Human and Animal Health

Vol.61: e18160508, 2018
http://dx.doi.org/10.1590/1678-4324-2018160508
ISSN 1678-4324 Online Edition

BRAZILIAN ARCHIVES OF
BIOLOGY AND TECHNOLOGY
A N I N T E R N A T I O N A L J O U R N A L

Co-Infection by *Sarcoptes scabiei* and *Microsporum gypseum* in Free-Ranging Crab-Eating Fox, *Cerdocyon thous* (Linnaeus, 1766).

Jonatas Campos de Almeida[1]*, Carlos Adriano de Santana Leal[1], Renata Pimentel Bandeira de Melo[1], Pedro Paulo Feitosa de Albuquerque[1], Camila de Morais Pedrosa[1], Fabiana Correa Zermiani[2], Roberto Citelli de Farias[2], Rinaldo Aparecido Mota[1]
[1]Universidade Federal Rural de Pernambuco, Recife, Pernambuco, Brasil. [2]Parque Zoobotânico Arruda Câmara, João Pessoa, Paraiba, Brasil

ABSTRACT

The aim of the present study was to describe the clinical manifestation, treatment and outcome of a case of co- infection by Sarcoptes scabiei and Microsporum gypseum in Cerdocyon thous (crab-eating fox) from Northeastern Brazil.

Key words: dermatophytes, public health, sarcoptic mange, wild canid, zoonose

*Author for correspondence: jonatas_campos86@hotmail.com

INTRODUCTION

There are several diseases that may be transmitted from not only domestic but also from wild animals, thus wildlife is an important component in the transmission chain of zoonosis[1]. Nowadays, zoonoses with a wildlife reservoir constitute a public health issue worldwide and its importance has been recognized, demanding attention from scientific community[2]. Foxes are known to carry many species of ectoparasites, the majority of which are potentially transmissible to humans, pets and livestock[3].

Despite the public health issue, there are few data about the real impact of skin diseases on wild carnivores. Coyote populations (*Canis latrans*) from Texas were monitored from 1974 to 1991, and sarcoptic mange was identified affecting 69% of animals, resulting in reproductive disorders such as the pregnancy rate reduced and ovulation problems[4].Concerning to the occurrence of dermatophytes in wild canids, further studies are necessary in order to provide new insights and advances related to the diagnosis, treatment and control of this mycotic infection.

The activities of wildlife veterinarians in zoo management are inestimable since they apply their knowledge and skills for the improvement of habitat conditions, nutrition, health and breeding of captive wild animals[5]. Thus, the exposure to zoonotic diseases is one of the most important health risks for wildlife veterinarians due a close association with wild animals.

Accordingly, the present case report describes the clinical manifestation, treatment and outcome of a case of zoonotic dermatoses caused by *Sarcoptes scabiei* and *Microsporum gypseum* in *Cerdocyon thous* (crab-eating fox) from Brazil.

MATERIAL AND METHODS

During the autumn, five free-range *Cerdocyon thous* (crab-eating fox) were caught by veterinarians of a Zoo from Paraiba state, Northeastern Brazil. The animals were caught due their health condition and after a first clinical examination were referred to the quarantine room. These animals were estimated 4-month-old (young animals), being four females and one male, and their mother probably was killed in a traffic accident. The five animals were alert and responsive, and except for the skin lesions, were otherwise healthy. Chemical restraint (1% xylazine hydrochloride and 10% cetamine hydrochloride) was required to examine the crab-eating foxes.

The body surface of each crab-eating fox was examined carefully for the presence of ectoparasites such as ticks, fleas and lice. They were collected in microtubes containing 70% ethanol and fleas were washed and stored in 10% KOH solution for 24 hours before identification. An identification key was used for species identification[6].

Two skin scrapings from affected body parts of the crab-eating foxes were collected for mite isolation. Each skin scrapings were digested in 10% KOH and were meticulously examined for the presence and identification of mites. Detected mites were identified properly[7].

In order to carry out the mycological diagnosis hair and scabs were collected by coat brushing and multiple skin scrapings using sterile scalpel blade. Each sample was clarified with a 30% KOH on a glass slide for 30 minutes, followed by identification of fungal structures as hyphae and arthroconidia (arthrospores) according to previous study[8]. Hair and scabs samples were cultured in Petri dishes containing Sabouraud Dextrose Agar with yeast extract, chloramphenicol and cycloheximide. Petri dishes were incubated aerobically at 25ºC and examined

daily for five weeks[9]. Yeasts were evaluated macroscopically and their microscopic characteristics were observed by smear stained by Gram method.
Filamentous fungi were identified by observation of texture, topography and color of the obverse and reverse of the colonies, and microscopic characteristics such as type of conidia and hyphae. Microscopic analysis was performed properly[10].
The crab-eating foxes were treated with ivermectin (Ivomec®, Merial, São Paulo, Brazil) 200ug/kg orally, once per week, during six weeks.

RESULTS AND DISCUSSION

Dermatological investigation revealed moderate alopecia patches (hair loss) distributed in head, ears, trunk, extremities and tail (Figure 1). Foul odor, mild to moderate scratch, small swellings and moderate incrustations also reported. The skin was wrinkled and crusty with a flaky appearance.

Figure 1- Alopecia and moderate incrustations in the ear of the crab-eating fox, *Cerdocyon thous* (Linnaeus, 1766).

The fleas *Ctenocephalides felis* and *C. canis* were found in all five animals. A total of 20 fleas (thirteen *C. felis* and seven *C. canis*) were collected with a mean of four fleas per animal. Neither ticks nor lice were reported. *Sarcoptes scabiei* were identified in all five crab-eating fox (Figure 2).

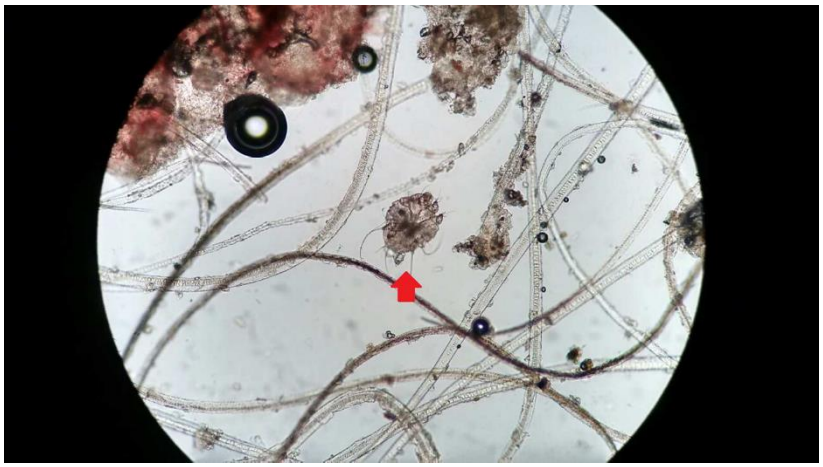

Figure 2- Skin scraping containing *Sarcoptes scabiei* mite (red arrow)

"Hair follicles parasitized by arthroconidia were observed by direct examination in 1/5 of the samples analyzed. However this findings clearly suggests a fungal infection by dermatophytes, all samples were submitted for fungal culture to confirm the result obtained by the direct examination, once this technique is considered the gold standard".

After three days of incubation, in all five samples were observed colonies with the following characteristics: the colony surface was matte, yellowish, convex, and wrinkled, and the undersurface was flat. These characteristics were compatible with those of *Malassezia pachydermatis*. With approximately seven days of culture, a flat colony, cream color at the surface and a yellow-brown reverse pigment was observed in one sample. Microscopically numerous symmetrical macroconidia, thick-walled, asperulate spindle-shaped with 3-5 septa were visualized. These characteristics were compatible with those of *Microsporum gypseum*.

After two weeks of treatment a significant improvement in the skin condition was observed with approximately 50% size reduction of the lesions. Four weeks post initial treatment almost all lesions had resolved and, for this reason, the treatment was maintained for two additional weeks, during which all lesions had resolved completely. There is a limited data about the occurrence and treatment of zoonotic dermatoses in wild canids, especially in crab-eating fox. To the best of the author´s knowledge, this is the first case report of co-infection by *Sarcoptes scabiei* and *Microsporum gypseum* in free-ranging crab-eating fox. The association between *M. pachydermatis* and *S. scabiei* was also observed previously[11].

In Europe, sarcoptic mange infections are endemic and has been described a high prevalence in red foxes (*Vulpes vulpes*), leading to substantial mortality and reducing the population of red foxes over 70%[12,13,14]. Dangerous sarcoptic mange outbreaks have been described in some species worldwide, with mortality rates of up to 90%[15,16,17,18]. This wild canid may visit human settlements attracted by accessible food sources[19], increasing incidence of accidental pseudo scabies infestation of man, pets and domestic animals[3]. Have been reported the possibility of adaptation between *S. scabiei* and red fox populations[20] with description of non-fatal, restricted, subclinical cases in red foxes[21]. Little is known about *S. scabiei* infection in crab-eating foxes, but it is believed they may play a role in sarcoptic mange infection similar those by red foxes.

Dermatophytosis is an infection of the skin and its appendages caused by a group of closely related species of fungi of the genera *Microsporum*, *Trichophyton* and *Epidermophyton*[22]. There are few studies about fungal diseases in wild animals. Nonetheless, it is important to remember that many ringworm infections may be transmitted from animals to humans, being considered a public health problem[10,23]. *Microsporum canis* was first reported in silver-grey foxes[24] and in red fox in a close contact with an asymptomatic Persian cat[25]. The relationship between the presence of dermatophytes on the hair coats of dogs and cats without skin lesions in their respective owners and other pets have been investigated[26]. In the present study, the crab-eating foxes affected were young (approximately 4-months-old), in accordance with a previous study that observed a higher incidence of dermatophytosis in animals less than one-year- old[22]

Pathogens have been found associated with *Ctenocephalides* as biological vectors or intermediate hosts, such as bacteria, helminths and protozoa, representing a potential health risk for humans[27]. Thus, it is important to choose the adequate approach to prevent vector-borne outbreak diseases into Zoos or Center of Triage of Wild Animals, threatening other carnivore species.

The literature no provides well established protocols to treat sarcoptic mange infection and dermatophytosis in wild canids. In the most of cases, the treatment of these skin infections in dogs is adopted as model to treat wild canids achieving good results[25]. The present case report also reports the treatment of sarcoptic mange infection in wild canid with success. In this case no antifungal treatment was performed. The complete resolution of the skin lesions may be explained by the fact that the animal is considered as carrier agent of *M. gypseum*, a common situation noticed in cats. The same condition should not be ruled out in case of dermatophytosis in wild animals[28,29]. Based on the above, information about zoonotic dermatoses in wild canids is scarce, complicating diagnosis and correct approaching of these diseases. Thus, researches are required in this field to better understand the epidemiology, pathogenesis and treatment of zoonotic dermatoses and even to develop control measures.

REFERENCES

1. Letkova V, Lazar P, Čurlik J, Goldova M, Kočišova A, Košuthova L, et al. The red fox (*Vulpes vulpes L.*) as a source of zoonoses. *Veterinarski Arhiv*. 2006; 76: 73-81.
2. Jorge RSP, Rocha FL, Junior JAM, Morato RG. Ocorrencia de patogenos em carnivoros selvagens brasileiros e suas implicacoes para a conservacao e saude publica. *Oecol Austral*. 2010, 14: 686-710.
3. Kočišova A, Lazar P, Letkova V, Čurlik J, Goldova M. Ectoparasitic species from red foxes (*Vulpes vulpes*) in East Slovakia. *Veterinarski Arhiv*. 2006; 76: 59-63.
4. Pence DB, Windberg LA. Impact of a Sarcoptic Mange Epizootic on a Coyote Population. *J Wildlife Manage*. 1994; 58: 624-633.
5. Kumar HR, Srivatsav UC. The zoo veterinary profession: challenging, interesting, vibrant and fulfilling. *Zoo's Print*. 2010; 25: 15-16.
6. Furman C, Catts DM. Manual of Medical Entomology. 4th edition. Cambridge: Cambridge University Press, 1982.
7. Wall R, Shearer D. Veterinary Ectoparasites: Biology, Pathology and Control. 2nd edition. Ames: Wiley-Blackwell, 1997.
8. Muller CEV, Kirk GHV. Doencas parasitarias da pele. In: Scott DW, editor. Dermatologia de Pequenos Animais. 5th edition. Rio de Janeiro: Interlivros; 1996. p. 385-388, 390-392, 394-397, 399.
9. Cruz LCH. Micologia Veterinaria. 2nd edition. Rio de Janeiro: Revinter, 2010.
10. Albano APN, Mendes JF, Felicio AP, Coimbra MAA, Leite ATM, Minello LF, et al. Microbiota fungica de felideos silvestres higidos encaminhados a centros de triagem no Rio Grande do Sul e Mato Grosso do Sul. *Rev Cient Med Vet*. 2011; 9: 654-658.
11. Salkin IF, Stone WB, Gordon MA. Association of *Malassezia* (*Pityrosporum*) *pachydermatis* with sarcoptic mange in New York State. *J Wildl Dis.* 1980; 16: 509-514.
12. Forchhammer MC, Asferg T. Invading parasites cause a structural shift in red fox dynamics. *Proc Biol Sci.* 2000; 267: 779-786.
13. Goldova M, Lazar P, Letkova V, Kočišova A, Čurlik J, Soroka J. Occurrence of *Sarcoptes scabiei* in wild red foxes (*Vulpes vulpes*) in East Slovakia. Proceedings of the 3rd International Symposium on Wild Fauna, 24-28 may, Italy, 2003, 313-317.
14. Soulsbury CD, Iossa G, Baker PJ, Harris S. Environmental variation at the onset of independent foraging effects full-grown body mass in the red fox. *Proc Biol Sci*. 2008; 22: 2411-2418.
15. Morner T. Sarcoptic mange in Swedish wildlife. *Rev Sci Tech*. 1992; 11: 1115-1121.
16. Lindstrom ER, Andren H, Angelstam P, Cederlund G, Hornfeldt B, Jaderberg L, Lemnell P-A, et al. Disease reveals the predator: sarcoptic mange, red fox predation, and prey populations. *Ecology*. 1994; 75: 1042-1049.
17. Martin RW, Handasyde KA, Skerratt LF. Current distribution of sarcoptic mange in wombats. *Aust Vet J*. 1998; 76: 411-414.
18. Kalema-Zikusoka G, Koch RA, Macfie EJ. Scabies in freeranging mountain gorillas (*Gorilla berengei berengei*) in Bwindi Impenetrable National Park, Uganda. *Vet Rec.* 2002; 150: 12-15.

19. Balestrieri A, Remonti L, Ferrari N, Ferrari A, Lo Valvo T, Robetto S, et al. Sarcoptic mange in wild carnivores and its co-occurrence with parasitic helminthes in the Western Italian Alps. *Eur J Wildl Res*. 2006; 52: 196-201.
20. Davidson RK, Bornstein S, Handeland K. Long-term study of *S. scabiei* infection in Norwegian red fox (*Vulpes vulpes*) indicating host/parasite adaptation. *Vet Parasitol.* 2008; 156: 277-283.
21. Morner T, Christensson D. Experimental infection of red foxes (*Vulpes vulpes*) with *S. scabiei* var. *vulpes*. *Vet Parasitol.* 1984; 15: 159-164.
22. Carlotti DN, Bensignor E. Dermatophytosis due to *Microsporum persicolor* (13 cases) or *Microporum gypseum* (20 cases) in dogs. *Vet Dermatol.* 1999; 10: 17-27.
23. Lima B, Lopez S, Luna L, Aguero MB, Aragon L, Tapia A, et al. Essential oils of medicinal plants from the Central Andes of Argentina: chemical composition, and antifungal, antibacterial, and insect-repellent activities. *Chem Biodivers*. 2011; 8: 924-936.
24. Levenberg IG. *Microsporum* infection in silver-gray foxes. *Trudy Vesoyies Inst Vet Sanit.* 1960; 16: 379-382.
25. Malmasi A, Khosravi AR, Selk-Ghaffari M, Shojaee-Tabrizi A. Scientific Report *Microsporum canis* infection in a red fox (*Vulpes vulpes*). *Iran J Vet Res*. 2009; 10: 189-191.
26. Cafarchia C, Romito D, Capelli G, Guillot J, Otranto D. Isolation of *Microsporum canis* from the hair coat of pet dogs and cats belonging to owners diagnosed with *M. canis* tinea corporis. *Vet Dermatol*. 2006; 17: 327-331.
27. Linardi PM. Pulgas. In: Marcondes CB, editor. Entomologia medica e veterinaria. 2nd edition. Sao Paulo: Atheneu; 2001. p.157-179
28. Farias MR, Condas LAC, Ramalho F, Bier D, Muro MD, Pimpao CT. Avaliacao do estado de carreador assintomatico de fungos dermatofiticos em felinos (*Felis catus* – Linnaeus, 1793) destinados a doacao em centros de controle de zoonoses e sociedades protetoras de animais. *Vet Zoot*. 2011; 18: 306-312.
29. Ferreiro L, Sanches EMC, Spanamberg A, Ferreira RR, Machado MLS, Roehe C, et al. Zoonoses micoticas em caes e gatos. *Acta Sci Vet*. 2007; 35: 296-299.

Received: June 20, 2016;
Accepted: September 26, 2017