-014-3229-5

www.beyondpesticides.org - a useful database of information