

Efficacy of the d-phenothrin/pyriproxyfen association against mites in naturally co-infested rabbits¹

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ABSTRACT.- Fernandes J.I., Verocai G.G., Ribeiro F.A., Melo R.M.P.S., Correia T.R., Coumendouros K. & Scott F.B. 2013. **Efficacy of the d-phenothrin/pyriproxyfen association against mites in naturally co-infested rabbits.** *Pesquisa Veterinária Brasileira* 33(5):597-600. Instituto de Medicina Veterinária, Faculdade de Medicina Veterinária, Universidade Federal do Pará, BR-316 Km 61, Castanhal, PA 68740-970, Brazil. E-mail: vetjulio@yahoo.com.br

The aim of the present study was to evaluate the efficacy of the d-phenothrin/pyriproxyfen association against *Psoroptes ovis*, *Cheyletiella parasitivorax*, and *Leporacarus gibbus* infestations in naturally co-infested rabbits. Twenty crossbreed (New Zealand White x California) rabbits concurrently infested by the three mite species were randomly divided in two groups. All rabbits presented with hyperemia, erythema and formation of crusts in the ear canals caused by *P. ovis*. Infestations by both *C. parasitivorax* and *L. gibbus* were considered asymptomatic in all animals. Ten animals were treated with a 4.4% d-phenothrin and 0.148% pyriproxyfen spray formulation until have their body surface uniformly sprayed, including external ear canals. The other ten rabbits remained untreated, serving as control group. Observations were done on days +7, +14, +21, +28, and +35 post-treatment. The d-phenothrin/pyriproxyfen association showed 100% efficacy against the three mite species and was responsible for the remission of psoroptic mange lesions on treated animals. No signs of intoxication were observed. The results indicate that d-phenothrin/pyriproxyfen spray formulation in a single application is an effective and clinically safe option for the control of different mite infestations in rabbits.

INDEX TERMS: Arthropod growth regulator, cheyletiellosis, fur mites, *Leporacarus gibbus*, psoroptic mange, pyrethroid, rabbits.

RESUMO. [Eficácia da associação de d-fenotrina e piriproxifen no controle de ácaros em coelhos naturalmente co-infestados.] O objetivo do presente estudo foi avaliar a eficácia da associação de d-fenotrina e piriproxi-

fen no controle de infestações simultâneas por *Psoroptes ovis*, *Cheyletiella parasitivorax* e *Leporacarus gibbus* em coelhos naturalmente co-infestados. Vinte coelhos mestiços (Nova Zelândia Branco x Califórnia) infestados simultaneamente pelas três espécies de ácaros foram divididos aleatoriamente em dois grupos. Todos os coelhos infestados por apresentavam eritema, hiperemia e formação de crostas nas orelhas, causados por *P. ovis*. Infestações simultâneas por *C. parasitivorax* e *L. gibbus* foram considerados assintomáticas em todos os animais. Dez animais foram tratados com uma formulação spray contendo d-fenotrina a 4,4% e piriproxifen a 0,148%, pulverizando toda a superfície corporal de forma uniforme, incluindo a face interna das orelhas. Os outros 10 coelhos não foram tratados, sendo mantidos como grupo controle. Os animais foram avaliados nos dias 7, 14, 21, 28 e 35 pós-tratamento. A associação de d-fenotrina e piriproxifen foi 100% eficaz no controle das três espécies de ácaros e foi responsável pela remissão das lesões de sarna psoróptica nos animais tratados. Não

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foram observados sinais de intoxicação. Os resultados indicam que a formulação spray de d-fenotrina e piriproxifen em uma única aplicação é uma opção clinicamente segura e eficaz no controle de infestações por ácaros em coelhos.

TERMOS DE INDEXAÇÃO: Regulador de crescimento de artrópodes, queilietelose, ácaros de pele, *Leporacarus gibbus*, sarna psoróptica, piretróide, coelhos.

INTRODUCTION

Skin diseases are among the most common reasons that lead owners to bring their pet rabbits to the veterinarian. Also, skin disorders negatively affect animals from laboratory colonies and commercial husbandries. Ectoparasites, especially mites, are the most frequent cause of these dermatologic problems. Among the disease-associated species are *Psoroptes ovis* (Hering, 1838) (Psoroptidae), *Cheyletiella parasitivorax* (Megnin, 1878) (Cheyletiellidae), and *Leporacarus gibbus* (Pagenstecher, 1861) (Listrophoridae) (see White et al. 2002).

Infestations by the highly contagious, non-burrowing mite *P. ovis* are known as psoroptic mange. A recent revision considered that the genus *Psoroptes* is represented by a single species; and *P. ovis* the taxonomical priority (Wall & Kolbe 2006). The typical clinical presentation is bilateral auricular disease characterized by intense pruritic otitis with thick crusts in the external ear canal extending up to the ear pinna. In chronic cases, otitis media and neurological signs and symptoms may arise, with eardrum perforation, secondary bacterial infection, and meningitis (White et al. 2002). Ectopic and/or generalized cases are less common but have been reported (Cutler 1998).

C. parasitivorax, the walking dandruff, is a large and very active parasite. Usually, infested rabbits do not show evident signs. Lesions are generally not severe presenting with crusting and scaling along the dorsum, with variable pruritus. Partial alopecia and hyperkeratosis may occur in heavy infestations (Bronswijk & De Kreek 1976, Cloyd & Moorhead 1976, White et al. 2002). This parasite has zoonotic potential and is associated with the human cheyletiellosis, causing papular dermatitis (White et al. 2002).

The rabbit fur mite, *L. gibbus*, is a cosmopolitan species reported in variable prevalence rates worldwide (Kirwan et al. 1998, Kim et al. 2008). Infestation is usually asymptomatic in normal healthy adult animals. However, heavy infestations can cause alopecia, moist dermatitis, mild scurf, and pruritus (Patel & Robinson 1993, Pinter 1999, Serra-Freire et al. 2010).

Several drugs have been reported to be effective against single or combined infestations by those mite species. Currently, ectoparasitic control strategies in small animals focus on the association of adulticidal drugs (e.g.: pyrethroids) with arthropod growth regulators (AGR's). Such drug associations have demonstrated longer residual effect, combined with control of immature stages in the environment (Otranto & Wall 2008). Thus, the control of ectoparasites in rabbits should also follow this concept. The association of the pyrethroid d-phenothrin and the AGR pyriproxyfen has been effective on the control of the cat flea *Ctenocephalides*

felis, the ear mange mite *Otodectes cynotis*, and the scabies mite *Sarcoptes scabiei* on dogs (Correia et al. 2005, Scott et al. 2005).

The present study was conducted to evaluate the efficacy of the association d-phenothrin plus pyriproxyfen against *P. ovis*, *C. parasitivorax*, and *L. gibbus* infestations in rabbit.

MATERIALS AND METHODS

Twenty crossbreed (California x New Zealand White) rabbits aging from 6 to 11 months (1.0 to 1.2 kg) of both sexes, naturally co-infested by three mite species *Psoroptes ovis*, *Cheyletiella parasitivorax*, and *Leporacarus gibbus* were used. Animals were kept in individual cages during the experimental period in the Laboratory of Experimental Chemotherapy in Veterinary Parasitology from the Universidade Federal Rural do Rio de Janeiro, Brazil. Animals from each group were kept in different housing supplied with commercial rabbit food and water *ad libitum*. This study was conducted in accordance to the ethical and humane standards, and it was approved by the institutional animal care committee (CEUA-FAPUR). March 5, 2012.

For *P. ovis* diagnosis, crusts from each ear canal were collected with tweezers. Observation of clinical lesions remission was also performed. Diagnosis of *C. parasitivorax* and *L. gibbus* was performed by mite visualization, fur clipping, and superficial skin scrapping. Animals had the fur clipped from shoulders (left and right sides), and mid region of dorsum and ventral area. For each these body regions, two circles of 2.5cm diameter were clipped (6 circular areas/animal). Superficial skin scrapping was performed in each trimmed circular area, specifically for *C. parasitivorax* diagnosis. Crust, fur and skin scrapping samples were individually placed in identified Petri dishes, and readily evaluated under stereomicroscope. Samples were considered positive when living mites and/or eggs were observed. This procedure was repeated post-treatment on each day of evaluation.

Table 1. Presence of *Psoroptes ovis* in the ear canals of rabbits from treated (4.4% d-phenothrin/0.148% pyriproxyfen spray formulation^a) and control groups on Day 0 and after treatment (Days +7, +14, +21, +28 and +35)

Groups/ Animals	Presence of <i>Psoroptes ovis</i> before and after treatment											
	Day 0		Day + 7		Day + 14		Day + 21		Day + 28		Day + 35	
	LE ^b	RE ^c	LE	RE	LE	RE	LE	RE	LE	RE	LE	RE
Control												
1	+	+	+	+	+	+	+	+	+	+	+	+
2	+	+	+	+	+	+	+	+	+	+	+	+
3	+	+	+	+	+	+	+	+	+	+	+	+
4	+	+	+	+	+	+	+	+	+	+	+	+
5	+	+	+	+	+	+	+	+	+	+	+	+
6	+	+	+	+	+	+	+	+	+	+	+	+
7	+	+	+	+	+	+	+	+	+	+	+	+
8	+	+	+	+	+	+	+	+	+	+	+	+
9	+	+	+	+	+	+	+	+	+	+	+	+
10	+	+	+	+	+	+	+	+	+	+	+	+
Treated												
11	+	+	-	-	-	-	-	-	-	-	-	-
12	+	+	-	-	-	-	-	-	-	-	-	-
13	+	+	-	-	-	-	-	-	-	-	-	-
14	+	+	-	-	-	-	-	-	-	-	-	-
15	+	+	-	-	-	-	-	-	-	-	-	-
16	+	+	-	-	-	-	-	-	-	-	-	-
17	+	+	-	-	-	-	-	-	-	-	-	-
18	+	+	-	-	-	-	-	-	-	-	-	-
19	+	+	-	-	-	-	-	-	-	-	-	-
20	+	+	-	-	-	-	-	-	-	-	-	-

^a. Mypet® Plus Spray, Vetbrands/CEVA Sante Animale; ^b Left ear; ^c Right ear.

Rabbits were randomly divided in two groups. On day 0, ten animals were treated with a 4.4% d-phenothrin and 0.148% pyriproxyfen spray formulation⁷. Animals had their whole body surface sprayed with the product, including external ear canals. The other ten rabbits were not treated, serving as control group. Evaluation was done on days +7, +14, +21, +28, and +35 post-treatment using the above mentioned methods. When no auricular crusts were observed, swabs were used to collect inner material from ear canals. The efficacy for each mite species was calculated using the formula: [number of infested animals (or ears) before treatment - number of infested animals (or ears) after treatment] / [number of infested animals (or ears) before treatment] x 100.

RESULTS

All treated animals were negative for the presence of *Psoroptes ovis*, *Cheyletiella parasitivorax*, and *Leporacarus gibbus* throughout the 35 days of the study (Table 1 and 2). The d-phenothrin/pyriproxyfen association showed to be 100% effective against the three parasitic mite species. No adverse effects to the product were observed during the 35 days of experimentation. Regarding psoroptic mange, treated animals showed progressive remission of ear crusts starting from day +7. Clinical resolution was observed in these animals on the following days of observation. No clinical signs related to the other mites' infestations were noticed also after treatment in both groups.

Rabbits from control group remained infested by the three mite species along the experimental days. Lesions due to psoroptic mange worsened in six animals. Considerable discomfort and pruritus were also observed. Control animals received the same treatment given to treated ones on day +35.

⁷ Mypet® Plus Spray, Vetbrands/CEVA Santé Animale.

DISCUSSION

A number of drugs have been reported to be effective for the treatment of psoroptic mange in rabbits, using different routes of administration and protocols. Subcutaneous ivermectin at 400µg/kg after a double treatment was proven 100% effective (Curtis et al. 1990). Treatment with injectable moxidectin at 0.2mg/kg twice at 10 days interval (Wagner & Wendlberger 2000) or a single topical selamectin application (McTier et al. 2003) also achieved 100% efficacy. In contrast, topical eprinomectin applied twice at 14 days interval was partially effective on the control of rabbit psoroptic mange (Ulutas et al. 2005). Melo et al. (2008), using a single application of 2% permethrin spray formulation directly in the ear canals obtained success on the remission of auricular psoroptic mange.

Regarding cheyletiellosis, the use of a single subcutaneous application of ivermectin at 400mg/kg also obtained 100% efficacy in controlling *Cheyletiella parasitivorax* infestation in laboratory rabbits (Akitunde et al. 1994). Other authors consider as treatment of choice subcutaneous ivermectin at 200 to 400mg/kg once every two weeks for two to three treatments, mentioning though, that some clinicians prefer lime sulphur dips (Jenkins 2001). Once again, selamectin in a single topical application in pet rabbits achieved clinical and parasitic resolution within three weeks (Kim et al. 2008). In contrast, both spot-on selamectin and subcutaneous ivermectin, the later combined or not with oral ivermectin, were not totally effective against rabbit walking dandruff. Selamectin-treated animals had 80.8% of clinical remission, whereas the protocols using ivermectin ranged from 51.9 to 81.8% (Mellgren & Bergvall 2008).

Table 2. Presence of *Cheyletiella parasitivorax* and *Leporacarus gibbus* on rabbits from treated (4.4% d-phenothrin/0.148% pyriproxyfen spray formulation^a) and control groups on Day 0 and after treatment (Days +7, +14, +21, +28 and +35)

Groups/ Animals	Presence of mites before and after treatment											
	Day 0		Day + 7		Day + 14		Day + 21		Day +28		Day +35	
	<i>C. parasitivorax</i> ^b	<i>L. gibbus</i> ^c	<i>C. parasitivorax</i>	<i>L. gibbus</i>	<i>C. parasitivorax</i>	<i>L. gibbus</i>	<i>C. parasitivorax</i>	<i>L. gibbus</i>	<i>C. parasitivorax</i>	<i>L. gibbus</i>	<i>C. parasitivorax</i>	<i>L. gibbus</i>
Control												
1	+	+	+	+	+	+	+	+	+	+	+	+
2	+	+	+	+	+	+	+	+	+	+	+	+
3	+	+	+	+	+	+	+	+	+	+	+	+
4	+	+	+	+	+	+	+	+	+	+	+	+
5	+	+	+	+	+	+	+	+	+	+	+	+
6	+	+	+	+	+	+	+	+	+	+	+	+
7	+	+	+	+	+	+	+	+	+	+	+	+
8	+	+	+	+	+	+	+	+	+	+	+	+
9	+	+	+	+	+	+	+	+	+	+	+	+
10	+	+	+	+	+	+	+	+	+	+	+	+
Treated												
11	+	+	-	-	-	-	-	-	-	-	-	-
12	+	+	-	-	-	-	-	-	-	-	-	-
13	+	+	-	-	-	-	-	-	-	-	-	-
14	+	+	-	-	-	-	-	-	-	-	-	-
15	+	+	-	-	-	-	-	-	-	-	-	-
16	+	+	-	-	-	-	-	-	-	-	-	-
17	+	+	-	-	-	-	-	-	-	-	-	-
18	+	+	-	-	-	-	-	-	-	-	-	-
19	+	+	-	-	-	-	-	-	-	-	-	-
20	+	+	-	-	-	-	-	-	-	-	-	-

^a Mypet® Plus Spray, Vetbrands/CEVA Sante Animale; ^b *Cheyletiella parasitivorax*; ^c *Leporacarus gibbus*.

In respect to *L. gibbus* infestation, baths or spray products are frequently recommended once mites live attached to the hair, having less contact with the skin itself. Selenium sulphide baths or bromocyclen washes were successfully used as well as the use of carbaryl in one or two applications at a 5 to 7 days interval (Patel & Robinson 1993, Niekrasz et al. 2008). Topically applied pyrethrin three times at 7 day intervals was also proven to be effective in a single rabbit (Pinter 1999). Birke et al. (2009) compared the efficacy of selamectin and imidacloprid plus permethrin, achieving 100% of efficacy in both treatments by day +3 and +13, respectively.

A few contributions have reported treatments for concomitant *C. parasitivorax* and *L. gibbus* infestations using spot-on administration. Hughes (2001) used selamectin at the dose rate of 15 mg for rabbits weighing less than 2.3 kg and 45 mg for those weighing more than 2.3 kg, with a second treatment required after one month for cheyletiellosis, and at monthly intervals until live mites are no longer detected for fur mites. While, Hansen et al. (2006) using a single imidacloprid/permethrin spot-on application achieved 100% effectiveness for both mite species, and the cat-flea. To our knowledge, this is the only treatment protocol for a triple ectoparasitic infestation in rabbits, aside the present study.

Topical application of ectoparasitic drugs, including spray formulations, is believed to disturb rabbits much more than subcutaneous injections. Although, topical treatment should be considered for treating concurrent infestations by ear and fur mites because these (especially *L. gibbus*) have limited contact with host skin, and may not be effectively controlled by using other commonly used administration routes (e.g. subcutaneous, oral).

The association of the adulticidal drug and the AGR may have a synergistic effect, acting directly in killing adult mites and affecting metamorphosis process in immature stages on the host. Therefore, less frequent treatments are required since these drug combinations tend to promote a longer residual efficacy.

CONCLUSION

Our results indicate that a single application d-phenothrin/pyriproxyfen spray formulation is an effective and clinically safe option for the control of *Psoroptes ovis*, *Cheyletiella parasitivorax*, and *Leporacarus gibbus* infestations in rabbits.

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