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IMPACT OF ANTIPARASITIC TREATMENT ON THE PREVALENCE OF ECTOPARASITES IN DOGS FROM AN INDIGENOUS TERRITORY, STATE OF PARANÁ, BRAZIL

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ABSTRACT

We report on surveys of ectoparasites in dogs from an indigenous village of the state of Paraná, southern Brazil, before and after ivermectin treatment. From April through June 2008, we conducted a baseline survey to evaluate 145 of an estimated population of 200 dogs. The dogs received parasitological and clinical examinations, and were treated with up to four doses of ivermectin. In September 2008, we conducted a monitoring survey with 83 dogs, to assess the impact of treatment on the prevalence of ectoparasitosis. The initial investigation found 9 taxa of ectoparasites in 37.9% of dogs examined. The most prevalent ectoparasitosis was myiasis caused by larvae of *Dermatobia hominis* (28.9%). Clinical evaluation showed that 51% of the dogs had signs of scabies, and 48.9% had alopecia. The follow-up monitoring survey found a similar overall prevalence of ectoparasites (40.9%); *D. hominis* (22.9%) remained the most frequent, followed by *Ctenocephalides felis felis* (18.1%). However, the signs of sarcoptic mange (12.0%) were significantly reduced ($p<0.0001$) by the antiparasitic treatment. After treatment, 51.3% of the animals had no ectoparasites. These results indicate that the dogs of this indigenous village continue to be important hosts for ectoparasites, in spite of clinical improvement after ivermectin treatment.

KEY WORDS: Ectoparasites; dogs; myiasis; indigenous territory; ivermectin.

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RESUMO

Impacto do tratamento antiparasitário sobre a prevalência de ectoparasitos em cães de uma Terra Indígena, Estado do Paraná, Brasil

Neste estudo são relatados os resultados de inquéritos ectoparasitológicos realizados em cães de uma aldeia indígena do Estado do Paraná, sul do Brasil, antes e após os tratamentos com ivermectina. De abril a junho de 2008, foi realizado um inquérito incial avaliando-se 145 de uma população estimada de 200 cães. Os animais foram avaliados clínica e parasitologicamente e tratados com até quatro doses de ivermectina. Em setembro do mesmo ano foi realizado um inquérito de monitoramento com 83 cães para avaliar o impacto do tratamento sobre a prevalência das ectoparasitoses. Na investigação inicial foram encontrados 9 taxa de ectoparasitas em 37,9% dos animais examinados. A ectoparasitose mais prevalente foi a miíase causada por larvas de *Dermatobia hominis* (28,9%). Na avaliação clínica, 51% dos cães apresentavam sinais de sarna e a alopecia foi o mais prevalente ocorrendo em 48,9% dos cães. No inquérito de monitoramento, a prevalência total de ectoparasitas (40,9%) não se alterou significativamente; parasitismo por *D. hominis* (22,9%) manteve-se o mais freqüente, seguido por *Ctenocephalides felis felis* (18,1%). No entanto, a prevalência de sinais de sarna sarcóptica (12,0%) foi significativamente reduzida ($p < 0,0001$) pelo tratamento antiparasitário. Após o tratamento, 51,3% dos animais não tinha infestação por ectoparasitas. Estes resultados indicam que os cães desta aldeia indígena permanecem como importante hospedeiro para ectoparasitas, apesar da melhora clínica obtida com o tratamento com ivermectina.

DESCRITORES: Ectoparasitos; cães; miíase; território indígena; ivermectina.

INTRODUCTION

Domestic pet animals such as dogs are important companions (Robertson et al., 2000). Pets are frequently parasitized by arthropods that may transmit zoonotic diseases to humans (Alcaíno et al., 2002; Moriello, 2003; Torres et al., 2004; Castro & Rafael, 2006; Soares et al., 2006; Gracia et al., 2008). Parasitism of dogs by *Amblyomma* spp., *Rhipicephalus sanguineus*, and *Ctenocephalides* spp. favors the transmission of rickettsioses such as spotted fever, typhus, and erlichiosis (Moriello, 2003; Nogari et al., 2004; Gracia et al., 2008), making these arthropods important for both animal and human health (Rodrigues et al., 2001).

The ectoparasite fauna of dogs in different states of Brazil and other countries includes species such as *R. sanguineus*, *Amblyomma* spp. (Labruna et al., 2005), *Ctenocephalides felis*, *Ctenocephalides canis*, *Pulex irritans* (Koutinas et al., 1995; Gracia et al., 2008), *Sarcoptes scabiei* var. *canis*, *Demodex canis* (Torres et al., 2004; Castro et al., 2005), *Dermatobia hominis*, and *Cochliomyia hominivorax* (Cramer-Ribeiro et al., 2003, Bermúdez et al., 2007). In Latin America, the species of fleas most commonly found parasitizing dogs in rural areas are *Rhopalopsyllus lutzi* and *Tunga penetrans*, and in urban areas are *C. felis*, *C. canis*, and *P. irritans* (Alcaíno et al., 2002; Soares et al., 2006). Among ticks, species of the genus *Amblyomma* parasitize dogs in rural areas, and *R. sanguineus* is more common in urban areas (Labruna et al., 2000). The larva of the fly *D. hominis* causes primary nodular cutaneous myiasis in vertebrate animals, and the dog is among its principal hosts (Cramer-Ribeiro et al., 2002;

Fortes, 2004). The mite *S. scabiei* var. *canis*, the causative agent of sarcoptic mange (Giordano & Aprea, 2003; Nogari et al., 2004; Castro et al., 2005), has a worldwide distribution (Urquhart et al., 1996) but has become a public-health problem in developing countries because of its increasing prevalence (Giordano & Aprea, 2003).

Maringá State University (UEM) has been carrying out research on various different topics in the Indigenous Territories (ITs) in the state of Paraná, Brazil, inhabited by the *Kaingáng* and *Guarani* ethnic groups. The large populations of dogs in these villages, which have been increased by gifts of dogs from residents of neighboring urban areas, have attracted researchers' attention. The present study tested whether the prevalence of ectoparasite infestation in this canine population could be reduced by ivermectin treatment. So, the prevalence of ectoparasites in the canine population of a *Kaingáng* village in Paraná was determined before and after treatment with an antiparasitic drug.

MATERIAL AND METHODS

The Faxinal IT is situated in central Paraná (24º41´S 51º17´W), southern Brazil, at an altitude of 540 m, is 6 km from the nearest urban area, and has an area of 2,044 hectares. The population consists of about 500 members of the *Kaingáng* ethnic group. The climate is subtropical, with mean monthly temperatures of below 18ºC to above 22ºC, with hot summers and infrequent frosts. Rainfall is concentrated in the summer months, with no defined dry season. During the study period, the maximum and minimum temperatures were 21ºC and 15ºC, and the monthly rainfall ranged from 70 to 240 mm (IAPAR, 2008).

The total number of dogs in the village, estimated at 200, was determined through visits to the 63 existing houses, in the company of an indigenous research assistant. Animals aged four months or older were included in the sample. With the aid of the program EpiInfo 3.3.2, considering the population size and an expected frequency of 50%, a 99.9% confidence level was obtained in the baseline survey and 95% in the subsequent monitoring survey.

The animals, mostly middle-sized, were classified as: young (≥4 months-2 years), adults (>2-8 years), or old (>8 years). Most belonged to specific owners, were fed on scraps and from their own hunting efforts, and received no antiparasitic treatment.

From April through June 2008, we carried out a baseline ectoparasite survey (1st survey), including 145 dogs. Each animal was identified by a microchip (Animalltag®, São Carlos, Brazil) implanted subcutaneously between the scapulae. The data for each individual included the microchip number and the name, weight, age, sex, breed, coat characteristics, presence of ectoparasites, types of lesions, and number of doses of antiparasitic medication administered.

Ectoparasites were recovered manually or with the aid of tweezers from each dog, placed in labeled vials containing 70% ethanol, and taken to the UEM

Parasitology Laboratory for identification (Urquhart et al., 1996; Fortes, 2004; Costa & Botelho, 2005). Fleas and lice were collected manually, and the species and sex of each specimen were determined by microscopic examination (stereomicroscope), with the use of taxonomic keys by Linardi & Guimarães (2000) for fleas and Urquhart et al. (1996) for lice. Engorged ticks were removed whole by means of tweezers, avoiding damage to the mouthparts; they were identified by the dichotomous key by Aragão & Fonseca (1961). Dipteran larvae were collected by manual compression, and some were identified at the site and others in the laboratory (Linhares, 2005). The clinical diagnosis of sarcoptic mange was made through observation of the characteristic lesions (alopecia, erythema, crusts/scabs, thickened skin, papules, ulcers, and pustules) and asking the owner about the presence of itching (Harvey & McKeever, 2004; Medleau & Hnilica, 2006). Although in animals that are heavily infested by many ectoparasites, itching cannot be considered relevant for diagnosing sarcoptic mange, this information was recorded. The parasitological diagnosis was made by means of a deep skin scrape, within the limits of both healthy skin and scabs, and adhesive tape was applied to the affected body areas (Botelho, 2005; Foreyt, 2005; Pin et al., 2006).

The examinations provided information on the following indicators: total prevalence of ectoparasites (excluding dogs that only showed signs of scabies, and including dogs with a positive parasitological diagnosis), specific prevalence, prevalence of multiple infestations, and prevalence of ectoparasites by sex and age group.

Following the parasitological and clinical diagnoses, the animals were treated with an antiparasitic containing 1% of the ivermectin derivative 22,23-dihydroavermectin B_1 (Virbamec® LA). In accordance with the literature, the therapeutic schedule consisted of a single subcutaneous dose of 400 $\mu g\ kg^{-1}$ body weight, repeated biweekly, for a period of up to two months (Paradis, 1998; Curtis, 2004; Méndez, 2006). Some animals received only one dose of the antiparasitic, because they were not present in the home during subsequent visits. Those that tested negative for ectoparasites also received a single dose as a prophylactic. The animals were separated into three groups, according to the number of doses received: (i) four doses, (ii) two to three doses, or (iii) one dose. The number of uninfested dogs was calculated for the total number of treated dogs, and for each group. Dogs were considered uninfested if they showed no ectoparasites in subsequent evaluations. Those that showed at least one ectoparasite were considered as a therapeutic failure. The overall cure rate and the cure rate according to the number of doses, were calculated from the ratio of the number of uninfested animals and the total number of animals treated, multiplied by 100.

In order to assess the impact of the intervention (antiparasitic treatment) against ectoparasites, a monitoring survey (2nd survey) was carried out in September 2008, in which 78 dogs that had been treated in the baseline survey, were re-evaluated clinically and parasitologically for ectoparasites. Five animals that had

not been evaluated and treated during the baseline survey were included in this 2nd survey, giving a total of 83 dogs. Animals that were found to be still infested during this survey received an extra dose of ivermectin at 400 μg kg^{-1} body weight. The parasitological indicators obtained were compared by the chi-square test (c^2), using the software BioEstat 5.0.

The study was approved by the UEM Committee on Ethical Conduct in the use of Experimental Animals (Comitê de Conduta Ética no Uso de Animais em Experimentação, CEAE, nº 060/07), and by the National Committee on Research Ethics (Comitê Nacional de Ética em Pesquisa, CONEP, nº 875/07). Authorization to enter the IT was obtained from the National Indian Foundation (Fundação Nacional do Índio, Funai).

RESULTS

The age ranges and sexes of the dogs evaluated during the two surveys are shown in Table 1.

Table 1. Composition of the sample of dogs examined, by age range and sex in the Faxinal Indigenous Territory, state of Paraná, 2008.

Age group (months)	Males	Females	Total (%)
1st survey			
4-24	30	34	64 (44.1)
25-96	24	26	50 (34.5)
≥ 97	04	05	09 (6.2)
ND	10	12	22 (15.2)
Subtotal (%)	68 (46.9)	77 (53.1)	145 (100.0)
2nd survey			
4-24	17	18	35 (42.2)
25-96	13	14	27 (32.5)
≥ 97	01	03	04 (4.8)
ND	08	09	17 (20.5)
Subtotal (%)	39 (46.9)	44 (53.0)	83(100.0)
Total (%)	107 (46.9)	121 (53.0)	228 (100.0)

ND: Not determined

In the first survey, nearly all (98%) of the animals were mixed-breed, except for a boxer, a Brazilian mastiff, and a Doberman pinscher. At least one ectoparasite species was present in 37.9% of the dogs; the most prevalent parasites were myiasis caused by *D. hominis* (28.9%), followed by *C. felis felis* (11.7%) (Table 2).

In the parasitological diagnoses, *S. scabiei* var. *canis* was found in only one animal (0.7%) (Table 2). The prevalence of sarcoptic mange obtained through clinical diagnoses was 51.0%, and the dogs showed significant variation ($p<0.0001$) in the presence of characteristic lesions (Table 3). Coat length did not significantly affect the prevalence of disease.

Table 2. Total prevalence (%) of ectoparasite species in dogs from the Faxinal Indigenous Territory, state of Paraná, 2008.

Species	Survey		
	1st	2nd	p value
N	(145)	(83)	
Dermatobia hominis	28.9	22.9	NS
Ctenocephalides felis felis	11.7	18.1	NS
Amblyomma sp.	2.1	10.8	0.0109
Cochliomyia sp.	1.4	0.0	NS
Tunga penetrans	0.7	1.2	NS
Sarcoptes scabiei var. canis	0.7	0.0	NS
Pulex irritans	0.0	1.2	NS
Menacanthus sp.	0.0	1.2	NS
Trichodectes canis	0.0	1.2	NS
Total prevalence	37.9	40.9	NS

n: sample size; NS: Non-significant

Table 3. Prevalence (%) of skin lesions in dogs from the Faxinal Indigenous Territory, state of Paraná, 2008.

Lesion	Survey		
	1st	2nd	p value
N	(145)	(83)	
Alopecia	48.9	12.0	<0.0001
Erythema	20.7	0.0	<0.0001
Crusts/scabs	13.8	0.0	0.0001
Thickened skin	12.4	0.0	0.0002
Papule	8.9	0.0	0.0023
Ulcer	1.4	0.0	NS
Pustule	1.4	0.0	NS
Total prevalence	51.0	12.0	<0.0001
p value*	<0.0001	NS	

n: sample size; NS: Non-significant. *Within-survey comparisons

Total and specific prevalence did not vary significantly with sex or age group, except for *D. hominis*. Males and adult dogs were significantly ($p=0.0006$, sex; $p=0.0217$, age) more often parasitized by this dipteran. The locations on the body that were parasitized significantly more often ($p<0.0001$) were back, legs and head.

The type of infestation varied significantly ($p<0.001$) and single-species infestations were more frequent (Table 4). Of the multiple infestations, 10.9% were due to parasitism by *D. hominis* and *C. felis felis*. There were no statistical differences in the type of infestation with respect to age group, but the type of infestation varied significantly ($p<0.001$) during the first survey, with males exhibiting more single infestations than females.

In the monitoring survey, we examined 83 dogs, including 44 females and 39 males. Young dogs were most numerous (42.2%), followed by adults

(32.5%) (Table 1). Nearly all the animals (98.8%) were of mixed breed, except for one Doberman pinscher. In this survey, 40.9% of the animals showed at least one ectoparasitosis, of which the most prominent was myiasis caused by *D. hominis* (22.9%) followed by *C. felis felis* (18.1%). The incidence of parasitism by larvae, nymphs, and adults of *Amblyomma* sp. increased significantly (p=0.0109) (Table 2).

Table 4. Prevalence (%) of multiple and single infestations, by age group and sex, in dogs from the Faxinal Indigenous Territory, state of Paraná, 2008.

Type of infestation							
	Age group*				Sex**		
	Young	Adult	Old	ND	Males	Females	Total**
1st survey							
n	(64)	(50)	(09)	(22)	(68)	(77)	(145)
Multiple	4.7	4.0	11.1	4.5	7.4	2.6	4.8
Single	39.1	40.0	22.2	4.5	47.0	20.8	33.1
Negative	56.2	56.0	66.7	91.0	45.6	76.6	62.1
2nd survey							
n	(35)	(27)	(04)	(17)	(39)	(44)	(83)
Multiple	5.7	11.1	0.0	23.5	17.9	6.8	12.1
Single	40.0	25.9	0.0	23.5	30.8	31.8	31.3
Negative	54.3	63.0	100	53.0	51.3	61.4	56.6

n: sample size; ND: not determined; Within and between-survey comparisons: * Non-significant p value; ** $p<0.001$ only in the 1st survey.

Alopecia was the most common single type of lesion caused by sarcoptic mange, found in 12.0% of the dogs (Table 3). All the dogs showed a negative parasitological diagnosis. There were no statistical differences in prevalence according to coat length.

The type of infestation varied, and uninfested animals predominated with 56.6% (Table 4). There were no statistical differences in relation to age group or sex.

Following the clinical and parasitological examinations, 144 dogs were treated with ivermectin during the first survey. Of these, 78 were re-evaluated in the second survey. The therapeutic scheme varied: 24 (30.7%) animals received four doses, 41 (52.5%) two or three doses, and 13 (16.7%) one dose. The percentages of treated and uninfested dogs, according to the number of doses, are shown in Table 5. Of all the treated dogs, 51.3% had no ectoparasite infestation in the second survey.

Comparisons between the surveys showed no significant variation in the total and specific prevalence of ectoparasites, except that of *Amblyomma* sp., which increased (Table 2). Only the individual and total prevalence of signs of scabies decreased significantly (Table 3). With respect to the prevalence of infestation type, no significant variation was observed between the surveys (Table 4).

Table 5. Number and percentage of animals without ectoparasitic infestation, according to the number of doses of ivermectin (400 µg kg^{-1}) administered subcutaneously, in dogs from the Faxinal Indigenous Territory, state of Paraná, 2008.

No of doses	No of infested dogs	No of uninfested dogs	Total (%)	"% of cure"*
1	9	4	13 (16.7)	30.7
2 to 3	21	20	41(52.5)	48.8
4	8	16	24 (30.7)	66.7
Total	38	40	78 (100.0)	51.3

* p value not significant

DISCUSSION

The present study, a pioneering investigation of ectoparasites infesting dogs in an indigenous village in Brazil, assessed the prevalence of all species of ectoparasites found. In contrast, most published articles treat species of ectoparasites individually. This is probably because of the species' different epidemiological characteristics and their differing degrees of impact on public health.

The baseline survey revealed a high prevalences of ectoparasites, with six species and three genera found (see Table 2). The specific prevalence were similar to those found in other studies on dogs of different breeds, provenances (rural/urban/domestic/stray), and geographic localities (Bellato et al., 2003; Torres et al., 2004), and lower than those found by González et al. (2004). Following the antiparasitic treatment, there was no reduction in the total and specific prevalence of ectoparasites, although the prevalence of signs of scabies declined significantly.

The clinical examinations revealed that the most frequent ectoparasitosis was sarcoptic mange. The large canine population in the village likely facilitates the dissemination of the mites, because of increased contact between the animals (Moriello, 2003; Castro et al., 2005; Méndez, 2006). Although the parasite can survive for only a few hours away from the host, contamination of the environment would also favor its transmission (Nogari et al., 2004; Méndez, 2006). Alopecia was the most prevalent type of lesion, followed by erythema, crusts/scabs, and thickened skin, similar to the findings of Pin et al. (2006) in a study with 10 cases of the disease. On the other hand, Castro et al. (2005), evaluating mostly purebred dogs, recorded a greater predisposition to the disease for adult males with long coats; whereas the present study of mostly mixed-breed dogs found no significant influence of these variables. The low positivity of the parasitological diagnostic techniques for sarcoptic mange found here (0.7%) differs from literature reports, which range from 20% to 50% depending on the type of skin scraping, whether superficial or deep (Giordano & Aprea, 2003; Rhodes, 2005; Méndez, 2006). A possible explanation for the low positivity rate found here is failure of the diagnostic methods used. Certain factors such as not storing the slide in a refrigerator and a delay in examination may have influenced these results.

The larvae of *D. hominis* causing myiasis was the most prevalent ectoparasite, and indeed is common in dogs. It was significantly more frequent in adult male dogs due to their habit of hunting in the scrub around the village, whereas the females spend more time with their puppies. In addition, the climate, the temperature, the areas of natural vegetation of the village, and also the cultural habits of the indigenes with respect to hygiene and cleanliness, can favor the development of the dipterans, since myiasis is a consequence of the owner's neglect of the animal and of its environment (Cramer-Ribeiro et al., 2002; Cramer-Ribeiro et al., 2003). The sites on the body that were most often parasitized by the larvae were those that are most easily accessed by the flies, as reported by Cramer-Ribeiro et al. (2002). Myiasis caused by fly larvae of the genus *Cochliomyia* showed a low prevalence in this study, similar to that of *D. hominis*, affecting mainly adult male dogs. Although dogs are frequently parasitized by dipteran larvae, published data on this subject are sparse.

Similarly to this study, other investigators have found that the flea *C. felis* was most prevalent, followed by *P. irritans* (Koutinas et al., 1995; Alcaíno et al., 2002; Bellato et al., 2003), or have found only species of the genus *Ctenocephalides* (Cruz-Vazquez et al., 2001; Rodrigues et al., 2001; González et al., 2004; Torres et al., 2004; Castro & Rafael, 2006; Soares et al., 2006; Rinaldi et al., 2007). *C. felis felis* usually predominates in urban dogs (Alcaíno et al., 2002; Soares et al., 2006; Gracia et al. 2008), and the environment of the Indigenous Territory is more similar to a rural situation than to an urban one. This can be explained, in part, by the urban origin of many dogs in this IT. *P. irritans*, which uses humans as a host, was found in only one dog, as a result of accidental exposure, although other investigators have observed that parasitism by this species is more prevalent in farm dogs (Gracia et al., 2008). The finding of *T. penetrans* is explained by the practice of allowing pigs to roam freely in the village. Although pigs are important reservoirs of *T. penetrans* in rural areas (Linardi & Guimarães, 2000) and dogs are frequently infested, the relative importance of these two host species remains unknown (Heukelbach et al., 2004).

The parasitism of dogs by *Amblyomma* sp. found in this study concords with literature reports that dogs in rural areas that live together with other domestic and wild hosts can be infested by ticks of this genus (Labruna et al., 2000; Labruna et al., 2001; Oyafuso et al., 2002), and that species of this genus predominate in rural areas of southern Brazil, including in Paraná (Ribeiro et al., 1997; Labruna & Pereira, 2001; Labruna et al., 2001). In spite of the ivermectin treatment, the tick parasitism rate showed a significant increase in the second survey. Ivermectin is not the drug of choice to treat ticks (Campbell et al., 1983; Nogari et al., 2004; Dias et al., 2005). Furthermore, ticks produce one generation per year, and the period of greatest dispersal of nymphs, the stage with the least host specificity, is in September, coinciding with the monitoring survey (Labruna & Pereira, 2001; SUCEN, 2002).

The records of the other ectoparasites, *Trichodectes canis* and *Menacanthus* sp., although they occurred with low prevalence, demonstrate the

variety of the ectoparasite fauna on the village dogs. *T. canis* was also recorded in low prevalence from street dogs in the state of Minas Gerais (Rodrigues et al., 2001), in dogs treated in a veterinary hospital in the state of Santa Catarina (Bellato et al., 2003), and in domestic and stray dogs in the states of Pernambuco (Torres et al., 2004) and Amazonas (Castro & Rafael, 2006). The finding of *Menacanthus* sp., a louse of domestic birds (Urquhart et al., 1996), may have resulted from close contact between dogs and birds.

Although nine taxa of parasites were found in this study, single-species infestations predominated; the prevalence of multiple infestations was 4.8% and 12.1%, respectively, in the first and second surveys. Other investigators have also observed multiple infestations, with prevalence ranging from 4.6% in domestic and stray dogs in Recife (Torres et al., 2004), or 15.1% in dogs treated in veterinary clinics in Lages (Bellato et al., 2003), to a high of 96.5% in domestic dogs in a rural area in Buenos Aires Province, Argentina, which were analyzed in detail (González et al., 2004).

Ivermectin is active against a wide variety of nematode and arthropod parasites of animals and humans, and is used in different therapeutic schemes (Campbell et al., 1983; Barragry, 1987; Paradis, 1998; Mueller & Bettenay, 1999; Méndez, 2006; Pin et al., 2006), whereas pyrethroids act only on ectoparasites (Santos et al., 2007). We opted to use ivermectin because different therapeutic schemes have been used successfully to control sarcoptic mange (Curtis, 2004; Méndez, 2006), the most prevalent ectoparasitosis in the dogs of this study. The significant reduction in the overall and specific prevalence of sarcoptic mange signs can be attributed to the high sensitivity of *S. scabiei* to ivermectin (Curtis, 2004; Méndez, 2006). Although the treated animals had not shown a positive parasitological diagnosis, they responded positively to the treatment, which suggests that their skin lesions were due to sarcoptic mange (Pin et al., 2006).

The ivermectin treatment had practically no impact on the populations of fly larvae, ticks, and fleas, although ivermectin is highly effective against myiasis. The introduction of new and infested dogs into the areas and houses after these were visited in the first survey, may have contributed to the low efficiency of the treatment of other ectoparasitoses. Moreover, interacting factors such as climate variations, and the dispersal period of the parasites may have influenced the ectoparasite prevalence rates and the efficacy of the antiparasitic treatment found in this study.

CONCLUSIONS

The results indicate that the prevalence of ectoparasite infestation in the canine population was not reduced significantly by treatment with ivermectin, despite the reduction in the prevalence of sarcoptic mange signs.

The dogs of Faxinal IT harbored nine taxa of ectoparasites, composed of mites, dipterans, siphonapterans, ixodids, and chewing lice (Mallophaga), and can be

considered important hosts of ectoparasites in this village. These parasites can act as potential vectors of several infectious agents, both to other dogs and to human beings.

Among the available intervention measures for the control of ectoparasites at the community level, treatment with ivermectin proved to be a viable alternative in the significant reduction of sarcoptic mange in the dogs of this village, and can be adopted by health authorities, with semi-annual administration to minimize reinfestations.

These results take on another dimension when one considers the numerous population of dogs, and the cultural and genetic differences between the indigenous people of this village and the remainder of the Brazilian population.

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