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Baylisascariasis in Raccoons from Southern Coastal Texas

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ABSTRACT: Two hundred and two *Baylisascaris procyonis* were collected from 23 (70%) of 33 raccoons (*Procyon lotor*) at three localities in southern coastal Texas (USA). Abundances of *B. procyonis* were similar among collection localities. The presence of *B. procyonis* in Texas is confirmed, and this record considerably extends the potential range of baylisascariasis larval migrans in North America.

Key words: *Baylisascaris procyonis*, baylisascariasis, larval migrans, nematode, *Procyon lotor*, raccoon, survey.

Baylisascaris procyonis is a large ascarid nematode found in the small intestine of raccoons (*Procyon lotor*). The life cycle of the parasite is direct in the raccoon definitive host, but larvae may affect many secondary (paratenic) hosts including rodents, lagomorphs, other mammals, and birds (Davidson and Nettles, 1988). Human infections that occur after ingestion of infective eggs of *B. procyonis* passed in raccoon feces may result in cases of visceral, neural, and ocular larval migrans (Kazakos and Boyce, 1995).

Baylisascaris procyonis in raccoons is common in the northeastern and midwestern United States, but it appears to be rare or absent in the far western states (California and Washington) and in the extreme southern tier of coastal states (North and South Carolina, Georgia, Florida, Alabama, Mississippi, and Louisiana) in the southeastern United States (Harkema and Miller, 1964; Kazacos and Boyce, 1995). A personal communication cited in Kazacos and Boyce (1995) mentions an unpublished report of eggs assumed to be those of *B. procyonis* in the feces of raccoons from northeastern Texas, but these data have not been verified.

As part of a larger study in which we compared helminth communities of raccoons across different habitat types in Texas, 33 raccoons were captured from 15 February to 25 July 1996 at three localities in southern coastal Texas; 12, 11 and 10 raccoons were collected from the El Charco ranch near Agua Dulce (27°51′N, 97°52′W), within the city limits of Corpus Christi (27°42′N, 97°24′W), and on the campus of Texas A&M University–Kingsville (27°32′N, 97°52′W), respectively. Raccoons were caught in Havahart traps (Forestry Suppliers, Inc., Jackson, Mississippi, USA) baited with sardines. Captured animals were killed with a .22 caliber rifle shot. Collection and use of animals in this study was approved by the Texas A&M University-Kingsville Animal Care and Use Committee. The sex of each raccoon was noted. Raccoons were eviscerated and viscera were frozen at −10 C until necropsy. A lower canine tooth extracted from each raccoon was used for age determination (Johnston et al., 1987). Gastrointestinal tracts were examined for helminths according to methods outlined in Wallace and Pence (1986). Nematodes were collected, quantified, and ultimately fixed and stored in 70% ethanol containing 8% glycerin. *Baylisascaris procyonis* was identified using the table of differentiating features of *Baylisascaris* spp. in Sprent (1968). Accordingly, *B. procyonis* was separated from *B. columnaris* by structure of the denticles (equilateral versus tall triangles) and tip of the male tail (knobbed versus spiked). Representative specimens of *B. procyonis* from raccoons that we examined in this study are deposited in the United States National Parasite Collection (Beltsville, Maryland 20705, USA; Accession No. 86941).

A general linear model's analysis of variance (PROC GLM; SAS Institute Inc., 1989) was used to test the effect of geographic locality on abundance of *B. pro-*

TABLE 1. Prevalence and abundance of *Baylisascaris procyonis* in raccoons from southern coastal Texas, February through July 1996.

Locality	Prevalence		Abundance	
	NI/NE[a]	%	$\bar{x} \pm$ SE	Total[b]
All locations	23/33	70	6.1 ± 1.3	202
Agua Dulce	8/12	67	6.4 ± 2.6	77
Corpus Christi	8/11	73	4.7 ± 1.6	52
Kingsville	7/10	70	7.3 ± 2.4	73

[a] Number of hosts infected/number of hosts examined.
[b] Cumulative number of nematodes in host sample.

cyonis. Because the frequency distributions of helminth populations are usually overdispersed, abundance values were rank transformed (PROC RANK; SAS Institute Inc., 1989). Statistical significance was inferred at $P < 0.05$. The terms prevalence and abundance used to describe helminth infections follow the definitions of Margolis et al. (1982).

Of 33 raccoons examined, 23 (70%) were infected with 202 *B. procyonis* (Table 1); individual infected hosts had one to 28 adult nematodes. The mean (±SE) abundance of helminths was 6.1 ± 1.3. Abundance of *B. procyonis* was similar between collection localities (Table 1). Three, three, and two raccoons collected from Agua Dulce, Corpus Christi, and Kingsville localities were classified as juveniles, respectively. Of the eight juveniles, only two from Corpus Christi were infected with one and two adult *B. procyonis*, respectively.

This is the first conclusive evidence that *B. procyonis* occurs in Texas. Based on a personal communication (S. C. Waring and D. D. Dingley), Kazacos and Boyce (1995) reported that *B. procyonis* occurred in 14 (23%) of 62 raccoons surveyed in the late 1980's by the Texas Department of Health in northeastern Texas (localities centered near Tyler in Smith County at approximately 32°13'N, 95°11'W); however, this prevalence was based only on eggs isolated from fecal samples of raccoons and not from the collection of adult helminths (D. D. Dingley, pers. commun.). While eggs can not be used for specific identification to the genus or species level in these ascarids, our data support the assumption that the eggs found in raccoons from northeastern Texas could have been those of *B. procyonis* and that this nematode may be distributed widely in eastern Texas. However, lack of previous surveys on the helminth community of raccoons in this area precludes any definitive conclusions regarding the distribution of *B. procyonis*. None of 37 raccoons were infected with *B. procyonis* from a commercial source located farther west in a more arid locality (Brown County centered at approximately 31°25'W, 98°35'N) of Texas (Schaffer et al., 1981).

Whether our samples represent a natural enzootic focus of infection with this nematode remains speculatative. Introduction of *B. procyonis* could have resulted from raccoons that naturally dispersed or were translocated from areas enzootic for this parasite in the northeastern and midwestern United States. Likewise, local raccoons could have acquired *B. procyonis* by ingesting larvae in migratory wild birds or other translocated wild and domestic paratenic hosts. Finally, occurrence of this ascarid in Texas may represent a northern extension of the range of *B. procyonis* from Latin America; it is reported in another procyonid, the kinkajou (*Potos flavus*), from Colombia (Overstreet, 1970).

Although infections with large numbers of *B. procyonis* usually are associated with young animals (Kazakos and Boyce, 1995), we found equal or greater abundances of this ascarid in adult versus juvenile raccoons from coastal Texas. However, our sample sizes of juveniles were small and we did not examine any very young animals. The latter age group is where the highest abundances of nematodes are expected and where clinical obstructive ascariasis sometimes occurs (Stone, 1983; Carlson and Nielsen, 1984). Alternatively, perhaps juvenile raccoons in southern latitudes rely less on a carnivorous diet than those in northern latitudes; thus, they may

have less exposure to larvae of *B. procyonis*. Raccoons are considered to be opportunistic omnivores; however, Johnson (1970) noted that predation on vertebrates by raccoons in Alabama (USA) was infrequent.

Prevalence of *B. procyonis* in humans is unknown (Kazacos and Boyce, 1995); however, the potential for human infection is high, especially in areas of the midwestern and northeastern United States where suburban sprawl increases the liklihood of frequent human contact with raccoons and their feces. Physicians and veterinarians in Texas may overlook baylisascariasis larval migrans as part of a differential diagnosis of human and domestic animal disease because *B. procyonis* presently is not recognized as an important cause of larval migrans. Until otherwise proven, the high prevalence of *B. procyonis* in raccoons from southern coastal Texas is evidence that baylisascariasis larval migrans should now be considered as a potential cause of clinical larval migrans disease in animals and as a possible health threat to humans. Certainly, the distribution, prevalence, transmission, and secondary hosts of *B. procyonis,* as well as its potential impact on humans and domestic animals in Texas, needs further investigation.

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