Fleas and ticks have been around for a long time, but we still have much to learn about these parasites, particularly with regard to their control and the vector-borne diseases that they can transmit. Changing climate, increased feral hosts, and reduced use of toxic environmental insecticides has contributed to population booms in both fleas and ticks. Now more than ever pet owners need quality veterinary advice on how to control these ectoparasites to protect the health of their pets as well as their own health. Our efforts are stymied, though, by the fact that flea control products are now available over-the-counter and many people know very little about the life cycle of these pests and the diseases they can carry. Furthermore, the diversion of veterinary products into the OTC market allows for the misuse of these products, with increased reports of side effects and/or toxicoses and perceived product failures. It is very important that veterinarians provide flea control advice to their clients. This advice can be given in the form of handouts, videos, and referral to some of the great information on line provided by Bayer, Elanco, Merck, and Merial. There are videos, downloads, and explanations that are fun for clients. My favorite is “The Dirt On Fleas” a video made by Dr. Michael Dryden, available at the website for Comfortis (http://www.comfortis4dogs.com/about-comfortis/testimonials.aspx). Many of these sites offer email reminder services for clients to help them remember to apply their flea control every 30 days. We can also take advantage of our veterinary technicians as well as our receptionist, but we need to make sure that they understand the flea life cycle and can explain it to their clients. Excellent information is also available about ticks. As one example, Merck has an excellent website for Scalibor (http://www.scalibor-usa.com/), which discusses tick control and has user-friendly videos as well as tools to identify ticks. Finally, excellent information for clients and veterinarians is available at Dr. Michael Dryden’s website (http://www.drmichaeldryden.com/); he has excellent videos of questing ticks, as well as downloadable handouts and a link to the video “The Dirt on Fleas.” I have enclosed a copy of the flea control handout we use in our practice. Additional sites include http://www.vectrapet.com for videos about life cycles and how Vectra 3D works, and http://www.petparents.com/show.aspx/products/advantage-ii-for-dogs/flea-fun-facts.

Fleas

We have some differences in the way we approach dogs and cats with flea infestations compared to those with flea allergies. With regard to infestations, there are some basic facts that the client needs to know and some myths that need to be busted. The major flea infesting the dog and cat is Ctenocephalides felis, and like many insects, it undergoes metamorphosis. The female flea feeds on blood in order to lay eggs, and under ideal conditions she can lay 50 eggs per day. Adult fleas spend their lifetime on their host, but the flea eggs will roll off into the environment where they hatch into
larvae, pupate, and then emerge as adults. The life cycle is variable and dependent on environmental conditions as well as the availability of hosts. For every one flea seen on the pet, there are many more in the environment in the form of eggs, larvae, and pupae and control measures have to address not only the fleas seen on the pet but those remaining in the environment. We know these facts, but most clients don’t. Because they don’t, they have unrealistic expectations about flea control and make poor decisions about how to use it.

There is much talk about flea resistance to the products we use for flea control; however, most of this is perception not fact. It is very true that fleas have become resistant to older insecticides such as organophosphates or carbamates, but it is yet to be proven that fleas have become resistant to fipronil, imidocloprid, or selamectin. In most cases, failure of flea control is due to one or more of the following reasons:

1. The product is not being used every 30 days throughout the year.

2. Flea control products are not being used on all the dogs and cats in the household.

3. The flea control products are not being applied directly to the skin correctly and at the right dose.

4. One tube of flea control is being used on more than one animal.

5. Our pets are being exposed to other dogs or cats who have fleas and who are not being treated with flea control products regularly. In particular, many people will feed feral or semi-feral cats in their yards, which encourages the accumulation of eggs, larvae, and pupae in that yard in protected places.

6. Our pets are being exposed to fleas from wildlife. It has been shown that possums can carry up to 1000 fleas per animal! A significant source of fleas are feral cats, populations of which are increasing in many urban areas. Many of these animals are nocturnal and may or may not be appreciated by the pet owner.

7. Pets are being exposed to fleas in areas under porches, in sheds, or under trees where the wild vectors may congregate at night!

8. Unreasonable expectations: no flea product we use, whether oral or topical, will truly repel fleas, although there may be some repellency associated with permethrin. It can take anywhere from 30 minutes to 24 hrs for a flea to die, depending on what product is used and the time after application. Some products disable the flea from effectively feeding before they die, which is why good flea control helps pets that are allergic to flea saliva. If flea control is not used until adult fleas are seen, it will take 8-12 weeks to get rid of fleas in the
environment, as they complete their life cycle and become adults. So, the fleas that are seen today are not the same fleas that will be seen tomorrow.

We can help reduce the length of time it takes to get good control by using integrated pest management. We can utilize products that contain insect growth regulators as well as adulticides, and in some cases, we need to recommend environmental treatment as well.

What about the flea surge? Each part of the country that supports fleas will have times at which the flea numbers increase greatly. For my part of the country, numbers of fleas surge in the spring and again in the fall. These are times at which the climate is perfect.

Flea allergy is special! How many times have we heard from our clients (especially for indoor cats) that fleas cannot be the cause of the skin disease because they never see fleas. That is the time to pull out the flea comb and see what can be found. But it is important to know that failure to identify fleas or flea dirt is not proof that fleas are not the cause of dermatitis. Flea allergic pets have been shown to have fewer fleas or flea dirt than nonallergic pets because they do so much grooming. The best way to rule out flea allergy is by response to treatment. Capstar (nitenpyram) is one of the most effective flea control products we have and the killing effects of one dose persist for 48 hrs. A Capstar trial can be used in both dogs and cats to determine the role of fleas in pruritus. Capstar can be given every other day for one month. If fleas are the sole cause of the itch, the pet will be dramatically improved, and a regular flea control program can be started that will work for them.

The best source of information about parasiticides can be found at the CAPC website. You can download a PDF for those used in dogs, and one for cats as well (http://www.capcvet.org/resource-library/). We do not need to review each of these, but we can make a few comments about specific products that are relatively new. There are two ways to approach flea control: orally or topically. The appearance of spinosad (Comfortis, Trifexis) revolutionized oral flea control for many allergic pets, because these animals often need frequent bathing. In addition, many clients prefer the oral route because they don’t like the smell or the appearance of the coat after topical products are applied, they have observed topical drug eruptions, and/or they are concerned about transfer of the chemical to their children. Spinosad has been reported to be effective for ticks as well, but tick control requires weekly administration and spinosad is not the best choice. Spinosad is labeled for use every 30 days but it is very clear that efficacy falls off after two weeks, and for the flea allergic pet it may be necessary to advise administration every 2 weeks (unpublished data from Dr.’s Michael Dryden and Byron Blagburn, as well as published data). Still, this is preferable to having to use Capstar every other day. Lufenuron, present in Program and Sentinel remains a great product and I like to use Sentinel combined with Comfortis because we then get both adulticide and insect growth regulator with this combination. We see quite a few patients that utilize Sentinel as their sole flea control; it is important to remind people that there is no adulticide activity in this product. In addition, it is very important
that spinosad be given with a full meal to maximize absorption. The appearance of the isoxazoline class has really revolutionized flea and tick control, and offers a striking new treatment for mites! Afoxolaner (Nexgard, Merial) is given every 30 days by mouth, and provides excellent flea and tick control. It can be given with or without food and is approved for use in dogs of 8 weeks of age or older. Fluralaner (Bravecto, Merck) also provides excellent flea and tick control. It is given every 3 months with food; if Lone Star tick is of concern then every 2 months is recommended. Bravecto is approved for use in dogs 6 months of age or older.

The other route for flea control involves topical administration. The efficacy of most topical products may be affected by frequent dermatologic bathing, although good killing can persist for 30 days when bathing is done weekly. Reduced efficacy would have major effects on those pets allergic to fleas. Many veterinarians have made the decision to stock flea control products that are not readily available over the counter. Because of the issues with diversion, at our practice we do not stock Frontline, Frontline Plus, Advantage or Advantix, because we can’t compete with the pricing available to clients through on-line pharmacies or local distributors such as Petco or Petsmart. These remain excellent products, but it is worthwhile noting that compared to Advantage, Advantage Multi (imidacloprid with moxidectin) has improved efficacy against fleas (data from Dr. Byron Blagburn), and it provides excellent heartworm protection as well as efficacy against several mites. It can be useful in dogs with mild to moderate demodicosis when used weekly, and in some cats with Demodex gatoi if used every other week for 3 months. Another useful multifunctional product is Revolution (selamectin). If used every 30 days it provides excellent flea control for cats and dogs, and when used every 2 weeks is great for treatment of sarcoptic mange, cheyletiellosis, and ear mites. It is NOT effective against Demodex mites in dogs or cats. There are many new products containing fipronil these days; Merial has recently come out with Certifect, containing fipronil and amitraz. This product has improved efficacy against ticks. Unlike Promeris (metaflumazone with amitraz) which is no longer available, it is NOT expected to be efficacious against Demodex as the percentage of amitraz is lower. Promeris was a good choice for Demodex in dogs, but some dogs developed pemphigus foliaceus following one or more applications. There is very early anecdotal evidence that Certifect may also cause PF-like eruptions in a small percentage of dogs, but this remains to be proven. Merial has a topical product containing fipronil, methoprene, and cyphenothrin for dogs, or etofenprox for cats (Frontline Tritak). Data from Merial suggest a very rapid kill for fleas and ticks. Vectra (dinotefuran and pyriproxifen) and Vectra 3-D (dinotefuran, pyriproxifen, and permethrin) have been useful to us in Texas, particularly along the coast where Culicoides and mosquitoes may contribute to skin disease. Similar results have been seen in Florida, where Culicoides hypersensitivity may be more common in dogs (personal communication, Dawn Logas). We have had several successes with Vectra-3-D in dogs that did not do well with Comfortis, and its permethrin may help provide some tick control as well. Alternatives could include the Scalibor collar and the new Seresto collar from Bayer, but time will tell how these collars perform in the southeastern US and Texas!
Fleaborne diseases potentially transmissible by C. felis to humans include cat scratch fever (Bartonella henselae), other Bartonella spp., murine typhus (Rickettsia typhi), flea-borne spotted fever/cat flea typhus (Rickettsia felis), plague (Yersinia pestis), and the tapeworm Dipylidium caninum. It is disturbing to note that 58% of stray cats can be positive for Bartonella spp, and up to 90% of the fleas that infest them positive. Fortunately, the prevalence in pet cats is much lower (3%). In addition to causing anemia in cats and dogs by blood loss, C. felis also carries Mycoplasma spp which cause anemias in cats (M. haemominutum, M. haemophilus).

**Canine demodicosis**

Canine demodicosis has traditionally been divided into juvenile and adult onset forms, as well as localized and generalized form. It is commonly accepted that the tendency to develop juvenile generalized demodicosis is an inherited trait, and for that reason we recommend against breeding these dogs. We also recognized that when females come into estrus, demodicosis can relapse; ovariohysterectomy is therefore recommended not only to prevent breeding but to help control the disease. Adult onset demodicosis is recognized commonly, and we often find an underlying cause to include immunosuppressive therapy, endocrinopathies such as hypothyroidism and canine Cushing’s disease, any systemic or metabolic disease, and neoplasia. But not all dogs with adult onset demodicosis have an identifiable underlying cause; we recognize in some breeds (e.g. the Shih Tzu) the tendency to develop adult onset demodicosis. In particular we recognize the development of deep pyoderma in the feet which responds to antibiotics but relapses. These dogs are rarely curable, so they require maintenance mitecidal therapy for life.

Why dogs develop generalized demodicosis remains poorly understood. We still don’t completely understand the immune response to these mites, or the influence of local factors in the skin that regulate their growth. It is suspected that both humoral and cell mediated immunity contribute to mite control. There is an association between mite overgrowth and production of anti-inflammatory cytokines such as TGFbeta and interleukin-10; these cytokines have suppressive effects on the immune system, and treatment has been shown to reduce their levels.

We have always believed that all dogs have Demodex mites, albeit in low numbers, but it has been difficult to demonstrate by skin scrapings or hair plucks from normal dogs. Recently though, this belief was corroborated by using real time PCR from material associated with plucked hairs. These experiments confirmed that mites do live in very low numbers in normal canine skin. BUT when we find even one mite on skin scraping, it likely suggests clinical relevance and disease.

Three mite types have been described in the skin of dogs. The traditional follicular mite is Demodex canis. A long-tailed mite Demodex injai has been described that is often associated with dorsal greasy skin in terrier dogs, and a short tailed mite, called Demodex cornei, that is found together with D. canis in some dogs. Recent analysis by
PCR has shown that while D. injai appears to be a novel species, D. cornei is actually a morphologic form of D. canis, the follicular mite.

Diagnosis of demodicosis is most commonly made by deep skin scrapings, but hair plucks are very useful particularly around the eyes and feet. Several hairs are plucked and placed in mineral oil; the slide is examined as we would for a deep skin scraping. Occasionally biopsy may be necessary when lesions are fibrotic (e.g. in the feet) and for the Shar Pei. It is important to note that skin scrapings are rarely negative if they are done correctly; capillary ooze is what we are hoping to achieve. In contrast to scabies, we do not do treatment trials to rule out demodicosis when we don’t find mites.

Treatment options for demodicosis in dogs are varied. The only approved treatment is amitraz dips (Mitaban). Most clinicians use oral ivermectin daily, achieving a final dose of 0.4 to 0.6 mg/kg/day. Several breeds of dog, including the Collie, have a mutation in an efflux pump (MDR-1) that increases their sensitivity to the drug. A PCR-based test is available at Washington State University to determine if dogs carry this gene (http://www.vetmed.wsu.edu/depts-VCPL/test.aspx); this website gives the breeds of predisposition and the percentages of dogs in that breed that carry the gene. If the results are reported at normal/normal, ivermectin can be used, even in Collies. We still recommend stepping up the dose slowly though as ivermectin toxicosis has more than one mechanism. It is critical to avoid the use of spinosad when using high dose ivermectin, as it precipitates ivermectin toxicosis. We are often asked when we can restart the spinosad after stopping the ivermectin. A good rule of thumb is about 5 half lives; our toxicology friends suggest 10-14 days should be helpful. And if you want to use ivermectin, wait 2-3 weeks after stopping the spinosad.

Other treatments include injectable doramectin given weekly by subcutaneous injection, oral moxidectin given daily, oral milbemycin given at 2 mg/kg/day, and topical moxidectin applied weekly in the form of Advantage Multi. The latter only seems to work well in dogs with low numbers of mites and mild demodicosis.

One of the most exciting new findings is the efficacy of fluralaner and afoxalaner for the treatment of demodicosis. One paper has been published about fluralaner (Bravecto, Merck), but we are rapidly accumulating evidence that afoxalaner (Nexgard, Merial) is equally effective. Bravecto given orally every 2-3 months or Nexgard given every 30 days seems to provide a very rapid kill of Demodex mites. For dogs that need long term mite control, using these products according to label may well prevent relapse while controlling fleas and ticks!

**Feline demodicosis**

Cats have a follicular mite, Demodex cati, and a surface mite Demodex gatoi. Recently a third mite has been identified by PCR, but its role in skin disease has not yet been identified. Demodex cati, the hair follicle mite, has been identified as a cause of chin acne, particularly in older cats, and it can sometimes be found within the ear canals of cats with ceruminous otitis externa. In these cases, there may be no identifiable underlying cause. Some cats treated with inhalation steroids have developed localized demodicosis on the muzzle. More extensive infestation with D. cati has been associated with serious systemic diseases (neoplasia, metabolic disease) or retroviral infections. More commonly we see the short tailed mite, D. gatoi, as a cause of hair pulling in cats, particularly on the abdomen.

Diagnosis of D. gatoi is made by skin scrapings, but it is not always possible to find the mites. It may
be helpful to do a fecal exam. We have also found it helpful to do skin scrapings on the unaffected
cats in the household as they seem to carry more mites. Because we can't rule out D. gatoi on the
basis of negative skin scrapings, therapeutic trials are recommended. Key historical clues include a
poor response to steroids, a history of a new cat in the home, and/or a cat that goes outside. This mite
is not sensitive to selamectin or other routine methods of flea control. The treatment of choice has
been weekly lime sulfur dips for 6-8 weeks, but this treatment is not 100% effective. Some cats will
respond to the use of Advantage Multi applied every 2 weeks for 3 months; the moxidectin is the active
ingredient. Ivermectin given at 0.3 mg/kg every other day, or oral milbemycin give daily or every other
day have been used. Some cats resistant to any of these treatments can be successfully treating with
½ strength amitraz dips every 2 weeks for 3 treatments. Because this mite is contagious, it is
important to treat all in contact cats. I have found in my patient population that the pruritus in these
cats is only partially responsive to mite eradication. We go on to perform allergy testing for these cats
and discover that they are atopic. Perhaps cats that are symptomatic with D. gatoi are similar to dogs
with sarcoptic mange: atopic predispositions can set these patients up for a severe allergic reaction to
the mites.

Updates on Sarcoptic Mange

Sarcoptic mange is easy to diagnose in its classic form (young dog with crusting on the ears,
elbows, body with demonstrable mites), but it is important to consider this mite in older dogs as
well. We don't always find the mite with skin scrapings, so it is important to rule out this
possibility by treatment. My suspicion is raised when I see an older allergic dog that suddenly
has a relapse of severe itch. Skin scrapings in these patients are often negative, so a
treatment trial is warranted.

I usually recommend selamectin (Revolution) or imidacloprid/moxidectin (Advantage Multi,
Bayer) for treatment, asking the owners to apply it every 2 weeks for 3 treatments. This will
provide flea control as well, which is important in many parts of the country. It is important to
note that avermectin resistant scabies has been identified; there is one case report in Japan but
we are identifying these cases in some areas in the USA. For those dogs, treatment options
could include amitraz dips, lime sulfur dips, and weekly Frontline sprays.

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