Universidade Federal de Uberlândia
Instituto de Biologia
Pós-Graduação em Ecologia e Conservação de Recursos Naturais -

ECOLOGIA E COMPORTAMENTO DA RAPOSA-DO-CAMPO *PSEUDALOPEX VETULUS* E DO CACHORRO-DO-MATO *CERDOCYON THOUS* EM ÁREAS DE FAZENDAS NO BIOMA CERRADO

Frederico Gemesio Lemos

2007

Frederico Gemesio Lemos

ECOLOGIA E COMPORTAMENTO DA RAPOSA-DO-CAMPO *PSEUDALOPEX VETULUS* E DO CACHORRO-DO-MATO *CERDOCYON THOUS* EM ÁREAS DE FAZENDAS NO BIOMA CERRADO

Dissertação apresentada à Universidade Federal de Uberlândia, como parte das exigências para obtenção do título de Mestre em Ecologia e Conservação de Recursos Naturais.

Orientador

Profa. Dra. Kátia Gomes Facure

UBERLÂNDIA
Fevereiro - 2007

Dados Internacionais de Catalogação na Publicação (CIP)

L557e Lemos, Frederico Gemesio, 1981-
Ecologia e comportamento da raposa-do.campo *Pseudalopex vetulus* e do cachorro-do-mato *Cerdocyon thous* em áreas de fazendas no bioma Cerrado/ Frederico Gemesio Lemos. - 2007.

62 f. : il.

Orientador: Dra. Kátia Gomes Facure.
Dissertação (mestrado) – Universidade Federal de Uberlândia, Programa de Pós-Graduação em Ecologia e Conservação de Recursos Naturais.

Inclui bibliografia.

1. Ecologia animal - Teses. I. Facure, Kátia Gomes. II. Universidade Federal de Uberlândia. Programa de Pós-Graduação em Ecologia e Conservação de Recursos Naturais. III. Título.

CDU: 591.5

Elaborado pelo Sistema de Bibliotecas da UFU / Setor de Catalogação e Classificação

Frederico Gemesio Lemos

ECOLOGIA E COMPORTAMENTO DA RAPOSA-DO-CAMPO *PSEUDALOPEX VETULUS* E DO CACHORRO-DO-MATO *CERDOCYON THOUS* EM ÁREAS DE FAZENDAS NO BIOMA CERRADO

Dissertação apresentada à Universidade Federal de Uberlândia, como parte das exigências para obtenção do título de Mestre em Ecologia e Conservação de Recursos Naturais.

APROVADA em 26 de Fevereiro de 2007

Prof. Dr. Flávio H. G. Rodrigues UFMG

Prof. Dr. Heraldo L. de Vasconcelos UFU

Prof. Dr. José Fernando Pinese UFU

Profa. Dr. Kátia Gomes Facure
UFU
(Orientadora)

UBERLÂNDIA
Fevereiro - 2007

Dedicado a meus pais, Ana e Nilson,

por me apresentarem o mundo...

E á Kátia e Ari (pais adotivos),

por me apresentarem a diversidade do mundo!

E à Carolina, que Deus lhe conceda calmas e verdes pastagens.

Sua amizade e doçura jamais serão esquecidos...

AGRADECIMENTOS

Agradeço de coração à Dra. Kátia Gomes Facure e ao Dr. Ariovaldo Antonio Giaretta, que mais do que orientadores, tornaram-se verdadeiros pais e amigos, sempre me mostrando, ou pelo menos tentando, qual o melhor caminho a seguir, tanto profissionalmente quanto no dia-a-dia. E, principalmente, por terem confiado em mim;

Aos grandes amigos e biólogos Alan “Grilo” Nilo da Costa, Hugo Cardoso de Moura Costa e Paulo Mapache pelo auxílio nos trabalhos de campo, discussões e por muitas vezes disponibilizarem precioso tempo para conversarmos à toa;

À Maria Angélica pela amizade e devoção ao trabalho, estando sempre disponível nos momentos menos propícios de seu tão longo dia;

Aos professores Drs. Flávio H. G. Rodrigues e Heraldo L. de Vasconcelos por aceitarem participar da banca examinadora;

Aos botânicos Dra. Adriana Assis Arantes e Dr. Ivan Schiavini pelo auxílio na identificação dos frutos consumidos pelos canídeos;

Ao Ponêis, João Batista, Zé Bereca, Juninho e Carlim, pessoal dos locais onde trabalhei, pelo apoio logístico, sugestões e ajuda nos trabalhos de campo;

Ao Bruno Cardoso de Moura Costa pela disponibilidade e rapidez em fazer os desenhos de cachorro-do-mato;

À Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) pela concessão da bolsa de Mestrado;

À Universidade Federal de Uberlândia (UFU) pelo empréstimo de equipamentos e fornecimento de apoio logístico;

Ao meu irmão Felipe (Mano Black) por quase sempre entender minha necessidade e liberar o computador durante os finais de semana;

À Branquinha (Fê, minha namorada, companheira e amiga!), pelos gestos de incentivo na fase final do trabalho e por me ajudar a encontrar algo que há muito procurava; meu coração é seu...

...e, em especial, aos meus pais Ana e Nilson, pelas inúmeras portas que abriram em minha vida. Sem eles nada disso seria possível.

ÍNDICE

Página

RESUMO

Lemos, Frederico G. 2007. Ecologia e comportamento da raposa-do-campo *Pseudalopex vetulus* e do cachorro-do-mato *Cerdocyon thous* em áreas de fazendas no Bioma Cerrado. Dissertação de Mestrado em Ecologia e Conservação de Recursos Naturais. Universidade Federal de Uberlândia. Uberlândia-MG. 75p.

Estudos enfocando espécies sintópicas ajudam a entender como elas partilham os recursos e coexistem. O objetivo deste trabalho foi descrever o sistema social, o uso do habitat e a dieta da raposa-do-campo (*Pseudalopex vetulus*) e do cachorro-do-mato (*Cerdocyon thous*), em uma área de fazendas de gado no Brasil Central. Também é relatado um confronto entre as duas espécies observado durante um estudo sobre o repertório comportamental da raposa-do-campo. O sistema social e o uso de habitat foram estudados a partir da observação direta dos animais no campo e a dieta, através da análise de fezes. Os cachorros-do-mato foram encontrados em duplas em 34 (59%) de 58 encontros e as raposas-do-campo estavam solitárias em 58 (84%) de 69 encontros, não havendo variação sazonal no tamanho de grupo das duas espécies. Durante um dos encontros de uma dupla de cachorro-do-mato, o macho vocalizou para chamar a fêmea que havia ficado para trás. As raposas-do-campo foram avistadas em pastagens em uma proporção maior (84%) que os cachorros-do-mato (67%) e nunca foram encontradas em florestas ou brejos. Além disso, as duas espécies raramente foram vistas juntas, sendo que o único encontro registrado terminou em conflito, com o cachorro-do-mato expulsando a raposa-do-campo. Vinte e sete táxons foram identificados na dieta dos dois canídeos. O cachorro-do-mato (n = 32 fezes) consumiu frutos, insetos (principalmente Orthoptera e Coleoptera) e vertebrados (a maioria Cricetidae e Squamata) e a raposa-do-campo (n = 23 fezes) se alimentou principalmente de cupins (Isoptera). Os resultados indicam que casais de cachorros-do-mato mantêm laços mais estreitos que casais de raposa-do-campo. A coexistência de ambas as espécies pode estar relacionada às diferenças detectadas no uso do habitat e na dieta.

Palavras-chave: canídeos, competição interespecífica, ecologia alimentar, tamanho de grupo, uso do habitat

ABSTRACT

Lemos, Frederico G. 2007. Ecology and behavior of the hoary fox, *Pseudalopex vetulus*, and the crab-eating fox, *Cerdocyon thous*, in areas of farms in the Cerrado Biome. Master thesis on Ecology and Conservation of Natural Resources. Federal University of Uberlândia. Uberlândia-MG. 75p.

Studies focusing syntopic species help to understand how they partition resources and coexist. The objective of this work was to describe the social system, habitat use and diet of the hoary fox (*Pseudalopex vetulus*) and the crab-eating fox (*Cerdocyon thous*), in an area of cattle farms in Central Brazil. It is also reported a confrontation between the two species, observed during a study on the behavioral repertory of the hoary fox. Social system and habitat use were studied by direct observation of foxes in the field and diet, through scat analysis. Crab-eating foxes were found in pairs in 34 (59%) of 58 encounters and hoary foxes were solitary in 58 (84.0%) of 69 encounters, with no seasonal variation in the group size of both species. During one encounter of a crab-eating fox couple, the male vocalized to call the female that had remained behind. Hoary foxes were sighted in grazed pasture in a higher proportion (84%) than crab-eating foxes (67%) and they were never found in forest neither in swamp. Besides, both species were rarely seen together, and the only encounter registered ended in a conflict, with the crab-eating fox driving the hoary fox out. Twenty-seven taxa were identified in the diet of the two canids, with the crab-eating fox (n = 32 scats) consumed fruits, insects (mainly Orthoptera and Coleoptera) and vertebrates (most Cricetidae and Squamata) and the hoary fox (n = 23 scats) ate primarily termites (Isoptera). Results indicate that crab-eating fox couples keep more tight bonds than hoary fox couples. The coexistence of both species may be related to the detected differences in habitat use and diet.

Key-words: canids, feeding ecology, group size, habitat use, interspecific competition,

INTRODUÇÃO

Introdução geral

Os mamíferos carnívoros (Carnivora) compreendem 287 espécies viventes, com uma distribuição natural por todos os continentes, exceto Austrália, Nova Zelândia, Nova Guiné, Antártida e algumas ilhas oceânicas (Wozencraft 2005). Muitas espécies deste grupo são especializadas na captura de vertebrados, o que normalmente exige grandes áreas de vida e resulta em baixas densidades populacionais (Gittleman and Harvey 1982). Várias espécies de carnívoros brasileiros estão ameaçadas de extinção devido à destruição ambiental, inclusive, trabalhos sobre populações de carnívoros são ainda escassos no Brasil (Fonseca et al. 1994), o que dificulta a implementação de medidas conservacionistas.

Os canídeos originaram-se na América do Norte (Hunt 1996) no final do período Eoceno e chegaram à América do Sul há cerca de dois milhões de anos, onde estão representados atualmente por sete gêneros e dez espécies (Berta 1982; Wayne et al. 1997). Os grandes canídeos sul-americanos, com exceção de *Chrysocyon*, foram extintos devido ao desaparecimento de suas presas no final do Pleistoceno (Hunt 1996). O atual padrão de distribuição geográfica dos canídeos sul-americanos pode ser explicado pela chegada de um grupo de espécies de áreas abertas, o qual ocupou os hábitats de campo ao longo dos Andes, chegando aos pampas e à patagônia, bem como às terras altas brasileiras (Langguth 1975). A atual alta diversidade dos canídeos sul-americanos resulta, pelo menos em parte, de sua estratégia oportunística de forrageamento, que inclui o consumo de pequenas presas, como roedores e insetos, bem como frutos (Berta 1982).

Canídeos têm um importante papel na cadeia alimentar. A grande variedade de hábitos alimentares do grupo faz com que canídeos atuem desde dispersores de sementes como o lobo-guará (*Chrysocyon brachyurus*) (Dietz 1984), até predadores de topo como os lobos cinzentos (*Canis lupus*) (Nowak 1999). A conservação das espécies de canídeos do Brasil está

ameaçada principalmente pela diminuição na disponibilidade de presas, fragmentação de hábitat e perseguição direta do homem (Fonseca et al. 1994; Dalponte 1995).

O presente trabalho foca duas, das quatro espécies de canídeos do Cerrado, a raposa-do-campo (*Pseudalopex vetulus*) e o cachorro-do-mato (*Cerdocyon thous*). A raposa-do-campo é um canídeo de pequeno porte (2,5 – 4 kg), endêmico de áreas abertas de Cerrado do Brasil Central (Dalponte 1995; Dalponte and Courtenay 2004; Jácomo et al. 2004). Apesar de existirem alguns poucos trabalhos acerca de sua dieta principalmente e área de vida, muito pouco é conhecido sobre sua ecologia, sendo classificada pela IUCN como deficiente de dados (Dalponte and Courtenay 2004), o que impossibilita que seu status de conservação seja conhecido (Brasil 2003). É uma espécie solitária que se alimenta principalmente de cupins, alem de frutos, insetos e mamíferos (Courtenay et al. 2006; Dalponte 1995; Dalponte 2003; Jácomo et al. 2004; Juarez and Marinho-Filho 2002).

Maior que a raposa-do-campo, o cachorro-do-mato é um canídeo de porte pequeno a médio (5 – 7 kg) que apresenta uma ampla distribuição na América do Sul, ocorrendo desde o sul da Colômbia e Venezuela até o norte da Argentina, Paraguai e Uruguai (Berta 1982; Eisenberg and Redford 1999; Nowak 1999). Esta espécie não enfrenta graves problemas de conservação, sendo classificado pela IUCN como pouco preocupante (Courtenay and Maffei 2004). O cachorro-do-mato habita desde cerrados e caatingas às matas, florestas e manguezais (Facure and Giaretta 1996; Facure and Monteiro-Filho 1996; Facure et al. 2003; Jácomo et al. 2004; Juarez and Marinho-Filho 2002; Motta-Junior et al. 1994), sendo que sua dieta onívora pode variar entre diferentes regiões e sazonalmente (Facure et al. 2003; Montgomery and Lubin 1978). Estudos anteriores afirmam que é uma espécie social, que vive em pares e com a prole. Na Amazônia, adultos que já dispersaram podem manter contato próximo com seus pais (MacDonald and Courtenay 1996).

A dissertação foi dividida em três capítulos, que foram escritos já no formato para futuras publicações. Assim, parte da base de dados como o *material e métodos* é comum a alguns artigos (capítulos), porém, o enfoque principal de cada um é diferente. Os três capítulos abordam aspectos da ecologia e comportamento da raposa-do-campo e do cachorro-do-mato. O primeiro descreve o tamanho de grupo e uso de habitat, o segundo, relata uma interação entre as duas espécies e o terceiro trata da dieta.

Espero que o presente trabalho venha enriquecer o conhecimento acerca da ecologia da raposa-do-campo e do cachorro-do-mato e possa assim contribuir para a conservação das duas espécies de canídeos em áreas de Cerrado.

REFERÊNCIAS BIBLIOGRÁFICAS

BERTA, A. 1982. *Cerdocyon thous.* Mammalian Species 186:1-4.

BRASIL. 2003. Lista Nacional das Espécies da Fauna Brasileira Ameaçadas de Extinção. Ministério do Meio Ambiente. http://www.mma.gov.br/port/sbf/fauna/index.cfm.

COURTENAY, O. & L. MAFFEI. 2004. Crab-eating fox Cerdocyon thous (Linnaeus, 1776). Pp. 32-38 in Canids: Foxes, Wolves, Jackals and Dogs (C. Sillero-Zubiri, M. Hoffmann & D. W. MacDonald, eds.). IUCN/SSC Canid Specialist Group press. Gland, Switzerland and Cambridge, UK

COURTENAY, O.; D. W. MACDONALD; S. GILLINGHAM; G. ALMEIDA & R. DIAS. 2006. First observations on South America's largely insectivorous canid: the hoary fox (*Pseudalopex vetulus*). Journal of Zoology 268:45-54.

DALPONTE, J. C. 1995. The hoary fox in Brazil. Canid news 3:23-24.

DALPONTE, J. C. 2003. História Natural, Comportamento e Conservação da Raposa-do-campo, *Pseudalopex vetulus* (Canidae). Tese de Doutorado (Biologia Animal), Instituto de Ciências Biológicas, Universidade Federal de Brasília, Brasília, DF. 179 pp.

DALPONTE, J. C. & O. COURTENAY. 2004. Hoary fox *Pseudalopex vetulus* (Lund, 1842). Pp. 72-76 in Canids: Foxes, Wolves, Jackals and Dogs (C. Sillero-Zubiri, M. Hoffmann & D. W. MacDonald, eds.). IUCN/SSC Canid Specialist Group press. Gland, Switzerland and Cambridge, UK.

DIETZ, J. M. 1984. Ecology and Social Organization of the Maned Wolf (*Chrysocyon brachyurus*). Smithsonian contributions to zoology 392:1-51.

EISENBERG, J. F. & K. H. REDFORD. 1999. Mammals of the Neotropics, the Central Neotropics. The University of Chicago Press, Chicago and London.

FACURE, K. G. 2002. Ecologia alimentar de duas espécies de felinos do gênero *Leopardus* em uma floresta secundária no sudeste do Brasil. Tese (Doutorado em Ecologia) – Instituto de Biologia, Universidade Estadual de Campinas, Campinas.

FACURE, K. G. & A. A. GIARETTA. 1996. Food habitats of carnivores in a coastal Atlantic Forest of southeastern Brazil. Mammalia 60:499-502.

FACURE, K. G. & E. L. A. MONTEIRO-FILHO. 1996. Feeding habitats of the Crab-eating fox, *Cerdocyon thous* (Carnivora, Canidae), in a suburban area of southeastern Brazil. Mammalia 60:147-149.

FACURE, K. G.; A. A. GIARETTA & E. L. A. MONTEIRO-FILHO. 2003. Food habits of the crab-eating-fox, *Cerdocyon thous*, in an altitudinal forest of the Mantiqueira Range, southeastern Brazil. Mammalia 67:503-511.

FONSECA, G. A. B., A. B. RYLANDS, C. M. R. COSTA, R. B. MACHADO & Y. L. R. LEITE. 1994. Livro Vermelho dos Mamíferos Brasileiros Ameaçados de Extinção. Fundação Biodiversitas, Belo Horizonte.

GITTLEMAN, J. L. & P. H. HARVEY. 1982. Carnivore home-range size, metabolic needs, and ecology. Behavioral Ecology and Sociobiology 10:57-63.

HUNT, R. M. J. 1996. Biogeography of the Order Carnivora. Pp. 485-541 in Carnivore Behavior, Ecology and Evolution (J. L. Gittleman, ed.). Knoxville: Cornell University Press, Ithaca and London.

JÁCOMO, A. T. A., L. SILVEIRA & J. A. F. DINIZ-FILHO. 2004. Niche separation between the maned-wolf (*Chrysocyon brachyurus*), crab-eating-fox (*Cerdocyon thous*) and the hoary-fox (*Dusicyon vetulus*) in the Cerrado of Central Brazil. Journal of Zoology 262:99-106.

JUAREZ, K. M. & J. MARINHO-FILHO. 2002. Diet, habitat use, and home ranges of sympatric canids in central Brazil. Journal of Mammalogy 83:925-933.

LANGGUTH, A. 1975. Ecology and evolution in the South American canids. In The wild canids (M. W. Fox, ed.). Van Nostrand Reinhold Co, New York.

MACDONALD, D. W. & O. COURTENAY. 1996. Enduring social relationships in a population of crab-eating zorros, *Cerdocyon thous*, in Amazonian Brazil (Carnivora, Canidae). Journal of Zoology 239:329-355.

MONTGOMERY, G. G. & Y. D. LUBIN. 1978. Social structure and food habits of crab-eating fox (*Cerdocyon thous*) in Venezuelan llanos. Acta Cientifica Venezolana 29:392-393.

MOTTA-JUNIOR, J. C., J. A. LOMBARDI & S. A. TALAMONI. 1994. Notes on crab-eating fox (*Dusicyon thous*) seed dispersal and food habits in southeastern Brazil. Mammalia 58:156-159.

NOWAK, R. M. 1999. Walker's Mammals of the World. 6th ed. The Johns Hopkins University Press, Baltimore and London.

WAYNE, K. R., E. GEFFEN, D. J. GIRMAN, K. P. KOEPFLI, L. M. LAU & C. R. MARSHALL. 1997. Molecular systematics of the canidae. Systematic Biology 46:622-653.

WOZENCRAFT, W. C. 2005. Carnivora. Pp. 532-628 In: Mammal Species of the World a Taxonomic and Geographic Reference (D. E. Wilson & Reeder DM, eds), Smithsonian Institution Press, Washington, DC.

CAPÍTULO 1

Social system and habitat use of the crab-eating fox (*Cerdocyon thous*) and the hoary fox (*Pseudalopex vetulus*) in an area of cattle farms in the Cerrado Biome

ABSTRACT

There is a great variation in social system among canids, ranging from solitary species to highly social species. The main objectives of this paper are to describe the social system of the crab-eating fox (*Cerdocyon thous*) and the hoary fox (*Pseudalopex vetulus*) and to compare habitat use in both species in an area of cattle farms in Central Brazil. Field work was carried out from January 2003 to February 2006. Group size and habitat use was quantified by direct observation of foraging foxes in the field. A total of 127 encounters with foxes were recorded. Crab-eating foxes were found in pairs in 34 (58.6%) of 58 encounters and hoary foxes were found solitary in 58 (84.0%) of 69 encounters. Solitary crab-eating foxes were registered in 19 encounters (8.6%), while hoary foxes were found in pairs in nine encounters (13%). One family group of crab-eating foxes was found five times (8.6%) and two family groups of hoary foxes were found once each one. Fox species differed in habitat use. Hoary foxes were sighted in grazed pasture in a higher proportion (84% of 69 encounters) than crab-eating foxes (67% of 58 encounters) and they were never found in forest neither in swamp. Crab-eating foxes used a greater number of habitats than hoary foxes did. These results indicate that the crab-eating fox forages in pairs, and sometimes with the offspring, while hoary foxes are mainly solitaries. Based on detected differences in habitat use, the conversion of natural areas of Cerrado into pastures probably affects hoary foxes in a lower degree than crab-eating foxes.

RESUMO

Existe uma grande variação no sistema social entre canídeos, variando de espécies solitárias a espécies altamente sociais. Os principais objetivos deste trabalho são descrever o sistema social do cachorro-do-mato (*Cerdocyon thous*) e da raposa-do-campo (*Pseudalopex vetulus*) e comparar o uso de habitat entre essas espécies em uma área de fazendas de gado no Brasil Central. O trabalho de campo foi conduzido de janeiro de 2003 a fevereiro de 2006. O tamanho de grupo e o uso de hábitat foi quantificado por observação direta dos animais forrageando no campo. Foram registrados 127 encontros com os dois canídeos. Os cachorros-do-mato foram encontrados em pares em 34 (58.6%) de 58 encontros e as raposas-do-campo foram encontradas solitárias em 58 (84.0%) de 69 encontros. Cachorros-do-mato solitários foram registrados em 19 avistamentos (8.6%), ao passo que raposas-do-campo foram encontradas em pares em nove encontros (13%). Uma família de cachorros-do-mato foi avistada cinco vezes (8.6%) e duas famílias de raposas-do-campo foram encontradas uma vez cada. As duas espécies diferiram no uso de habitat, sendo que as raposas-do-campo foram avistadas em pastagem em uma proporção maior (84% de 69 encontros) que os cachorros-do-mato (67% de 58 encontros) e elas nunca foram encontradas em florestas ou brejos. Os cachorros-do-mato utilizaram um maior número de hábitats do que as raposas-do-campo. Esses resultados indicam que os cachorros-do-mato forrageiam em pares, e algumas vezes com sua prole, enquanto as raposas-do-campo são principalmente solitárias. Com base nas diferenças detectadas no uso de habitat, a conversão de áreas naturais de Cerrado em pastagens provavelmente afeta menos a raposa-do-campo que o cachorro-do-mato.

INTRODUCTION

There is a great variation in social system among canids, ranging from primarily solitary species, as the maned wolf *Chrysocyon brachyurus*, to highly social species as the gray wolf *Canis lupus* (Nowak 1999). According to Moehlman (1987), such variation is related to body weight and sometimes to prey size, so that small (< 6.0 kg) canids feeding mainly on small mammals, insects and fruit, live as solitary foragers whereas medium (6.0 – 13.0 kg) and large (> 13.0 kg) canids specialized on large prey hunt cooperatively. The social system in canids may also vary intraespecifically as a result of differences in food availability and/or habitat resources, as observed for the swift fox *Vulpes velox* (Kamler et al. 2004), the Artic fox *Alopex lagopus*, and the red fox *Vulpes vulpes* (Moehlman 1987). However, most studies focus on North American, European and African species, so it is necessary to verify if South American canids follow these trends.

Studies on the ecology and behavior of carnivores are important to know which factors affect their distribution and abundance and may be a guide to establish conservation priorities and efficient management programs (Sunquist 1992). Although species as the grey fox *Pseudalopex griseus* and the culpeo fox *P. culpaeus* have been well studied (Johnson and Franklin 1994; Salvatori et al. 1999; Travaini et al. 2003; Zapata et al. 2005), many South American canids remain little known in terms of behavior and ecology (Sillero-Zubiri et al. 2004). In Brazil, there is a lack of basic information on many aspects of the life stories of carnivores, mainly for the smaller species (Morato et al. 2004). Besides, studies in anthropic areas are still scarce (e.g. Dalponte and Lima 1999; Juarez and Marinho-Filho 2002), although agricultural and farming activities are occupying great part of the available territories for native carnivores in this country.

The crab-eating fox *Cerdocyon thous* (Figure 1) is a small to medium sized canid (5.0 – 7.0 kg) with a wide distribution in South America, occurring from south Colombia and

Venezuela to north Argentina, Paraguay, and Uruguay (Berta 1982; Eisenberg & Redford 1999; Nowak 1999). This species inhabits cerrado, caatinga, scrubland, woodlands, forests, and mangrove swamps and its omnivorous diet may vary among regions and seasonally (Courtenay and Maffei 2004; Facure and Giaretta 1996; Facure and Monteiro-Filho 1996; Facure et al. 2003; Jácomo et al. 2004; Juarez and Marinho-Filho 2002; Montgomery and Lubin 1978; Motta-Junior et al. 1994). In the Venezuelan *llanos* crab-eating foxes live in familiar groups that include an adult male, an adult female and their juvenile offspring (Brady 1979; Montgomery and Lubin 1978). However, in Amazonia, post-dispersal adults can maintain close contact with their parents (MacDonald and Courtenay 1996).

The hoary fox (*Pseudalopex vetulus*) (Figure 2) is a small canid (2.5 – 4.0 kg), endemic of open formations of Cerrado in central Brazil (Dalponte 1995; Eisenberg & Redford 1999; Nowak 1999), but it also adapts to insect-rich livestock pastures and agricultural areas (Dalponte and Courtenay 2004). Its diet consists mainly of termites, but other insects, fruits, birds, and small rodents are also eaten (Courtenay et al. 2006; Dalponte 1995; Jácomo et al. 2004; Juarez and Marinho-Filho 2002). The hoary fox is a solitary canid that may forage in loosely knit pairs, sometimes with their juvenile offspring (Courtenay et al. 2006; Dalponte 2003; Dalponte and Courtenay 2004).

Although smaller canids are previously thought to be monogamous and solitary, recent studies show that some species may live in complicated and cooperative societies (MacDonald and Courtenay 1996; Kamler et al. 2004). The objectives of this paper are to describe the social system of the crab-eating fox and the hoary fox and to compare habitat use in both species in an area of cattle farms in Central Brazil.

MATERIALS AND METHODS

Study area. – This study was conducted in two contiguous cattle farms located in Cerrado Biome, Municipality of Cumari (18°22'S, 48°07'W), south of Goiás State, central Brazil, comprising together an area of 1.122 ha, which holds about 1,700 oxes (*Bos taurus*). Most of the area (90%) has been covered with pasture (*Brachiaria* sp.) for at least ten years. However, it still contains small patches of original vegetation, such as gallery forest and cerrado *sensu stricto*. The climate has two well-defined seasons, one wet and warm, from September to March, and other dry and cold, from April to August (Sano & Almeida, 1998). Field work was carried out monthly from January 2003 to December 2004 and weekly from January 2005 to February 2006.

Group size. – Group size was quantified by direct observation of foraging foxes in the field. The technique we used was adapted from Brady (1979) and consists in driving through dirt roads crossing the study area from 18:00 to 24:00 h and search for foxes using the pick-up head lights and a portable 40-watt spotlight. When a fox was sighted, the vehicle was turned off and the animal was watched with binoculars for at least ten minutes from a distance that could vary from 10 to 30 m. While watching the animal, the area around it were searched for other foxes that could belong to the same group of the first one sighted. Foxes were considered from the same group when they were sighted keeping some kind of interaction (*e.g.*, moving or resting together). When possible, individuals were sexed based on their posture when urinating, with males raising one of their hind legs back and slightly outward (Brady 1979). Although the foxes were not individualized, it was possible to recognize and accompany familiar groups for several weeks due to their behavior of staying restricted to the same area during the lactation period (Courtenay et al. 2006). The age of juveniles was estimated based on their size and behavior (Courtenay et al. 2006) and born dates were estimated based on the sightings of pregnant females.

Habitat use. – Habitat use was quantified by recording the vegetation type where foxes were first sighted, categorized as (1) grazed pasture, (2) abandoned pasture with vegetation in some succession stage, (3) swamp or border of swamp, (4) border of forest and (5) forest. For statistical analyses, we combined the habitats different from grazed pasture in a single category (others) due to their low occurrence in the study area. Sporadic observations of foxes during daylight were also considered for describe habitats used for resting and as shelters.

Statistical analysis. – Mean values were followed by standard deviation. Intra and inter-specific variation in group size and habitat use were evaluated using Mann-Whitney and Chi-Square tests (Zar 1999).

FIGURE 1. Adult crab-eating fox (*Cerdocyon thous*) consuming a bovine carcass in Cumari, Goiás, Brazil.

FIGURE 2. Adult hoary fox (*Pseudalopex vetulus*) in pasture, in Cumari, Goiás, Brazil.

RESULTS

Sightings. – In 53 field surveys (mean = 1.4 ± 1.2 surveys/month; *n* = 37 months), crab-eating foxes were sighted in 37 (69.8%) and hoary foxes in 43 (81.1%). The number of animals found by survey varied from zero to seven for both species, with mode two (35.8%) for the crab-eating fox (mean = 1.96 ± 1.82) and mode one (37.7%) for the hoary fox (mean = 1.57 ± 1.35) (Figure 3). The number of animals sighted by survey did not vary between seasons both for the crab-eating fox (Mann-Whitney U test statistic = 319.000; *P* = 0.590) as for the hoary fox (Mann-Whitney U test statistic = 1559.500; *P* = 0.313) (*n* = 29 surveys in dry season and 24 surveys in the wet season for both species).

Group size. – In a total searching time of 234.3 h (mean = 4.4 ± 1.7 h/survey; *n* = 53 surveys), we recorded 127 encounters with foxes. Crab-eating foxes were found in pairs in 34 (58.6%) of 58 encounters and hoary foxes were found solitary in 58 (84.0%) of 69 encounters (Figure 4). No statistical difference was found between seasons in group size for both species. Crab-eating foxes were seen mainly in pairs as much in the dry season (59.4%) as in the wet season (80.8%) (Yates corrected X^2 = 2.15; *d.f.* = 1; *P* = 0.143), while hoary foxes were sighted more frequently alone both in the dry season (90.2%) and in the wet season (75.0%) (Yates corrected X^2 = 1.86; *d.f.* = 1; *P* = 0.173). Even so, solitary crab-eating foxes were registered in 19 encounters (32.8%), while hoary foxes were found in pairs in nine encounters (13.0%). One family group of crab-eating foxes (two adults and a pup) was found five times (8.6%) from November 2005 to January 2006 and two family groups of hoary foxes were found each one once, the first one (two adults and a pup of undetermined age) in January 2003 and the second (an adult and three pups aged c. 5 months old) in December 2003. The female crab-eating fox were pregnant in August–September and probably gave birth in October, when she was not found. The hoary fox puppies saw in December 2003 probably were born in July. When disturbed the adult and her puppies sheltered in a yellow armadillo

(*Euphractus sexcinctus*) hole in a pasture area, which they probably were using as a den. In other occasions, solitary adult hoary foxes were also observed using armadillos holes in pasture areas during the first hours of the evening and in the morning.

Acoustic communication (siren howl) related to pair contact maintenance was recorded once for the crab-eating fox, when a couple was separated by the pick-up. The male was c. 100 m from the female and started to call her until she joins him.

Habitat use. – Fox species differed in habitat use (Yates corrected $X^2 = 4.62$; *d.f.* = 1; $P = 0.032$). Hoary foxes were sighted in grazed pasture in a higher proportion (84% of 69 encounters) than crab-eating foxes (67% of 58 encounters) and they were never found in forest neither in swamp (Figure 5). Besides, crab-eating foxes used a greater number of habitats than hoary foxes did and, when using open areas, generally they were at most 100 m. from forest fragments (30.8% of 39 sightings in pasture).

During daylight inspections, the two canids were rarely observed, with hoary foxes being more frequently sighted than crab-eating foxes. At this period of the day, hoary foxes were sighted in the pasture and near armadillo holes ($n = 4$) and crab-eating foxes in forest border ($n = 1$) and pasture ($n = 1$).

Inter-specific relationships. – During all the work, crab-eating foxes and hoary foxes were never sighted together. However, during a study on hoary fox' behavior done in the same area (see Chapter 2), it was registered an encounter between the two species that ended in a conflict, with the crab-eating fox persecuting and driving the hoary fox out.

Three times during the study, hoary foxes were sighted foraging among the cattle while crab-eating foxes just once.

Although big carnivores as pumas (*Puma concolor*) and maned wolves (*Chrysocyon brachyurus*) were sighted and registered (by cameras-trap and the regular collect of scats) in the study area, no interaction (encounter or predation) was registered between them and the

foxes. However, three times foxes were persecuted by domestic dogs (C*anis familiaris*), but they escaped all the time. Twice hoary foxes ran into armadillo holes, while a crab-eating fox, into under a low bridge.

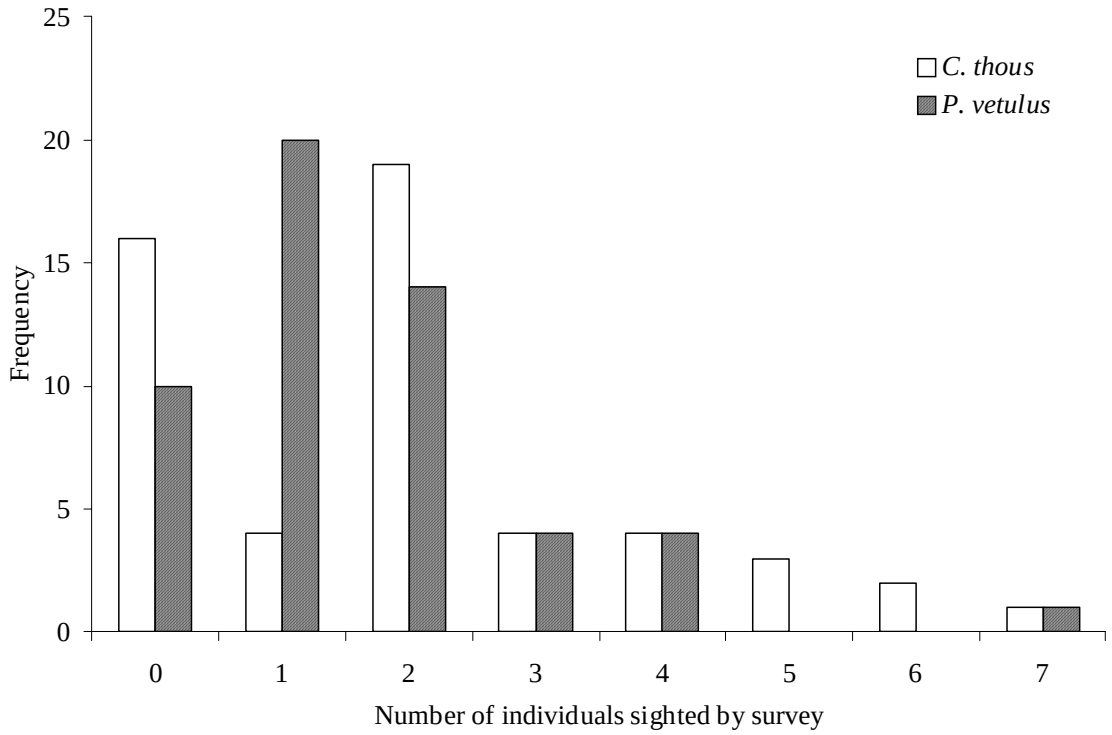

FIGURE 3. Frequency histogram of the number of crab-eating foxes (*Cerdocyon thous*) and hoary foxes (*Pseudalopex vetulus*) sighted by survey (*n* = 53 field surveys) in Cumari, Goiás, Brazil.

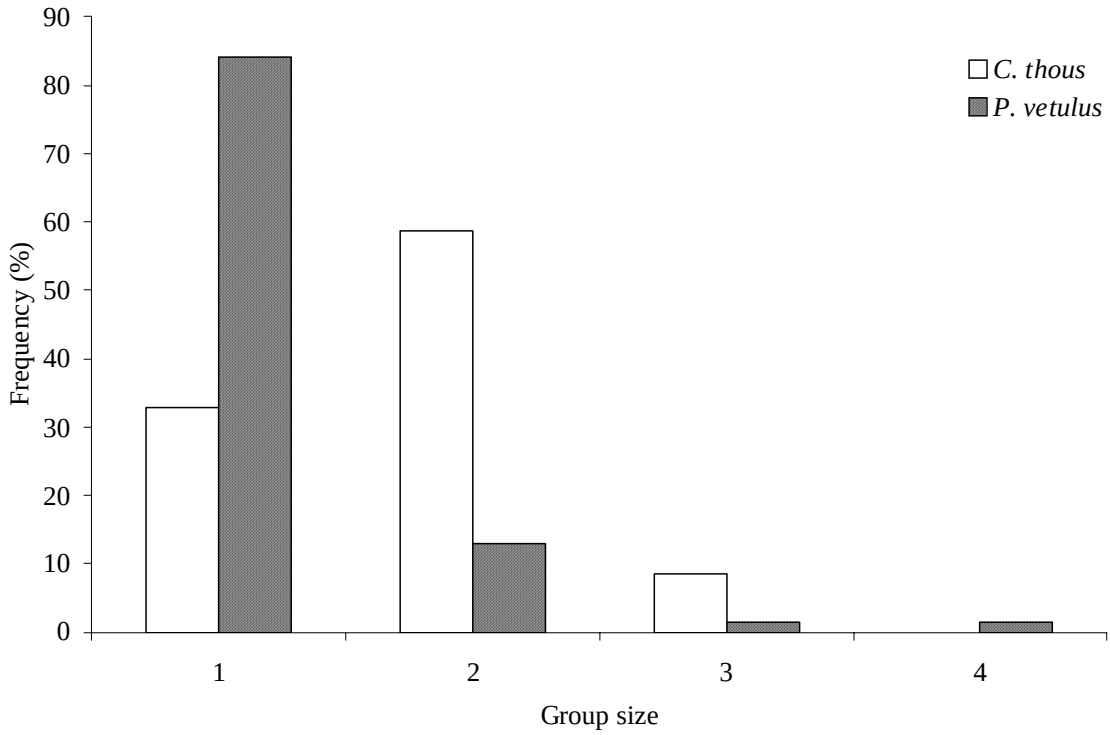

FIGURE 4. Variation in group size of the crab-eating fox (*Cerdocyon thous*) (*n* = 58 encounters) and the hoary fox (*Pseudalopex vetulus*) (*n* = 69 encounters) in Cumari, Goiás, Brazil.

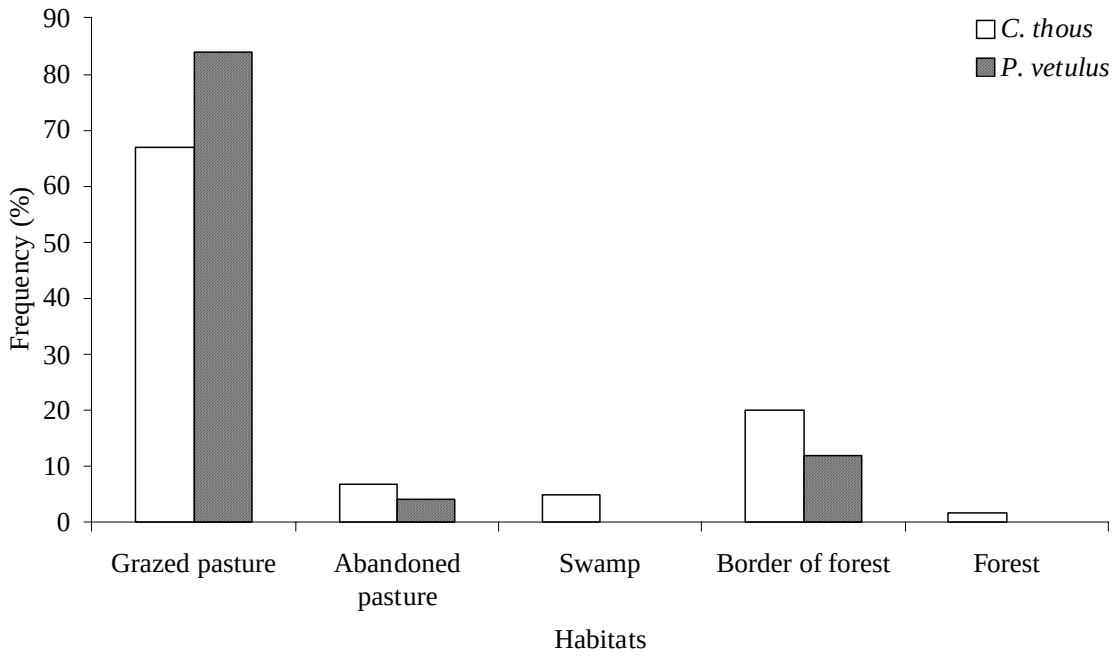

FIGURE 5. Differences in habitat use between the crab-eating fox (*Cerdocyon thous*) (*n* = 58 encounters) and the hoary fox (*Pseudalopex vetulus*) (*n* = 69 encounters) in Cumari, Goiás, Brazil.

DISCUSSION

Sightings. – Studies using radio-telemetry have shown that crab-eating foxes maintain a highly stable territory, with a couple's home-range ranging from 532 ha in Amazonia to 1.280 ha in Cerrado (Juarez and Marinho-Filho 2002; MacDonald and Courtenay 1996). A family of hoary foxes (a couple with five offspring) occupied an area of 456 ha in Minas Gerais state (Courtenay et al. 2006), while an adult female presented a home-range of 385 ha in the border of Bahia and Goiás states (Juarez and Marinho-filho 2002), both locations in Central Brazil. According to the known home-range of these species and the size of the study area (1.122 ha), the minimal number of resident animals expected in the area should be one couple of crab-eating foxes and three reproducing females of hoary foxes. The modal number of two crab-eating foxes in Cumari agrees with the expected for the area. Although the most frequent number of hoary foxes sighted by survey was only one, based on the encounter of puppies it is possible to infer that there are at least two family groups living there (see Kamler et al. 2003).

Group size. – Polygamy is the most common mating system among mammals, however, most canid species, as an exception, tends to be monogamous (Kleiman 1977). Canids are also known for their intraspecific variation in mating systems (Moehlman 1989). Many factors seem to be related to the variation of mating systems among canid species, such as body size (Moehlman 1989) and resource availability and dispersion (Geffen et al. 1996). Other researchers suggest that the variations in social systems of small canids may also be related to the mortality from larger canids, their predators (Cavallini 1996; Kamler et al. 2004). In the study area, crab-eating foxes forages in pairs, and sometimes with the offspring in agreement with the findings of Montgomery and Lubin (1978), although MacDonald and Courtenay (1996) in Amazonian forest had found that they may form groups of even five individuals (a couple and their adult offspring). Perhaps, food availability in Amazonian are

higher than in Cerrado allowing crab-eating foxes to form larger groups (MacDonald and Courtenay 1996).

Acoustic communication is a good indicator of sociability in canids (Biben 1982). The siren howl recorded in the present study probably is used to maintain pair contact during foraging activities. Couples of crab-eating foxes separated intentionally in the zoo of Athens, Ohio, EUA (Brady 1981) also emitted this kind of sound.

In canids, the group size is related to prey size, with species that hunt in group capturing larger prey them themselves (Moehlman 1987). Although the crab-eating foxes feed mainly on small prey (Facure and Giaretta 1996; Facure and Monteiro-Filho 1996; Facure et al. 2003; Jácomo et al. 2004; Juarez and Marinho-Filho 2002; Motta-Junior et al. 1994), Montgomery and Lubin (1978) suggests that when foraging in couples, both individuals may take advantage when one of them find abundant food resource (*e.g.* fruits, carcasses, eggs).

The hoary fox is a specialized species, feeding mainly on termites (Dalponte 1995; Juarez and Marinho-Filho 2002; Jácomo et al. 2004; Courtenay et al. 2006). Another insectivorous and specialized canid, the bat-eared fox (*Otocyon megalotis*), forms groups of various individuals that forage together (Moehlman 1989; Stuart et al. 2003). However, as other species of the genus *Pseudalopex* (Medel and Jaksic 1988; Salvatori et al. 1999; Travaini et al. 2003), the hoary foxes were seen mainly solitary.

The findings of hoary fox families in January and December 2003, confirms the few literature data that births occur mainly in spring (Coimbra-Filho 1966; Dalponte and Courtenay 2004; Courtenay at al. 2006), period of higher food availability, once insects are found in higher quantities (pers. obs.). Indeed, mating occurs in late June and it falls within the range of others members of the *Pseudalopex* group (Dalponte and Courtenay 2004). The litter size varied from one to three pups, while Coimbra-Filho (1966) reports three to four and Courtenay et al. (2006) reported five. The pups and the adults were sighted using holes of the

yellow armadillo, the most common armadillo in the area (pers. obs.). Courtenay et al. (2006) also reports hoary foxes using armadillo holes both puppies as an adult male.

Habitat use. – Other studies have already shown that crab-eating foxes can use several types of habitats (Brady 1979; Jácomo et al. 2004; Juarez and Marinho-Filho 2002; MacDonald and Courtenay 1996). Although the method used in the present study is more efficient for open areas, the fact of crab-eating foxes were sighted frequently near forest fragments and that they ran towards these habitats when threatened are good indicators that for this species, forested habitats is important as shelter. So, the presence of this species in anthropic areas, such as cattle farms, may be conditioned to the protection of some forest fragments.

The massive use of pasture by hoary foxes had already been shown by other authors (Courtenay et al. 2006; Jácomo et al. 2004; Juarez and Marinho-filho 2002). Indeed, despite the availability of other habitats, hoary foxes sheltered in pastures during the day and were active in the same habitat during the night, indicating that these species is well adapted to open areas. As Juarez and Marinho-Filho (2002) suggests, the preference of open habitats is probably related to the diet of the species. As a specialist in termites, hoary foxes use the habitats where it is more abundant and concentrated (Negret and Redford 1982), open areas and pasture. The conversion of natural areas of Cerrado into pastures probably raises the resource offer for the hoary fox, enhancing its ability to survive in anthropic areas, as previous suggested by other authors (Courtenay et al. 2006; Dalponte and Courtenay 2004).

Inter-specific relationships. – Courtenay et al. (2006) registered hoary foxes and crab-eating foxes foraging together, however our data showed that it is probably not so common. The fact that the only time we sighted a meeting between both species ended in a persecution indicates that crab-eating and hoary foxes do not tolerate each other and even compete for the use of the area.

At the study area, neither crab-eating foxes nor hoary foxes were intensively hunted or trapped by man, although they were blamed of preying on domestic fowl. Brady (1979) reports that crab-eating foxes avoid areas with cattle; however, our observations show that both crab-eating fox and hoary fox may forage among the cattle and, in the case of the hoary fox, also sleeps near the cattle. Jácomo et al. (2004) found that maned wolves may prey upon hoary foxes. Although not recorded in the present study, larger carnivore's predation upon the foxes may not be excluded. Indeed, Brady (1979) also suggests that small carnivorous mammals such as raccoons (*Procyon cancrivorus*), skunk (*Conepatus semistriatus*) and opossum (*Didelphis albiventris*), animals regularly sighted in our study area too, may also predate on the whelps.

Conclusions. – In Cumari, crab-eating foxes forage more frequently in pairs, while hoary foxes are primarily solitaries, with both species showing no seasonal variation in group size along the three years of study. Fox species differ in habitat use, with hoary foxes being sighted in grazed pasture in a higher proportion than crab-eating foxes; indeed, crab-eating foxes use a greater diversity of habitats than hoary foxes. Both fox species presented a negative relationship with domestic dogs in the area, with the dogs harassing the foxes anytime they met. The conversion of natural areas of Cerrado into pastures probably affects hoary foxes in a lower degree than crab-eating foxes.

LITERATURE CITED[1]

BERTA, A. 1982. *Cerdocyon thous*. Mammalian Species 186:1-4.

BIBEN, M. 1982. Ontogeny of social behaviour related to feeding in the Crab-eating fox (*Cerdocyon thous*) and the Bush dog (*Speothos venaticus*). Journal of Zoology 196:207-216.

BRADY, C. A. 1979. Observations on the behavior and ecology of the crab-eating-fox (*Cerdocyon thous*). In Vertebrate ecology in the northern Neotropics (J. F. Eisenberg, ed.). Smithsonian Institution Press, Washington, D.C.

BRADY, C. A. 1981. The vocal repertoires of the bush dog (*Speothos venaticus*), crab-eating fox (*Cerdocyon thous*) and maned wolf (*Chrysocyon brachyurus*). Animal Behavior 29:649-669.

CAVALLINI, P. 1996. Variation in the social system of the red fox. Ethology, Ecology and Evolution 8:323-342.

COIMBRA-FILHO, A. F. 1966. Notes on the reproduction and diet of Azara's fox *Cerdocyon thous azarae* and the hoary fox *Dusicyon vetulus* at Rio de Janeiro Zoo. International Zoological Yearbook 6:168-169.

COURTENAY, O. & L. MAFFEI. 2004. Crab-eating fox *Cerdocyon thous* (Linnaeus, 1776). Pp. 32-38 in Canids: Foxes, Wolves, Jackals and Dogs (C. Sillero-Zubiri, M. Hoffmann & D. W. MacDonald, eds.). IUCN/SSC Canid Specialist Group press. Gland, Switzerland and Cambridge, UK

COURTENAY, O.; D. W. MACDONALD; S. GILLINGHAM; G. ALMEIDA & R. DIAS. 2006. First observations on South America's largely insectivorous canid: the hoary fox (*Pseudalopex vetulus*). Journal of Zoology 268:45-54.

DALPONTE, J. C. 1995. The hoary fox in Brazil. Canid news 3:23-24.

---

1 - According to the Journal of Mammalogy norms

DALPONTE, J. C. 2003. História Natural, Comportamento e Conservação da Raposa-do-campo, *Pseudalopex vetulus* (Canidae). Tese de Doutorado (Biologia Animal), Instituto de Ciências Biológicas, Universidade Federal de Brasília, Brasília, DF. 179 pp.

DALPONTE, J. C. & LIMA, E. S. 1999. Disponibilidade de frutos e a dieta de *Pseudalopex vetulus* (carnivore - Canidae) em um cerrado de Mato Grosso. Revista Brasileira de Botânica 22, 2:325-332.

DALPONTE, J. C. & O. COURTENAY. 2004. Hoary fox *Pseudalopex vetulus*. Pp. 72-76 in Canids: Foxes, Wolves, Jackals and Dogs (C. Sillero-Zubiri, M. Hoffmann & D. W. MacDonald, eds.). IUCN/SSC Canid Specialist Group press. Gland, Switzerland and Cambridge, UK.

EISENBERG, J. F. & K. H. REDFORD. 1999. Mammals of the Neotropics, the Central Neotropics. The University of Chicago Press, Chicago and London.

FACURE, K. G. & E. L. A. MONTEIRO-FILHO. 1996. Feeding habitats of the Crab-eating fox, *Cerdocyon thous* (Carnivora, Canidae), in a suburban area of southeastern Brazil. Mammalia 60:147-149.

FACURE, K. G.; A. A. GIARETTA & E. L. A. MONTEIRO-FILHO. 2003. Food habits of the crab-eating-fox, *Cerdocyon thous*, in an altitudinal forest of the Mantiqueira Range, southeastern Brazil. Mammalia 67:503-511.

GEFFEN, E., M. E. GOMPER, J. L. GITTLEMAN, H. LUH, D. W. MACDONALD & R. WAYNE. 1996. Size, life-history traits, and social organization in the Canidae: a reevaluation. American Naturalist 147:140-160.

JÁCOMO, A. T. A., L. SILVEIRA & J. A. F. DINIZ-FILHO. 2004. Niche separation between the maned-wolf (*Chrysocyon brachyurus*), crab-eating-fox (*Cerdocyon thous*) and the hoary-fox (*Dusicyon vetulus*) in the Cerrado of Central Brazil. Journal of Zoology 262:99-106.

JOHNSON, W. E. & WILLIAM L. FRANKLIN. 1994. Role of body size in the diets of sympatric gray and culpeo foxes. Journal of Mammalogy 75:163-174.

JUAREZ, K. M. & J. MARINHO-FILHO. 2002. Diet, habitat use, and home ranges of sympatric canids in central Brazil. Journal of Mammalogy 83:925-933.

KAMLER, J. F., W. B. BALLARD, R. L. GILLILAND & K. MOTE. 2003. Spatial relationships between swift foxes and coyotes in northwestern Texas. Canadian Journal of Zoology 81:168-172.

KAMLER, J. F., W. B. BALLARD, P. R. LEMONS & K. MOTE. 2004. Variation in mating system and group structure in two populations of swift foxes, *Vulpes velox*. Animal Behavior 68:83-88.

KLEIMAN, D. G. 1977. Monogamy in mammals. Quarterly Review of Biology 52:39-69.

MACDONALD, D. W. & O. COURTENAY. 1996. Enduring social relationships in a population of crab-eating zorros, *Cerdocyon thous*, in Amazonian Brazil (Carnivora, Canidae). Journal of Zoology 239:329-355.

MEDEL, R. G. & F. B. JAKSIC. 1988. Ecología de los cánidos sudamericanos: una revisión. Revista Chilena de Historia Natural 61:67-69.

MOEHLMAN, P. D. 1989. Intraspecific variation in canid social systems. Pp. 143-163 in Carnivore Behavior, Ecology and Evolution (J. L. Gittleman, ed.). Cornell University Press, Ithaca, New York.

MONTGOMERY, G. G. & Y. D. LUBIN. 1978. Social structure and food habits of crab-eating fox (*Cerdocyon thous*) in Venezuelan llanos. Acta Cientifica Venezolana 29:392-393.

MORATO, R. G., F. H. G. RODRIGUES, E. EIZIRIK, P. R. MANGINI, R. L. G. MORATO & F. C. C. AZEVEDO. 2004. Plano de ação: pesquisa e conservação de mamíferos carnívoros do Brasil. Centro Nacional de Pesquisa e Conservação dos Predadores Naturais – CENAP, Ibama, São Paulo.

MOTTA-JUNIOR, J. C., J. A. LOMBARDI & S. A. TALAMONI. 1994. Notes on crab-eating fox (*Dusicyon thous*) seed dispersal and food habits in southeastern Brazil. Mammalia 58:156-159.

NEGRET, H. R. C. & K. H. REDFORD. 1982. The biology of nine termite species (Isoptera: Termitidae) from the Cerrado of central Brazil. Psyche 89:81-106.

NOWAK, R. M. 1999. Walker's Mammals of the World. 6th ed. The Johns Hopkins University Press, Baltimore and London.

SALVATORI, V., G. VAGLIO-LAURIN, P. L. MESERVE, L. BOITANI & A. CAMPANELLA 1999. Spatial organization, activity, and social interactions of culpeo foxes (*Pseudalopex culpaeus*) in north-central Chile. Journal of Mammalogy 80:980-985.

SANO, S. N. & S. P. ALMEIDA. 1998. Cerrado: ambiente e flora. Embrapa – CPAC, ppxii-56.

SILLERO-ZUBIRI, C.; M. HOFFMANN & D. W. MACDONALD. 2004. Canids: Foxes, Wolves, Jackals and dogs. 1st ed. IUCN/SSC Canid Specialist Group press. Gland, Switzerland and Cambridge, UK.

SUNQUIST, M. E. 1992. The ecology of ocelot: the importance of incorporating life history traits into conservation plans. Pp. 117-128 in Felinos de Venezuela: Biología, Ecología e Conservación. FUDECI, Caracas.

TRAVAINI, A., J. PEREIRA, R. MARTINEZ-PECK & S. C. ZAPATA. 2002. Monitoreo de zorros colorados (*Pseudalopex culpaeus*) y grises (*Pseudalopex griséus*) em Patagônia: diseño y comparación de dos métodos alternativos. Journal of Neotropical Mammalogy 10:277-291.

ZAPATA, S. C., A. TRAVAINI, M. DELIBES & R. MARTÍNEZ-PECK. 2005. Food habitats and resource partitioning between grey and culpeo foxes in southeastern Argentine Patagonia. Studies on Neotropical Fauna and Environment 40:97-103.

ZAR, J.H. 1999. Biostatistical analysis. 4th edition. Prentice-Hall, Englewood Cliffs, New Jersey, USA.

CAPÍTULO 2

Interference competition between the crab-eating fox (*Cerdocyon thous*) and the hoary fox (*Pseudalopex vetulus*)

ABSTRACT

Previous studies have focused on overlap in diet and habitat use between the hoary fox (*Pseudalopex vetulus*) and the crab-eating fox (*Cerdocyon thous*); however, there are no data about interference competition between these species. The objective of this work is to describe a behavioral interaction between these canids, observed in a cattle farm, in the south of Goiás State, Brazil. The encounter was registered during a study on hoary fox's behavior. Foxes were searched for at night using a spotlight and filmed for posterior description and quantification of behaviors. On September 23, 2004, at 23:20 h, a hoary fox was found foraging in the pasture, near a forest fragment. After some minutes, two crab-eating foxes arrived at the place and one of them started to walk slowly towards the hoary fox, with its body lowered and stopping twice. When it gets about 20 m from the hoary fox, it suddenly advanced towards the hoary fox, which ran in the opposite direction. The crab-eating fox persecuted the hoary fox for approximately 15 m, during six seconds, never reaching less than 10 m from it. After the persecution, the crab-eating fox returned and walked around the area where the hoary fox was foraging initially, keeping an aggressive posture, showing piloerection of the back and tail fur. After that, it joined the co-specific and both individuals walked towards the forest fragment. For the hoary fox it may be more advantageous run away and avoids the conflict, once it is smaller (2.5 – 4.0 kg) than the crab-eating fox (4.5 – 8.5 kg).

RESUMO

Estudos prévios têm enfocado a sobreposição na dieta e no uso do habitat entre o cachorro-do-mato (*Cerdocyon thous*) e a raposa-do-campo (*Pseudalopex vetulus*), porém não existem registros sobre competição por interferência entre essas espécies. O objetivo deste trabalho é descrever uma interação comportamental entre um cachorro-do-mato e uma raposa-do-campo, observada em uma fazenda de gado no sul de Goiás, Brasil. O encontro foi presenciado durante a realização de um estudo sobre o comportamento da raposa-do-campo. Os animais foram procurados durante a noite usando um holofote manual e filmados para posterior descrição e quantificação dos comportamentos. Em 23 de setembro de 2004, às 23:20 h, uma raposa-do-campo foi encontrada forrageando em uma área de pastagem, próximo a um fragmento de mata. Após alguns minutos, dois cachorros-do-mato chegaram ao local e um deles começou a caminhar lentamente em direção à raposa, com o corpo abaixado e olhando fixamente para ela. O cachorro-do-mato parou duas vezes por alguns segundos até ficar a cerca de 20 m da raposa, então ele avançou de repente em sua direção e ela correu na direção oposta. O cachorro-do-mato perseguiu a raposa por aproximadamente 15 m, durante seis segundos, nunca chegando a menos de 10 m dela. Após a perseguição, o cachorro-do-mato retornou e andou em torno da área onde a raposa forrageava inicialmente, mantendo uma postura agressiva, com os pêlos do dorso e da cauda eriçados. Depois disso, ele juntou-se ao co-específico e os dois indivíduos caminharam em direção ao fragmento de mata. Para a raposa-do-campo pode ser mais vantajoso fugir e evitar o conflito, uma vez que ela é menor (2,5 - 4,0 kg) que o cachorro-do-mato (4,5 - 8,5 kg).

INTRODUCTION

Interference competition is a major component of Canidae ecology (Macdonald and Sillero-Zubiri 2004). The red fox (*Vulpes vulpes*) is the most common species which interactions with other carnivores, such as badgers (*Meles meles*), martens (*Martes martes*) and other canids, have been most studied (Macdonald et al. 2004; Mitchell and Banks 2005; Tannerfeldt et al. 2002). However, many data have been already recorded for other species too as gray wolves (*Canis lupus*) (Paquet 1992; Peterson 1995) and coyotes (Kamler et al. 2003a; Kamler et al. 2003b; Ralls and White, 1995; Sargeant and Allen 1989; Scott-Brown et al. 1987; Voight and Earle 1983). In Africa, cape foxes (*Vulpes chama*) are harassed by black-backed jackals (*Canis mesomelas*) in the Kalahari, while wild dogs (*Lycaon pictus*) kill bat-eared foxes (*Otocyon megalotis*) (Rasmussen 1996). However, most of the data comes from northern hemisphere and information on interference competition among South American canids is still scarce.

Studies on canid species from Brazilian Cerrado generally focused on a single species (*e.g.*, Courtenay et al. 2006; Dalponte 1995; Dalponte and Courtenay 2004; Facure et al. 2003; MacDonald and Courtenay 1996; Rodrigues 2002). Although previous authors have quantified overlap in diet and habitat use between the crab-eating fox (*Cerdocyon thous*) and the hoary fox (*Pseudalopex vetulus*) (Jácomo et al. 2004; Juarez and Marinho-Filho 2002), there are no data about interference competition between these species. The objective of this paper is to describe a behavioral interaction between a crab-eating fox and a hoary fox, observed in a cattle farm in Central Brazil.

MATERIALS AND METHODS

Study area. – The interaction was observed in a cattle (*Bos taurus*) farm in the south of Goiás State, Central Brazil (18°22'S, 48°07'W). The farm is located in the Cerrado biome and presents a total area of 494.4 ha, of which c. 90% is covered by pasture and the other 10% by natural vegetation (gallery forest and cerrado sensu stricto). The climate has two well-defined seasons, one wet and warm, from September to March, and other dry and cold, from April to August (Sano and Almeida 1998). Field work was conducted on September 2004.

The interaction was registered during a study about hoary fox's behavior (Lemos et al. 2005). The technique consisted in driving through dirt roads that cross the study area from 18:00 to 24:00 h and search for foxes using the pick-up head lights and a portable 40-watt spotlight. When a fox was sighted, the vehicle was turned off and the animal was followed at a certain distance by foot, with the binoculars, in order to minimize our interference in the fox's behavior. The interaction was filmed with a camcorder (Sony Handy Cam CCDTR517, lens 18 X 200 mm) for posterior description (including drawings) and quantification of behaviors.

RESULTS

On September 23, at 23:20 h, a hoary fox was found foraging in a pasture area, near a forest fragment. After some minutes, two crab-eating foxes arrived at the place and one of them started to walk slowly towards the hoary fox, with its body lowered and stopping for some seconds twice. When it gets about 20 m from the hoary fox, it suddenly advanced towards it, which ran away in the opposite direction. The crab-eating fox persecuted the hoary fox for approximately 15 m, during six seconds, never reaching less than 10 m from it. After the persecution, the crab-eating fox returned and walked around the area where the hoary fox was foraging initially, showing piloerection of the back and tail fur. Then, it joined the co-specific and both individuals walked towards the forest fragment. All the interaction lasted two minutes and 40 seconds.

After the crab-eating foxes were gone, we moved by pick-up towards the hoary fox and met it again, 300 m from the area where the conflict happened. The hoary fox was sitting and apparently calm, so that, after few minutes it started foraging again.

FIGURE 1. A drawing of the crab-eating fox (*Cerdocyon thous*), showing its posture when approaching the hoary fox (*Pseudalopex vetulus*).

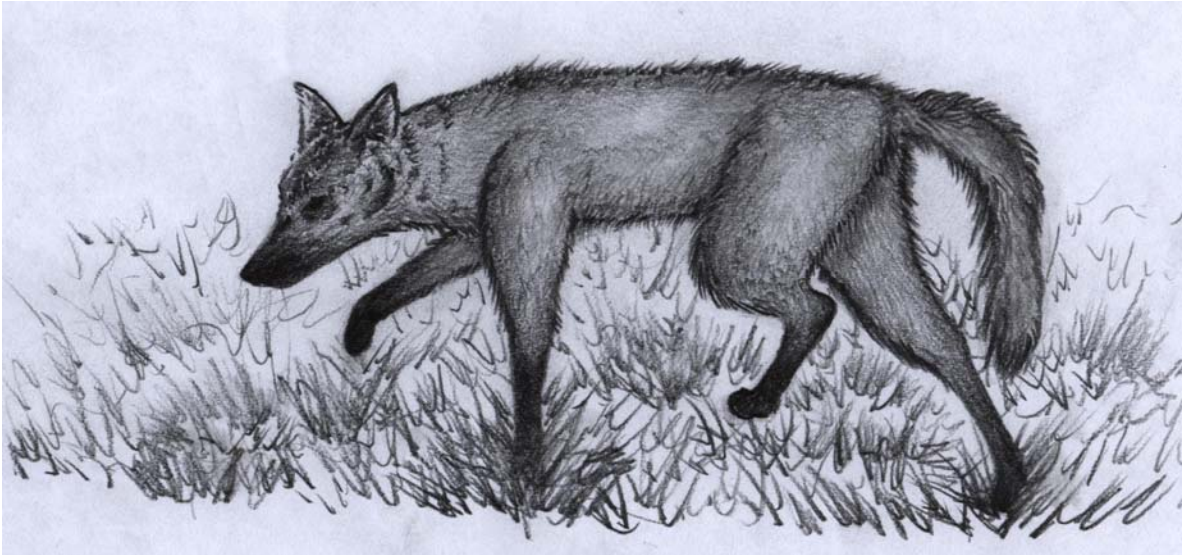

FIGURE 2. A drawing of the crab-eating fox (*Cerdocyon thous*), showing piloerection of the back and tail fur.

DISCUSSION

Niche overlap may indicate a potential for interspecific competition (Pianka 1981). Despite similarities in body mass and morphology, the hoary fox and the crab-eating fox present little dietary overlap (0.30-0.40), a result of the highly specialized diet (termitivory) of the former species (Juarez and Marinho-Filho200; Jácomo et al. 2004). In fact, the interaction did not involve a food source and the crab-eating fox did not stay in the place where the hoary fox was droved out. It is more likely that the conflict was a result of the intolerance of the crab-eating fox on other canid species.

Interference competition often results in spatial displacement of the smaller species by the larger ones. For example, swift fox's home ranges usually are located near the periphery or outside coyote's home ranges, what indicates that coyotes spatially displace swift foxes (Kamler et al. 2003a; Kamler et al. 2003b). Such behavior of the smaller species avoiding the larger one is common among canids and increases the individuals' survival rate (Macdonald and Sillero-Zubiri 2004; Voight and Earle 1983; Tannerfeldt et al. 2002). Generally, interspecific killing is responsible for 87% of mortalities among small carnivores (Palomares and Caro 1999). For the hoary fox it is more advantageous to avoid the conflict, once it is smaller (adults averaging 3.4 kg - Dalponte and Courtenay 2004) and lesser robust than the crab-eating fox (5.7 kg - Courtenay and Maffei 2004).

The interaction described here suggests that the crab-eating fox is territorial and more aggressive than the hoary fox, taking advantage on the contest for feeding sites. Despite being found in several habitat types in Cerrado (Jácomo et al. 2004; Juarez and Marinho-Filho 2002), at least in Limoeiro´s Ranch, crab-eating foxes seem to be more associated to areas with greater vegetal covering (see Chapter 1). The fact of the interaction had occurred near a forest fragment allow to suppose that in the study area hoary foxes have fewer chances of using such places.

LITERATURE CITED[1]

COURTENAY, O. & L. MAFFEI. 2004. Crab-eating fox *Cerdocyon thous* (Linnaeus, 1776). Pp. 32-38 in Canids: Foxes, Wolves, Jackals and Dogs (C. Sillero-Zubiri, M. Hoffmann & D. W. MacDonald, eds.). IUCN/SSC Canid Specialist Group press. Gland, Switzerland and Cambridge, UK

COURTENAY, O., D. W. MACDONALD, S. GILLINGHAM, G. ALMEIDA & R. DIAS. 2006. First observations on South America's largely insectivorous canid: the hoary fox (*Pseudalopex vetulus*). Journal of Zoology 268:45-54.

DALPONTE, J. C. 1995. The hoary fox in Brazil. Canid news 3:23-24.

DALPONTE, J. C. & O. COURTENAY. 2004. Crab-eating fox *Cerdocyon thous*. Pp. 32-38. Hoary fox *Pseudalopex vetulus*. Pp. 72-76 in Canids: Foxes, Wolves, Jackals and Dogs (C. Sillero-Zubiri, M. Hoffmann & D. W. MacDonald, eds.). IUCN/SSC Canid Specialist Group press. Gland, Switzerland and Cambridge, UK.

FACURE, K. G.; A. A. GIARETTA & E. L. A. MONTEIRO-FILHO. 2003. Food habits of the crab-eating-fox, *Cerdocyon thous*, in an altitudinal forest of the Mantiqueira Range, southeastern Brazil. Mammalia 67:503-511.

JÁCOMO, A. T. A., L. SILVEIRA & J. A. F. DINIZ-FILHO. 2004. Niche separation between the maned-wolf (*Chrysocyon brachyurus*), crab-eating-fox (*Cerdocyon thous*) and the hoary-fox (*Dusicyon vetulus*) in the Cerrado of Central Brazil. Journal of Zoology 262:99-106.

JUAREZ, K. M. & J. MARINHO-FILHO. 2002. Diet, habitat use, and home ranges of sympatric canids in central Brazil. Journal of Mammalogy 83:925-933.

KAMLER, J. F., W. B. BALLARD, R. L. GILLILAND & K. MOTE. 2003a. spatial relationships between swift foxes and coyotes in northwestern Texas. Canadian Journal of Zoology 81:168-172.

---

1 - According to the Journal of Mammalogy norms

KAMLER, J. F., W. B. BALLARD, R. L. GILLILAND, P. R. LEMONS II & K. MOTE. 2003b. Impacts of coyotes on swift foxes in northwestern Texas. Journal of Wildlife Management 67:317-323.

LEMOS, F. G.; A. N. COSTA & K. G. FACURE. 2005. Behavioral repertory of *Pseudalopex vetulus* (Carnivora; Canidae) in an antropic area of Cerrado in South of Goiás State, Brazil. Annual Meeting of the Association for Tropical Biology and Conservation, Resumos.

MACDONALD, D. W. & O. COURTENAY. 1996. Enduring social relationships in a population of crab-eating zorros, *Cerdocyon thous*, in Amazonian Brazil (Carnivora, Canidae). Journal of Zoology 239:329-355.

MACDONALD, D. W., C. D. BUESCHING, P. STOPKA, J. HENDERSON, S. A. ELLWOOD & S. E. BAKER. 2004. Encounters between two sympatric carnivores: red foxes (*Vulpes vulpes*) and European badgers (*Meles meles*). Journal of Zoology 263:385-392.

MACDONALD, D. W. & C. SILLERO-ZUBIRI. 2004. Biology and Conservation of Wild Canids. 1st ed. Oxford University Press, United States.

MITCHELL, B. D. & P. B. BANKS. 2005. Do wild dogs exclude foxes? Evidence for competition from dietary and spatial overlaps. Austral Ecology 30:581-591.

PALOMARES, F. & T. M. CARO. 1999. Interspecific killing among mammalian carnivores. American Naturalist 153:492-508.

PAQUET, P. C. 1992. Prey use strategies of sympatric wolves and coyotes in Riding Mountain National Park, Manitoba. Journal of Mammalogy 73:337-343.

PETERSON, R. O. 1995. Wolves as interspecific competitors in canid ecology. Pp. 315-324 in Ecology and Conservation of wolves in a changing world (L. N. Carbyn, S. H. Fritts, and D. R. Seip, eds.). Canadian Circumpolar Institute, Edmonton, Alberta, Canada.

PIANKA, E. R. 1974. Niche overlap and diffuse competition. Proceedings of the National Academy of Sciences of the United States of America 71:2141-2145.

RALLS, K. & P. J. WHITE. 1995. Predation on San Joaquin kit foxes by larger canids. Journal of Mammalogy 76:723-729.

RASMUSSEN, G. S. A. 1996. Predation on bat-eared fox Otocyon megalotis by Cape hunting dogs Lycaon pictus. Koedoe 39:127-129.

RODRIGUES, F. H. G. 2002. Biologia e conservação do lobo-guará na Estação Ecológica de Águas Emendadas, DF. Tese (Doutorado em Ecologia) – Instituto de Biologia, Universidade Estadual de Campinas, Campinas.

SANO, S. N. & S. P. ALMEIDA. 1998. Cerrado: ambiente e flora. Embrapa – CPAC, ppxii-56.

SARGEANT, A. B. & S. H. ALLEN. 1989. Observed interactions between coyotes and red foxes. Journal of Mammalogy 70:631-633.

SCOTT-BROWN, J. M., S. HERRERO & J. REYNOLDS. 1987. Swift fox. In Wild furbearer conservation and management in North America (M. Novak, J. A. Baker, M. E. Obbard & B. Malloch, eds.). Ontario Ministry of Natural Resources and the Ontario Trappers Association, Ontario, Canada.

TANNERFELDT, M., B. ELMHAGEN & A. ANGERBJÖRN. 2002. Exclusion by interference competition? The relationship between red and artic foxes. Oecologia 132:213-220.

VOIGHT, D. R. & B. D. EARLE. 1983. Avoidance of coyotes by red fox families. Journal of Wildlife Management 47:852-857.

WHITE, P. C. L. & S. HARRIS. 1994. Encounters between red foxes (*Vulpes vulpes*): implications for territory maintenance, social cohesion and dispersal. Journal of Animal Ecology 63:315-327.

CAPÍTULO 3

Food habits of two sympatric canids, the hoary fox *Pseudalopex vetulus* and the crab-eating fox *Cerdocyon thous*, in southeastern cattle farms of Central Brazil

ABSTRACT

The Cerrado presents a high diversity of mammalian carnivores. Studies focusing ecological aspects such as diet of syntopic species help to understand how they share resources. The objective of this work was to describe and to compare the diet of two syntopic canids: the hoary-fox *Pseudalopex vetulus* and the crab-eating-fox *Cerdocyon thous*, in the Cerrado Biome. The field work was carried out from September 2002 to November 2006, in two farms in the south of Goiás State, Brazil. Diet was studied analyzing 55 scats, twenty-three from hoary foxes and thirty-two from crab-eating foxes. Twenty-seven food items (twenty one animal and six plant species) were identified. In the diet of the hoary fox, the most frequent items were termites (Isoptera) (91.3% of the scats), although coleopterans (43.5%) and orthopterans (30.4%) have also been consumed in high frequencies too. Fruits were present in 30.4% of the scats, while Squamata (13%), mammals (13%) and birds (8.7%) were less consumed. The most consumed item by the crab-eating fox was an unidentified Bromeliaceae (56.3%) and fruits were present in 93.8% of the scats. From animal origin, arthropods were the most consumed (78.1%) item, together with mammals, which were registered in 68.8% of the scats; Cricetidae rodents were the most consumed mammal (53.2%). Squamata was found in 50% of the sample, being more consumed than birds (25%) and anurans (3.1%). The crab-eating fox presented a higher richness of food items in its diet than the hoary fox. Termites was the most important item in the diet of the hoary fox, occurring in almost all the scats, although arthropods did occurred in all hoary fox's scats and almost all crab-eating fox's scats. However, others work reports low dietary niche overlap for the hoary fox and the crab-eating fox, showing that they may compete in some degree.

RESUMO

O Cerrado apresenta uma alta diversidade de mamíferos carnívoros. Estudos enfocando aspectos ecológicos como dieta de espécies sintópicas ajudam a entender como essas espécies repartem recursos. O objetivo deste trabalho foi descrever e comparar a dieta de dois canídeos sintópicos: a raposa-do-campo *Pseudalopex vetulus* e o cachorro-do-mato *Cerdocyon thous*, no Bioma Cerrado. O trabalho de campo foi realizado de setembro de 2002 a novembro de 2006, em duas fazendas no sul do estado de Goiás, Brasil. A dieta foi estudada a partir da análise de 55 fezes, vinte e três de raposas-do-campo e 32 de cachorros-do-mato. Vinte e sete itens alimentares (21 de origem animal e seis de origem vegetal) foram identificados. Na dieta da raposa-do-campo o item mais freqüente foram cupins (Isoptera) (91.3% das amostras), embora coleópteros (43.5%) e ortópteros (30.4%) tenham sido consumidos em alta freqüência também. Frutos estiveram presentes em 30.4% das fezes, enquanto escamados (13%), mamíferos (13%) e aves (8.7%) foram pouco consumidos. O cachorro-do-mato apresentou uma maior diversidade de itens alimentares em sua dieta. O item mais consumido foi uma Bromeliaceae não-identificada (56.3%), sendo que frutos estiveram presentes em 93.8% das fezes. De origem animal, artrópodes foram os itens mais consumidos (78.1%), junto com mamíferos, os quais foram registrados 68.8% das fezes; roedores cricetídeos foram os mamíferos mais consumidos (53.2%). Escamados estiveram presentes em 50% da amostra, sendo mais consumidos que aves (25%) e anuros (3.1%). O cachorro-do-mato apresentou maior riqueza de itens alimentares em sua dieta que a raposa-do-campo. Cupins foi o item mais importante na dieta da raposa-do-campo, ocorrendo em quase todas as fezes. Artrópodes ocorreram em todas as fezes de raposa-do-campo e quase todas de cachorro-do-mato. Porém, outros trabalhos reportam uma baixa sobreposição de nicho alimentar entre a raposa-do-campo e o cachorro-do-mato, demonstrando que eles podem competir em certo grau.

I

INTRODUCTION

Surveys on carnivore's feeding ecology help to know the role that these animals play on natural communities and to understand competitive process and predator-prey interaction patterns. Besides, allow to compare and verify the existence of variation on the diet and behavior of different populations in distinct areas. Such information is important to the preparation of conservation management plans, mainly of extinction threatened species, as the maned wolf. Due to the lack of data on its ecology, the hoary fox is classified as data deficient in terms of conservation status (Dalponte and Courtenay 2004), being considered one of the seven least known canids of the world by the IUCN (The World Conservation Union). Different from the crab-eating fox, which is classified as least concern (Courtenay and Maffei 2004).

At the biome Cerrado, canids are represented by four species: the maned wolf (*Chrysocyon brachyurus*), the crab-eating fox (*Cerdocyon thous*), the hoary fox (*Pseudalopex vetulus*) and the bush-dog (*Speothos venaticus*) (Eisenberg 1999). Among these, the maned wolf and the bush-dog are considered as threatened of extinction (Brasil 2003).

The hoary fox (*Pseudalopex vetulus*) is a small canid (2.5 – 4.0 kg), endemic of open areas of Cerrado in central Brazil (Dalponte 1995; Jácomo et al. 2004), but it also adapts to insect-rich livestock pastures and agricultural areas (Courtenay et al. 2006; Dalponte and Courtenay 2004). As few studies about the behavioral habits of this species have been done, it is one of the less studied Neotropical canid (Courtenay et al. 2006; Dalponte 1995; Juarez and Marinho-Filho 2002). Its diet varies seasonally and consists mainly on termites, but other insects, fruits, birds, and small rodents are also eaten (Courtenay et al. 2006; Dalponte 1995; Jácomo et al. 2004; Juarez and Marinho-Filho 2002).

Larger than the slight hoary fox, the crab-eating fox (*Cerdocyon thous*) is a small to medium sized canid (5.0 – 7.0 kg) with a wide distribution in South America, occurring from

south Colombia and Venezuela to north Argentina, Paraguay, and Uruguay (Berta 1982; Eisenberg and Redford 1999; Nowak 1999). This species inhabits Cerrado (Brazilian savannah), forests, and mangrove swamps, and may be also found in city outskirts (Jácomo et al. 2004; Juarez and Marinho-Filho 2002). The crab-eating fox is mainly omnivorous, and its diet also may vary among regions and seasonally (Facure et al. 2003; Montgomery and Lubin 1978). According to most studies, which were done in Atlantic forest biome, fruits are an important item in the crab-eating fox diet, beyond vertebrates and arthropods (Facure and Monteiro-Filho 1996; Facure et al. 2003). In the other way, researches on this species ecology on biome Cerrado, as the one from Jácomo et al. (2004) and from Juarez and Marinho-Filho (2002), are still scarce.

Our research had as main objective to compare the diet of two canids' species: the hoary fox (*P. vetulus*) and the crab-eating fox (*C. thous*) in areas of Cerrado in the south of Goiás State, Brazil.

MATERIALS AND METHODS

Study area. – According to Sano e Almeida (1998), the Cerrado is the second biggest Neotropical biome and presents phytophysionomies that goes since more open landscapes, as *campos* and *veredas*, until more dense vegetation, as galleries and semi-deciduals forests. The climate is characterized by two well-defined seasons: one rainy and hot, that goes from October to March and another cold and dry, from April to September. The work was done in two contiguous cattle farms in the municipality of Cumari, Goiás State (GO), Brazil.

The farms comprise together an area of 1.122 hectares, with 90% represented by pasture and the other 10% by natural vegetation, mainly semi-deciduals forests and abandoned pastures on different succession stages.

Diet analysis. – Diet was studied through scat analysis, which is the most utilized method in studies on carnivore food habits (Mills 1996) and permits sufficient collection of data for intra and interspecific comparisons (Emmons 1987, Facure and Giaretta 1996, Sunquist et al. 1989).

In the field, samples were collected and stored in plastic bags with an etiquette containing date; collector's name and local where the sample was collected. Once in the laboratory, the samples were fixed in 70% alcohol and later analyzed.

For the analyses, each sample was open in a tray and the food items macroscopilly separated from others organics residues. Prey identification were done through comparison of bones, teeth, fur, feathers, scales and exoesqueletons found in the scats with specimens housed in the Museu de Biodiversidade do Cerrado of the Universidade Federal de Uberlândia and specialized bibliography (Borror and White 1979; Eisenberg and Redford 1999). Plant species were identified by comparison with a reference collection of fruits available in the study area and consulting specialists.

The predator identification was done through the encounter of hair ingested during self-grooming (Emmons 1987; Facure 2002), through association with tracks found near the scats (Becker and Dalponte 1999; Lima Borges and Tomás 2004) and through direct observation of the animals in the field. Hair was identified through macroscopic characteristics as length, texture and color and microscopic as kind of cuticle scales and marrow pattern (Chehébar and Martín 1989, Quadros 2002).

Food items were quantified according to their occurrence frequency, expressed as the percentage of scats that certain item or category was found (Facure 2002).

RESULTS

Number of samples and feeding ecology. – 106 scats were collected between September 2002 and November 2006, where, 23 (21.7%) were from hoary foxes and 32 (30.2%) from crab-eating foxes. The scats were collected along railroads, dirt roads, termite mounds and amid pasture. From the total of scats, 86.8% was collected in the dry season (April to September) and 13.2% in the wet season (October to March), so it was not possible to verify seasonality in the species' diet. In the total, 27 taxa were identified in the diet of the two studied species (Table 1).

Hoary fox. – All hoary fox's scats were grouped on rocky formations known as *cascalheiras* and on the pasture, among the vegetation. The scats presented a medium diameter of 2.3 cm (SD = 0.4; range: 1.4 - 3; *n* = 20).

Eleven taxa were identified in the diet of the hoary fox: two (18%) plant and nine (82%) animal. The most frequent items were termites (Table 1), which were present in 91.3% of the scats. Beyond the termites, dung-beetles and crickets were also consumed, with an occurrence frequency of 43.5% and 30.4%, respectively. Among the consumed fruits, the guava (*Psidium guajava*) was the most frequent, occurring in 13% of the scats. Cricetidae rodents were the most consumed vertebrate, presenting a frequency of occurrence of 13%. Passeriformes birds were present in 8.7% of the scats, whereas Colubridae and Viperidae snakes presented the same occurrence frequency of Scincidae (*Mabouya* sp., Squamata), being present in 4.3% of the analyzed scats. A hoary fox was observed consuming a rattlesnake (*Crotalus durissus*) carcass and after feeding on *mutamba* (*Guazuma ulmifolia*) during the same night.

Crab-eating fox. – Differently from the hoary fox, crab-eating fox's scats were in pastures and sometimes on railroads. The feces presented the same medium diameter (2.3 cm; SD = 0.5; range: 1.4 – 3; *n* = 23) of the hoary fox's ones.

Twenty-six taxa were identified in the diet of the crab-eating fox, six (23%) plants and 20 (77%) animals. Fruits and arthropods were the main categories, being found in respectively 93.8% and 78.1% of the analyzed scats (Table 1). Mammals represented the third most consumed category (68.8%), followed by snakes (50%), birds (25%) and anurans (3.1%). Fruits of a Bromeliaceous were the most frequent items (56.3% of the feces). Other important fruit on the crab-eating fox's diet was the *mutamba*, which were present in 14% of the samples. Among the arthropods, orthopterans were the most frequent (59.4%). Meanwhile, among vertebrates, Cricetidae rodents were the most consumed (53.2%), followed by Colubridae snakes (38%). Lagomorphs (*Sylvilagus brasiliensis*, Leporidae) and Marsupials (Didelphidae) were also consumed, however in low frequency, (9.4%) and (6.3%) respectively. An individual was observed consuming bovine carcass.

TABLE 1. Food items and their occurrence frequency in the diet of the hoary fox *Pseudalopex vetulus* (*n* = 23) and the crab-eating fox *Cerdocyon thous* (*n* = 32) in the Cerrado of Goiás State, Brazil.

	Cerdocyon thous *n* = 32		*Pseudalopex vetulus* *n* = 23	
Food Items	**Number of scats**	**(%)**	**Number of scats**	**(%)**
Plants				
Solanaceae				
Solanum lycocarpum	1	3.1	1	4.3
Myrtaceae				
Psidium guajava	7	21.9	3	13
Melastomataceae				
Miconia sp.	2	6.3		
Sterculiaceae				
Guazuma ulmifolia	14	43.8		
Bromeliaceae				
Species 1	18	56.3		
Gramineae total	11	34.4		
Gramineae unidentified	10	31.3	4	17.4
Saccharum officinarum	1	3.1		
Fruits unidentified	3	9.4		
Subtotal, plants	30	93.8	7	30.4
Arthropods				
Orthoptera total	19	59.4	7	30.4
Acrididae	3	9.4	1	4.3
Gryllidae	3	9.4	2	8.7
Tettigonidae	1	3.1		
Araneae	3	9.4		
Isoptera	4	12.5	21	91.3
Coleoptera total	9	28.1	10	43.5
Scarabaeidae	4	12.5	7	30.4
Lepidoptera	1	3.1		
Arthropoda unidentified	1	3.1	4	17.4
Subtotal, arthropods	25	78.1	23	100

Cont.

TABLE 1. Cont.

Food Items	*Cerdocyon thous* *n* = 32		*Pseudalopex vetulus* *n* = 23	
	Number of scats	**(%)**	**Number of scats**	**(%)**
Anuran				
Species 2	1	3.1		
Subtotal, anurans	1	3.1		
Squamata				
Colubridae unidentified	12	38	1	4.3
Scincidae				
Mabouya sp.			1	4.3
Viperidae				
Bothrops sp.	2	6.3		
Crotalus durissus	2	6.3	1	4.3
Subtotal, Squamata	16	50	3	13
Birds				
Passeriformes	5	15.6	2	8.7
Columbiformes	1	3.1		
Birds unidentified	2	6.3		
Subtotal, birds	8	25	2	8.7
Mammals				
Rodentia				
Muroidea				
Cricetidae total	17	53.2	3	13
Necromys lasiurus	2	6.3		
Calomys expulsus	2	6.3		
Calomys tener	3	9.4		
Olygoryzomys nigripes	1	3.1		
Cricetidae unidentified	10	31.2	3	13
Didelphimorphia				
Didelphidae total	2	6.3		

Cont.

TABLE 1. Cont.

	Cerdocyon thous *n* = 32		*Pseudalopex vetulus* *n* = 23	
Food Items	**Number of scats**	**(%)**	**Number of scats**	**(%)**
Monodelphis sp.	1	3.1		
Lagomorpha				
Leporidae				
Sylvilagus brasiliensis	3	9.4		
Artiodactyla				
Cervidae				
Mazama sp.	1	3.1		
Mammal unidentified	1	3.1		
Subtotal, mammals	22	68.8	3	13

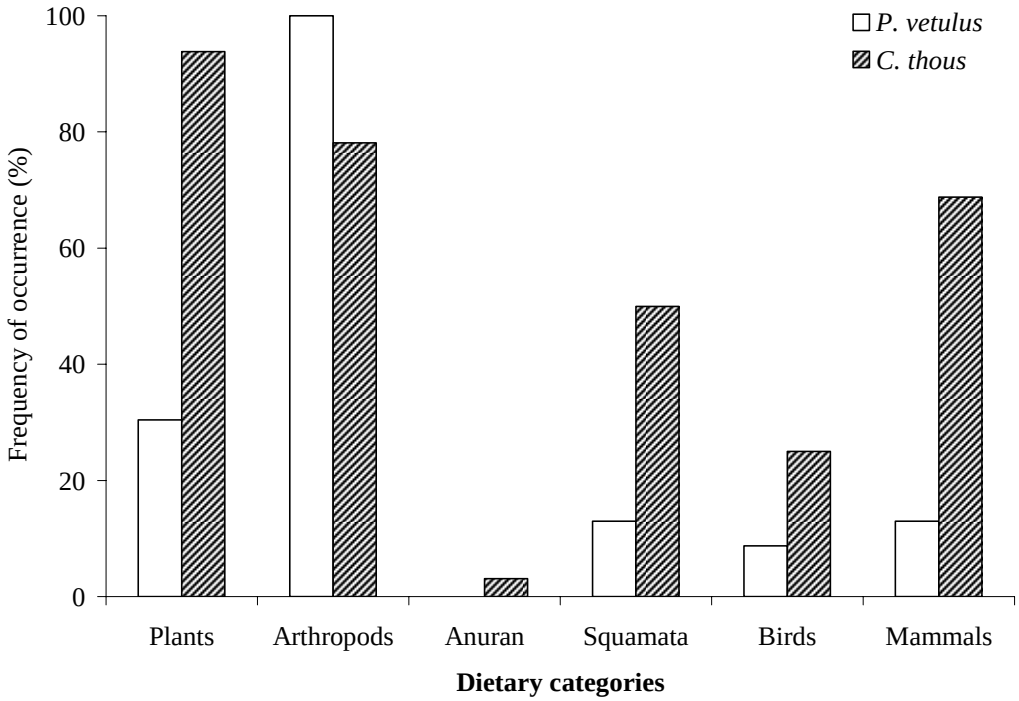

FIGURE 1. Frequency of occurrence of different food categories found in the scats of the hoary fox *Pseudalopex vetulus* (*n* = 23) and the crab-eating fox *Cerdocyon thous* (*n* = 32) in the South of Goiás State, Brazil.

DISCUSSION

Number of samples and feeding ecology. – In Cumari, most scats were collected during dry season (86.8%), as reported by Aragona and Setz (2001) in the southeast of Minas Gerais. This may be explained by the fact that during the months with high precipitation the trails and dirt roads are severely washed by torrents, which dissolve part of the scats; besides, on this season coprophagous insects are more abundant too (Koller et al. 1997; pers. obs.), taking great part of the scats too.

The hoary fox presented the most specialized diet of the species studied. Besides being found in more than 90% of the scats, termites (*Syntermes* sp.) were the only item found in 26% (six feces) of the analyzed samples. According to Dalponte and Courtenay (2004), harvester termites were registered in 87% of scats analyzed from six different localities; however, Jácomo et al. (2004), at Emas National Park, report a frequency of only 36.6%.

Among plant items, guava was the most consumed species, being found in 13% of the samples. Dalponte (1995), in Mato Grosso, registered fruits in at least 80% of the scats. Indeed, for Juarez & Marinho-Filho (2002), in relation to biomass, fruits were more important than items from animal origin. In Cumari, due the change of natural areas into pastures, apparently the fruit offer is lower, reflecting in low fruit consumption ratios by the hoary fox. Anyway, as the guava is a fruit related to anthropic areas, the offer of this fruit is higher than any other one.

Twenty-six different taxa were identified in the crab-eating fox diet (six plants and 20 animals), similar to the number found by Jácomo et al. (2004) (13 plants and five animals). Although Facure et al. (2003), who studied the food habits of this species in an altitudinal forest of the Mantiqueira Range, identified 37 taxa (12 plants and 26 animals) on its diet, while Juarez & Marinho-Filho (2002) registered 25 food items (nine plants and 16 animals). The difference in the number of identified taxa may be due to the variation between the

duration of different works (from five months to seven years). Among the animal preys, insects were the most consumed (78.1%), instead of the registered by Jácomo et al. (2004), who reports insects were present in only 4,3% of the scats. Facure et al. (2003) reports a higher insect's frequency of 49.5%. In Cumari, the presence of the cattle enhances the occurrence of coleopterans, raising the occurrence of this item in the foxes' diet.

Comparisons between the diets of the two species. – Fruits were more important to the crab-eating fox (93% of the scats analyzed) than to the hoary fox (30%). Among fruits, the most consumed item by the hoary fox, the *goiaba*, was also consumed by the crab-eating fox. However, other fruits were more important for the diet of crab-eating foxes, such as the unidentified Bromeliaceae and the *mutamba*. The crab-eating fox was the species that presented higher richness of food items. Termites were the most important item in the diet of the hoary fox, occurring in almost all the scats, although arthropods did occurred in all hoary fox's scats and almost all crab-eating fox's scats. However, others work reports low dietary niche overlap for the hoary fox and the crab-eating fox (Jácomo et al. 2004; Juarez and Marinho-Filho 2002), showing that they may compete in some degree. Indeed, during another work on hoary fox's behavior at the same area (Lemos et al., *in prep.*), a conflict between both species was registered, when a crab-eating fox persecuted a hoary fox, driving it away from the area where the hoary fox was foraging.

LITERATURE CITED[1]

ARAGONA, M. & E. Z. F. SETZ. 2001. Diet of the maned wolf, *Chrysocyon brachyurus* (Mammalia: Canidae), during wet and dry seasons at Ibitipoca State Park, Brazil. Journal Zoological of London 254:131-136.

BECKER, M. & J. C. DALPONTE. 1999. Rastros de mamíferos silvestres brasileiros. 2ª ed. Universidade de Brasília, Brasília.

BERTA, A. 1982. *Cerdocyon thous*. Mammalian Species 186:1-4.

BORROR, D. J. & R. E. WHITE. 1979. A field guide to insects of America north of Mexico. Houghton Miflin, Boston, MA.

BRADY, C. A. 1979. Observations on the behavior and ecology of the crab-eating-fox (*Cerdocyon thous*). In Vertebrate ecology in the northern Neotropics (J. F. Eisenberg, ed.). Smithsonian Institution Press, Washington, D.C.

CHEHÉBAR, C. & S. MARTÍN. 1989. Guia para el reconocimiento microscópico de los pelos de los mamíferos de la Patagonia. Acta Vertebrata 16:247-291.

COURTENAY, O. & L. MAFFEI. 2004. Crab-eating fox Cerdocyon thous (Linnaeus, 1776). Pp. 32-38 in Canids: Foxes, Wolves, Jackals and Dogs (C. Sillero-Zubiri, M. Hoffmann & D. W. MacDonald, eds.). IUCN/SSC Canid Specialist Group press. Gland, Switzerland and Cambridge, UK

COURTENAY, O., D. W. MACDONALD, S. GILLINGHAM, G. ALMEIDA & R. DIAS. 2006. First observations on South America's largely insectivorous canid: the hoary fox (*Pseudalopex vetulus*). Journal of Zoology 268:45-54.

DALPONTE, J. C. 1995. The hoary fox in Brazil. Canid News 3:23-24.

DALPONTE, J. C. & O. COURTENAY. 2004. Crab-eating fox *Cerdocyon thous*. Pp. 32-38. Hoary fox *Pseudalopex vetulus*. Pp. 72-76 in Canids: Foxes, Wolves, Jackals and

---

1 – De acordo com as normas da revista Journal of Mammalogy

Dogs (C. Sillero-Zubiri, M. Hoffmann & D. W. MacDonald, eds.). IUCN/SSC Canid Specialist Group press. Gland, Switzerland and Cambridge, UK.

DIETZ, J. M. 1984. Ecology and Social Organization of the Maned Wolf (*Chrysocyon brachyurus*). Smithsonian contributions to Zoology 392:1-51.

EISENBERG, J. F. & K. H. REDFORD. 1999. Mammals of the Neotropics, the Central Neotropics. The University of Chicago Press, Chicago and London.

EMMONS, L. H. 1987. Comparative feeding ecology of felids in a Neotropical forest. Behavioral Ecology Sociobiology 20:271-283.

FACURE, K. G. 2002. Ecologia alimentar de duas espécies de felinos do gênero *Leopardus* em uma floresta secundária no sudeste do Brasil. Tese (Doutorado em Ecologia) – Instituto de Biologia, Universidade Estadual de Campinas, Campinas.

FACURE, K. G. & A. A. GIARETTA. 1996. Food habitats of carnivores in a coastal Atlantic Forest of southeastern Brazil. Mammalia 60:499-502.

FACURE, K. G. & E. L. A. MONTEIRO-FILHO. 1996. Feeding habitats of the Crab-eating fox, *Cerdocyon thous* (Carnivora, Canidae), in a suburban area of southeastern Brazil. Mammalia 60:147-149.

FACURE, K. G.; A. A. GIARETTA & E. L. A. MONTEIRO-FILHO. 2003. Food habits of the crab-eating-fox, *Cerdocyon thous*, in an altitudinal forest of the Mantiqueira Range, southeastern Brazil. Mammalia 67:503-511.

FONSECA, G. A. B.; A. B. RYLANDS; C. M. R. COSTA; R. B. MACHADO & Y. L. R. LEITE. 1994. Livro Vermelho dos Mamíferos Brasileiros Ameaçados de Extinção. Fundação Biodiversitas, Belo Horizonte.

GITTLEMAN, J. L. & P. H. HARVEY. 1982. Carnivore home-range size, metabolic needs, and ecology. Behavioral Ecology and Sociobiology 10:57-63.

HUNT, R. M. J. 1996. Biogeography of the Order Carnivora. Pp. 485-541 in Carnivore Behavior, Ecology and Evolution (J. L. Gittleman, ed.). Knoxville: Cornell University Press, Ithaca and London.

JÁCOMO, A. T. A., L. SILVEIRA & J. A. F. DINIZ-FILHO. 2004. Niche separation between the maned-wolf (*Chrysocyon brachyurus*), crab-eating-fox (*Cerdocyon thous*) and the hoary-fox (*Dusicyon vetulus*) in the Cerrado of Central Brazil. Journal of Zoology 262:99-106.

JUAREZ, K. M. & J. MARINHO-FILHO. 2002. Diet, habitat use, and home ranges of sympatric canids in central Brazil. Journal of Mammalogy 83:925-933.

KOLLER, W. W.; A. GOMES; C. A. H. FLECHTMANN; S. R. RODRIGUES; I. BIANCHIN & M. R. HORNER. 1997. Ocorrência e sazonalidade de besouros copro/necrófagos (Coleoptera; Scarabaeidae), em massas fecais de bovinos, na região de Cerrados do Mato Grosso do Sul. Embrapa (Pesquisa em andamento) 48:1-5.

LANGGUTH, A. 1975. Ecology and evolution in the South American canids. In The wild canids (M. W. Fox, ed.). Van Nostrand Reinhold Co, New York.

LIMA BORGES, P. A. & W. M.TOMÁS. 2004. Guia de rastros e outros vestígios de mamíferos do Pantanal. 1A ed. Embrapa Pantanal, Corumbá.

MILLS, M. G. L. 1996. Methodological advances in capture, census and food-habitats studies of large African carnivores. Pp. 223-242 in Carnivore behavior, Ecology, and Evolution (J. L. Gittleman, ed.). Knoxville: Cornell University Press, Ithaca and London.

MONTGOMERY, G. G. & Y. D. LUBIN. 1978. Social structure and food habits of crab-eating fox (*Cerdocyon thous*) in Venezuelan llanos. Acta Cientifica Venezolana 29:392-393.

QUADROS, J. 2002. Identificação microscópica de pêlos de mamíferos brasileiros e sua aplicação no estudo da dieta de carnívoros. Tese (Doutorado em Zoologia) – Setor de Ciências Biológicas da Universidade Federal de Londrina, Londrina.

SANO, S. N. & S. P. ALMEIDA. 1998. Cerrado: ambiente e flora. Embrapa – CPAC, ppxii-56.

Wayne, K. R., E. Geffen, D. J. Girman, K. P. Koepfli, L. M. Lau & C. R. Marshall. 1997. Molecular systematics of the canidae. Systematic Biology 46:622-653.

Conclusões gerais

Na área de estudo, a raposa-do-campo forrageia solitária, ao passo que o cachorro-do-mato vive em pares, e algumas vezes com sua prole, inclusive, o uivo de alarme registrado reforça a idéia de que o casal mantém contato enquanto forrageia.

As duas espécies diferiram no uso de habitat, sendo que raposas-do-campo foram avistadas em pastagem em uma proporção maior que cachorros-do-mato, e ainda elas nunca foram encontradas em floresta nem brejo.

Nosso registro de conflito entre as duas espécies sugere que o cachorro-do-mato seja dominante em relação à raposa-do-campo, levando vantagem sobre essa na disputa por território.

Cupins foram os itens mais importantes na dieta da raposa-do-campo, ocorrendo em quase todas as fezes, embora outros artrópodes também tenham sido consumidos. O cachorro-do-mato apresentou a maior riqueza de itens alimentares.

Livros Grátis

(http://www.livrosgratis.com.br)

Milhares de Livros para Download:

Baixar livros de Administração
Baixar livros de Agronomia
Baixar livros de Arquitetura
Baixar livros de Artes
Baixar livros de Astronomia
Baixar livros de Biologia Geral
Baixar livros de Ciência da Computação
Baixar livros de Ciência da Informação
Baixar livros de Ciência Política
Baixar livros de Ciências da Saúde
Baixar livros de Comunicação
Baixar livros do Conselho Nacional de Educação - CNE
Baixar livros de Defesa civil
Baixar livros de Direito
Baixar livros de Direitos humanos
Baixar livros de Economia
Baixar livros de Economia Doméstica
Baixar livros de Educação
Baixar livros de Educação - Trânsito
Baixar livros de Educação Física
Baixar livros de Engenharia Aeroespacial
Baixar livros de Farmácia
Baixar livros de Filosofia
Baixar livros de Física
Baixar livros de Geociências
Baixar livros de Geografia
Baixar livros de História
Baixar livros de Línguas