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Current trends in the treatment of *Sarcoptes*, *Cheyletiella* and *Otodectes* mite infestations in dogs and cats

CATHY F. CURTIS

7 Chadwell, Ware, Hertfordshire, UK

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Abstract For a number of reasons, several of the more 'traditional' ectoparasiticides in the small animal veterinarian's armoury have been withdrawn over the past few years. New, safer products which are long-acting and easier to apply than the conventional dips, rinses and aerosol sprays of the past have replaced them. However, relatively few such novel acaricidal preparations have become commercially available. Consequently, practitioners and researchers frequently experiment with the drugs they have at their disposal to assess their efficacy against a variety of target acarids when used at different dosages and/or via different routes of administration, compared with those recommended by the manufacturer. This paper reviews the anecdotal and peer-reviewed reports describing the use of modern acaricides in dogs and cats that have recently appeared in the veterinary literature. It should be stressed, however, that no medicine should be prescribed for extra-label use without the informed consent of the owner.

Keywords: canine, cheyletiellosis, feline, otocariosis, sarcoptic mange, therapy.

SARCOPTIC ACARIOSIS (SARCOPTIC MANGE)

Aetiology

Sarcoptic mange is a highly contagious, nonseasonal, pruritic skin condition caused by infestation with the burrowing mite *Sarcoptes scabiei.* The disease affects many mammalian species and the variant *S. scabiei* var. *canis* occurs commonly in domesticated dogs. In contrast, sarcoptic acariosis is rare in the cat.

The traditionally held view is that mites are contracted by direct contact with an infested dog or fox but indirect infestation via fur or fomites has also been reported. Additionally, *Sarcoptes scabiei* var. *canis* has been isolated from species other than domestic and wild canids and has been experimentally established on rabbits, guinea pigs, sheep, goats, calves, cats and humans. This lack of host specificity has therapeutic and public health implications; theoretically, all mammals in contact with an infested individual should be treated simultaneously to limit the opportunities for cross- and re-infestation, and an acaricide should also be applied to their environment (see below).

Signalment and clinical signs

There are no reported age, breed or sex predilections for sarcoptic mange. In dogs, the disease typically presents as an intensely pruritic, papulocrustous dermatosis affecting the periocular skin, pinnal margins, elbows and hocks, which in time may generalize (Figs 1 and 2). A positive pinnal–pedal scratch reflex is also present in the majority of dogs.[1]

Diagnosis

Historically, the sudden onset of intense pruritus in one or more localized areas, which enlarge with time, is strongly suggestive of sarcoptic mange. Definitive diagnosis relies on the demonstration of mites and/or their eggs and this is possible using skin scrapings, dermatohistopathology or faecal flotation. Each of these tests is relatively insensitive however, and when mites evade detection, serological tests for circulating anti-*Sarcoptes* IgG determination by enzyme-linked immunosorbent assay may be useful.[2–4]

An alternative and commonly used diagnostic 'test' is a therapeutic trial. This has its limitations, however, because modern acaricides are capable of killing several different ectoparasite species, hence a favourable response to therapy is not absolute confirmation of sarcoptic mange.

Current treatment recommendations

A number of different acaricidal products are effective against *S. scabiei*. In North America, a 2.5% lime sulfur dip (LymDip®; DVM) is licensed for weekly use, but despite its wide safety margin in small animals, its foul odour and potential for staining light-coloured coats make it unacceptable to some owners. The monoamine oxidase inhibitor, amitraz (Aludex® (UK) Intervet; Mitaban® (North America) Pharmacia Animal Health), is an alternative topical scabicide and is applied as a 0.025%, sponge-on solution.[5] In the UK, the product is licensed for weekly use but in the USA, the manufacturers recommend a fortnightly treatment

Correspondence: Cathy F. Curtis, 7 Chadwell, Ware, SG12 9JX, UK. E-mail: cf.curtis@btopenworld.com

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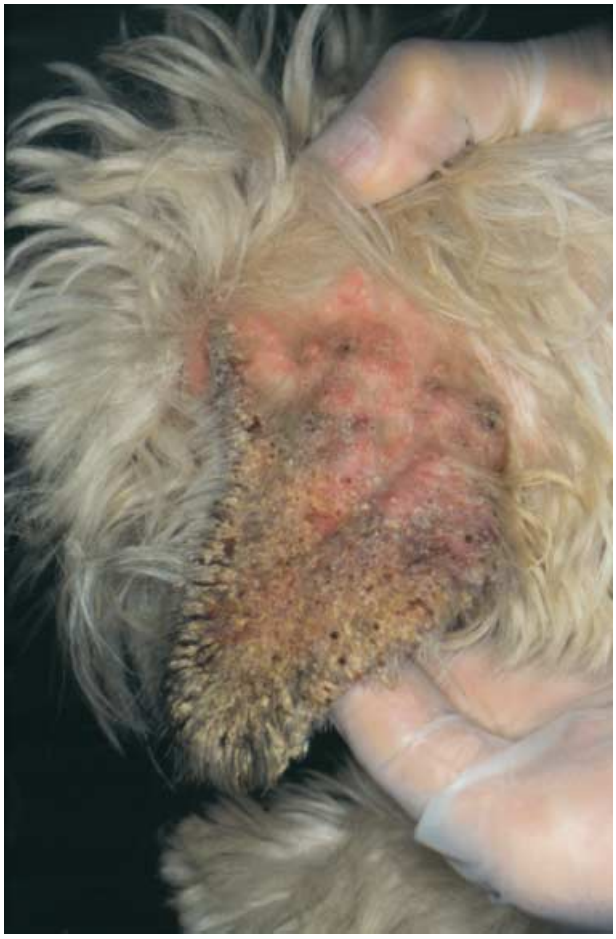

Figure 1. Left pinna of a Lhasa apso with advanced sarcoptic mange. Note the marked crusting of the entire pinna and the papules at its base.

Figure 2. Dorsum of a Japanese Akita with generalized sarcoptic mange showing crusting and hair loss.

interval. To improve acaricidal:skin contact, clipping is recommended for dogs with long and/or dense coats. Amitraz should not be used in Chihuahuas, in pregnant or nursing bitches or puppies less than 3 months of age. Care should be exercised if the product is being handled by, or applied to, a diabetic owner or patient, respectively, as individuals exposed to the active component and its vapours can develop transient hyperglycaemia. It should also be borne in mind that the α_2 adrenoreceptor agonistic properties of amitraz may induce central nervous system (CNS) depression, bradycardia and sedation and that these effects can last for 24 h following application. The drug is not licensed for use in cats but anecdotally it is has been described as an effective feline acaricide, although it must also be used with caution in this species.

Fipronil (Frontline Spray®; Merial Animal Health) is an γ-amino butyric acid receptor inhibitor and the 0.25% solution formulation, applied by pump spray at 3 ml kg^{-1} on three occasions at 3-weekly intervals, has been used to control an outbreak of scabies in a litter of puppies.[6] It has also been used successfully as a sponge-on in adult dogs when applied once weekly for 2 weeks at 6 ml kg^{-1}.[7] In the author's opinion, fipronil is mainly indicated for early sarcoptes mite infestations, or for those individuals in which the use of alternative products are contraindicated (e.g. very young puppies and pregnant or nursing bitches).

Systemic therapy offers an attractive alternative to topical treatment and several systemically acting macrocyclic lactones, e.g. ivermectin (Ivomec®; Merial Animal Health), milbemycin oxime (Interceptor®; Novartis – not available in the UK), moxidectin (Cydectin®; Fort Dodge Animal Health) and selamectin (Revolution® (USA); Stronghold® (UK); Pfizer) have been used successfully for the control of canine sarcoptic mange. With the exception of selamectin, these drugs are not licensed for this purpose and owner consent should be obtained prior to their off-label use. Ivermectin can be administered by subcutaneous (sc) injection, orally or topically as a pour-on, but owing to the possibility of an idiosyncratic reaction in collies and sheepdogs, it should not be used in these breeds or their crosses as it can affect the CNS causing ataxia, tremors, mydriasis, salivation, depression and even coma and death. Initial experimental reports in other breeds indicated that a single sc dose of 200 μg kg^{-1} was effective, however, a course of treatment is preferable as this ensures that larvae emerging from the relatively resistant ova are also killed. A more reliable regimen may therefore be the administration of 200–400 μg kg^{-1} every 7 days orally, or every 14 days sc for 4–6 weeks.[8] For convenience and when large numbers

of animals are involved, the pour-on formulation may be a useful and economical alternative.[9]

Several trials involving milbemycin oxime as an alternative treatment for canine sarcoptic mange have recently been conducted. Using a dosing regimen of 2 mg kg^{-1} every 7 days on 3–5 occasions, success rates ranging from 71 to 100% have been reported,[10–12] and another anecdotal study claims a 98% success rate with 1 mg kg^{-1} administered every 2 days on eight occasions.[13] Although more expensive than ivermectin, milbemycin is fairly well tolerated in collies and related breeds and is therefore a safer alternative therapy in high-risk breeds; however, some collies were found to be sensitive to higher dosages hence accurate dosing is essential. The drug is principally marketed as a canine heartworm prophylactic and is not available worldwide.

There is one anecdotal report of the off-label use of moxidectin to treat canine sarcoptic mange. Thirty-seven of 41 dogs given 0.2–0.25 mg kg^{-1} either orally or by sc injection weekly for 3–6 weeks were cured but side effects such as urticaria, angioedema and ataxia were observed in 7 of the animals.[14]

Selamectin is a novel avermectin and to the author's knowledge, its spot-on formulation is the only systemic treatment licensed for the control of canine sarcoptic acariosis. Its ease of application and apparent safety in collies and related breeds make it a very appealing product and field studies conducted by the manufacturers reported comparable efficacy rates to a reference positive-control product when the drug was applied at 6–12 mg kg^{-1} on two occasions, 30 days apart.[15] However, the author and other dermatologists have anecdotally reported delayed responses to selamectin and a small number of treatment failures when using the drug according to the manufacturer's recommendations and are concerned by the potential misinterpretation of a poor response to a therapeutic trial. Consequently, many are advocating that selamectin be used primarily in confirmed cases and that it be re-applied every 2–3 weeks on at least three occasions, provided that owners are informed of, and consent to this extra-label use of the drug.

Whichever scabicidal therapeutic regimen is prescribed, all dogs known to have been in recent contact with the affected animal should be treated concurrently and grooming equipment, bedding and the domestic environment should be treated with an appropriate acaricidal spray (e.g. one containing permethrin) to prevent possible re-infestation from these sources. Attempts should be made to limit socialization and mixing with other dogs and foxes, and persistently affected humans should consult their doctor to assess whether they themselves require scabicidal therapy. Dogs with unconfirmed scabies which fail to improve within 3–4 weeks should be re-assessed and their diagnostic approach re-evaluated as atopic dermatitis, flea bite hypersensitivity, dietary intolerance, pyoderma, *Malassezia* dermatitis and pemphigus foliaceus are important differential diagnoses for sarcoptic mange.

CHEYLETIELLOSIS

Aetiology

Cheyletiellosis is typically a mild, albeit very contagious dermatosis caused by mites living on the skin surface. *Cheyletiella yasguri* is the species most frequently isolated from dogs, but as a family Cheyletiellidae are not believed to be host specific and may readily transfer between dogs, cats and rabbits, although *C. blakei* and *C. parasitovorax* are most commonly associated with the latter host species, respectively. Humans in contact with pets carrying *Cheyletiella* sp. may also become transiently infested and develop pruritic papular lesions on the torso and arms.

Signalment and clinical signs

Cheyletiellosis affects animals of both sexes and in practice, is most commonly diagnosed in pet rabbits. Young animals are particularly susceptible and in the author's experience, canine infestations appear to be more prevalent in the boxer and cocker spaniel breeds. Pruritus is variable and lesions typically occur on the dorsum and are characterized by mild erythema and excessive scaling (Fig. 3). In cats, papulocrustous lesions (miliary dermatitis) may also develop, and dogs may be affected by pyotraumatic dermatitis. An asymptomatic carrier status also exists and this should be borne in mind when tackling problem cases in which repeated re-infestation and zoonotic transmission is occurring.

Diagnosis

The simplest diagnostic test is to sit the animal on a dark surface and to dislodge some of the scale from the skin surface, which on closer inspection may appear motile ('walking dandruff'). Mites and eggs can also be harvested using adhesive acetate tape ('Scotch tape®'), superficial skin scrapings and faecal flotation.

Cheyletiella sp. mites are usually present in large numbers, but occasionally they are difficult to detect, as demonstrated in two studies where investigators failed to recover mites in 15% of dogs and 58% of cats.[16,17] Therapeutic trials with reliable acaricides are therefore indicated in suspected cases but for the reasons explained above, they can only definitively rule out and not confirm a tentative diagnosis of cheyletiellosis.

Current treatment recommendations

There are currently no veterinary licensed products specifically indicated for the treatment of cheyletiellosis. The mites are susceptible to several of the insecticidal/acaricidal formulations which are available, however, and weekly application of lime sulfur dips, pyrethrin sprays or shampoos or amitraz solution, in conjunction with regular treatment of the environment, is effective although care should be exercised when using the latter two products in cats as this species is particularly sensitive to these drugs. Alternative topical treatment options for dogs and cats are two applications of either a 0.25% fipronil spray[18] or the 10% concentrated solution (Frontline Spot-On Dog®;

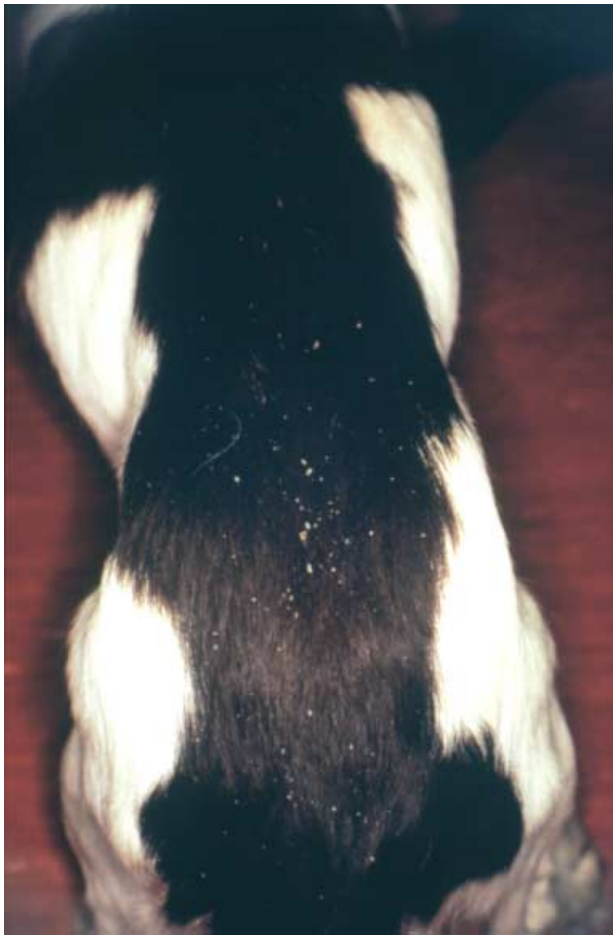

Figure 3. Springer spaniel with cheyletiellosis, typified by dorsal scaling and some areas of hypotrichosis, presumably due to self-trauma.

Merial Animal Health)[19] at 30-day intervals. In both dogs and cats, weekly bathing with a 1.0% selenium sulfide shampoo (Seleen®; Ceva) on three occasions is also efficacious, but clients need to supervise the animal at all times during the shampoo/skin contact time as the product is poisonous if ingested, and they should wear gloves when applying the shampoo. Owners of white animals should be warned that the product can occasionally stain the coat pale orange.

Animals that resent or do not tolerate topical therapy can be treated systemically with oral or injectable ivermectin at 200–300 μg kg^{-1} at 7 (orally) to 14 (sc) day intervals for 6–8 weeks[8] providing the associated risks of adverse reaction are considered and the owner gives informed consent (see 'Sarcoptic mange; Current treatment recommendations' above). Another recent study reported the successful use of a 0.5%, alcohol-based pour-on ivermectin formulation (Ivomec Classic Pour-On for Cattle®; Merial Animal Health) when applied to the withers of 16 infested cats at fortnightly intervals on four occasions.[20] Clinical signs resolved in all 16 cats, but a single *Cheyletiella* spp. egg of undetermined viability was detected 45 days after the final treatment. Ivermectin applied by this route was well tolerated but a few animals developed a transient, alopecic patch and mild scaling at the site of application. It should also be remembered that kittens are more susceptible to the toxic effects of this drug than adult cats with rare reports of lethargy, ataxia, coma and even death occurring within 1–12 h of administration.[21]

Selamectin may provide a safer alternative, as the results of a recent open, pilot study in which it was applied to 15 infested cats at monthly intervals on three occasions were promising.[22] In the absence of environmental control, all 15 cats had complete resolution of clinical signs by day 60 and coat brushings and faecal flotations contained no microscopic evidence of mature or immature mites. No evidence of relapse was detected within a 1-year follow-up period.

In dogs, milbemycin oxime has been shown to be effective in the control of cheyletiellosis when given orally at weekly intervals at 2 mg kg^{-1}.[23] Some animals required up to nine treatments to control the mites, however, and the relatively high cost of this drug may make this treatment protocol prohibitively expensive. To the author's knowledge, the use of milbemycin oxime in the control of feline cheyletiellosis has not been reported.

When compiling a treatment programme, the infested animal's bedding and grooming equipment should be treated with an acaricide or discarded to prevent fomite-mediated re-infestation. Washable fabrics should be cleaned at temperatures of at least 55 °C and then sprayed along with the rest of the environment with a pyrethroid-containing product. All in-contact mammals should be treated concurrently with a suitable acaricide and the infested dog or cat should be re-examined and monitored throughout the treatment period to screen for residual mites and eggs. Treatment should continue for a few weeks beyond clinical cure and when multiple tape strippings and superficial skin scrapings fail to reveal any microscopic evidence of ectoparasites.

OTOACARIOSIS (OTODECTIC MANGE)

Aetiology

Otoacariosis is caused by *Otodectes cynotis* (known colloquially as the 'ear mite'), which belongs to the family Psoroptidae. This mite is an obligate parasite which inhabits the vertical and horizontal ear canals of dogs and cats, although other species such as ferrets may become infested. It is nonburrowing and lives on the surface of the ear canal lining and in cats, mite feeding has been shown to induce a reaginic hypersensitivity response in some individuals, which may then subsequently develop an immunity to the mite proteins.[24]

Signalment and clinical signs

Animals infested with *O. cynotis* most commonly develop otitis externa characterized by vertical and horizontal canal erythema and a dark brown, ceruminous otic exudate (Fig. 4) In addition to otitis externa, 'ectopic' infestations of the head, neck, tail head and rarely the trunk can occur when mites escape the ear canals[25] and papulocrustous lesions (miliary dermatitis)

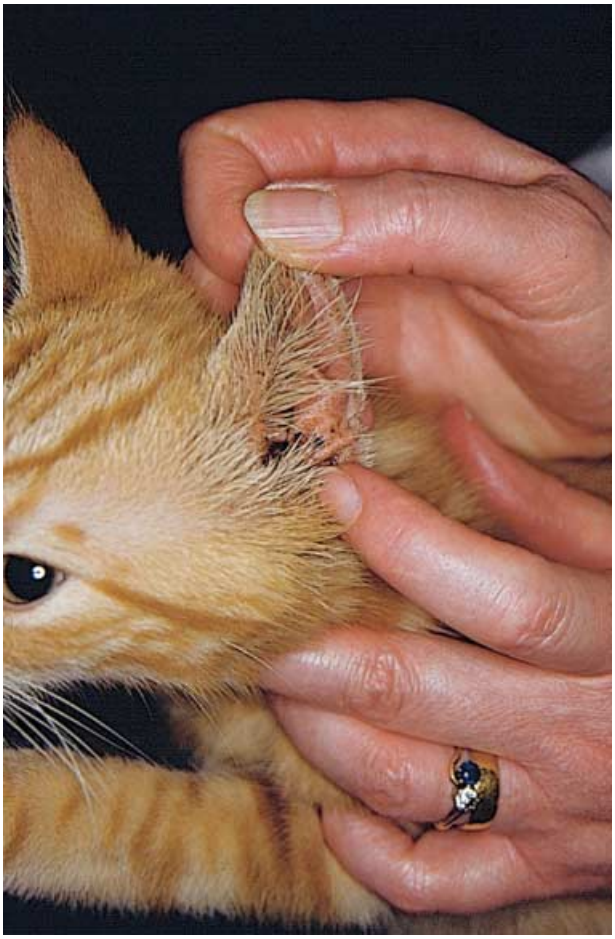

Figure 4. Left pinna of a kitten with otodectic mange. The inner surface of the pinna is erythematous and dark brown cerumen is accumulated at the opening of the vertical canal.

may be observed. Puppies and kittens appear to be most susceptible to otoacariasis, as older animals may acquire immunity. Zoonotic infections have also been reported,[26–28] with mites typically producing pruritic papular lesions on areas of the body which are in-contact with the infested pet.[25]

Current treatment recommendations

A number of different liquid, aural preparations are licensed for the topical treatment of *O. cynotis* infestations in dogs and cats, but although nonacaricidal preparations have been shown to be effective in a study involving 89 cats and 38 dogs[29] the majority contain acaricides such as thiabendazole (Auroto®; Arnolds Veterinary Products), monosulfiram (Oterna®; Schering Plough Animal Health) or permethrin (GAC Ear Drops®; Arnolds Veterinary Products). These drugs have a limited residual action and require regular re-application for at least 10 days, to ensure that all ova have hatched and that the newly emerged larvae are exposed to the drug. In one series of thiabendazole 'resistant' cases, 32 cats were treated via the otic route with a 1% ivermectin solution (Ivomec®; Merial Animal Health), which had been diluted at a rate of 1:9 with propylene glycol. Drops were administered daily for 21 days and all 32 animals responded to treatment with no reported adverse reactions.[30] In animals that resent topical treatment, the less frequent use of a long-acting acaricide has obvious benefits and a single, otic application of two drops of 10% fipronil solution (Frontline Spot-On®) was effective in controlling otoacariosis in one study involving 35 dogs and 14 cats, with no reported adverse effects.[31] The same product was used successfully in dogs although two treatments, 30 days apart were required to eradicate mites and the solution was applied to both the ears and the withers.[19] Four drops of the insect growth regulator pyriproxyfen, available as a 10% solution (Cyclio®, Virbac), when applied to a single ear of eight affected cats, controlled the mites in the treated ears for 30 days but failed to prevent re-infestation by day 60.[32] This suggests a lack of systemic effect and a potential need for repeat treatment. As a general rule, whenever topical therapy is prescribed for otoacariosis, drug-to-mite contact is improved by pretreatment with a cerumenolytic to remove exudate from the vertical and horizontal canals.

Systemic products with a long residual action offer an attractive therapeutic option and in cats, selamectin, applied to the withers at a dose of 6 mg kg^{-1} is licensed for the treatment of *O. cynotis* based on the results of controlled, masked field trials by Six and others.[15] A recent, independent, uncontrolled trial involving 120 cats with naturally acquired otoacariosis failed to detect any mites within 17 days of treatment with selamectin, although approximately one third of the subjects had some degree of residual erythema and/or pruritus for up to 14 days after testing negative for mites.[33] Injectable and topical ivermectin have also been used in this species and in one study, 23 of 24 *Otodectes*-infested cats responded to therapy with 2–4 applications of the drug on the withers, at 14-day intervals.[20] Caution must be exercised when using this drug in this species, however, for the reasons mentioned above. Oral or sc moxidectin at 0.2 mg kg^{-1} has been shown to be effective in dogs when given on two occasions, 10 days apart[34] but re-infestation occurred in a similar feline study when only a single sc injection was administered[32] suggesting that repeat treatments with this drug are required.

When treating confirmed cases of otoacariosis, it should be remembered that all in-contact dogs and cats should be included in the ectoparasiticidal programme in addition to the environment, bedding and grooming equipment, as the mites are capable of surviving for several weeks to months away from the host.[35] Concurrent, whole-body treatment with an appropriate acaricide is also recommended to control any mites which have moved out of the ear canals.

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Résumé Pour de raisons variées, plusieurs traitements antiparasitaires "traditionnels" en médecine des animaux de compagnie ont été abandonnés ces dernières années. De nouveaux produits, moins dangereux, à longue action, plus faciles à appliquer que les lotions, les shampooings ou les sprays sont apparus sur le marché. Cependant, relativement peu de ces nouveaux acaricides sont disponibles commercialement. En conséquence, les praticiens et les chercheurs réalisent souvent des essais avec les molécules dont ils disposent en utilisant des doses ou un mode d'administration différents de ceux recommandés par le fabricant. Cet article décrit les rapports référencés ou anecdotiques de la littérature rapportant l'utilisation des acaricides modernes chez le chien et le chat. Il est nécessaire de se rappeler toutefois que l'utilisation hors autorisation de mise sur le marché de médicaments doit s'accompagner d'un consentement éclairé du propriétaire.

Resumen Por diferentes razones, se han eliminado en los últimos años algunos de los tratamientos ectoparasiticidas "tradicionales" usados por el veterinario de pequeños animales. Han sido desplazados por productos nuevos, más seguros, de largo efecto, y de aplicación más fácil que los baños convencionales, enjuagues y aerosoles del pasado. Sin embargo, pocas de estas nuevas preparaciones pueden encontrarse en formato comercial. Por consecuencia, los veterinarios clínicos y los investigadores experimentan con frecuencia con fármacos que tienen a su disposición para probar su eficacia contra diferentes ácaros, a diferentes dosis y/o por diferentes vías de administración, comparado con las que recomiendan el fabricante. Este artículo revisa diferentes informes que describen el uso de acaricidas modernos en perros y gatos, que han aparecido recientemente en la bibliografía veterinaria. Debe recalcarse, sin embargo, que no debería administrarse ningún fármaco para un uso no especificado en la etiqueta del mismo, sin informar al propietario.

Zusammenfassung Innerhalb der letzten Jahre sind aus verschiedenen Gründen mehrere der mehr "traditionellen" Ektoparasitika aus dem Arsenal des Kleintierpraktikers entfernt worden. Neue, sicherere Produkte, die langfristig wirksam sind und einfacher als die konventionellen Tauchbäder, Spülungen und Aerosol-Sprays der Vergangenheit anzuwenden sind, haben sie ersetzt. Jedoch sind relativ wenige dieser neuartigen akariziden Präparate kommerziell verfügbar gemacht geworden. Infolgedessen experimentieren Praktiker und Forscher häufig mit Wirkstoffen, die ihnen zur Verfügung stehen, um ihre Wirksamkeit auf eine Vielzahl an Zielorganismen der Gattung Acari zu erproben, wenn sie in Dosierungen und/oder Darreichungsformen eingesetzt werden, die sich von den Herstellerempfehlungen unterscheiden. Diese Abhandlung bespricht anekdotische und peer-reviewed, vor kurzem in der Veterinärliteratur erschienene Berichte, die den Einsatz moderner Akarizide bei Hunden und Katzen beschreiben. Es sollte jedoch betont werden, dass kein Medikament für einen nicht zugelassenen Einsatz ohne Aufklärung und Einwilligung des Besitzers verschrieben werden sollte.