

## Parasite prevalence survey in shelter cats in Citrus County, Florida



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### ABSTRACT

Free-roaming cat population estimates within the United States currently range from 10 to 114 million individual cats. Zoonotic parasites of free-roaming cats are public health concerns; therefore, it is important to investigate the parasite prevalence in these populations. Seventy-six fecal samples from shelter cats in Citrus County, FL were surveyed for parasites using the Sheather's sugar centrifugal flotation method. The objective was to determine the prevalence of patent gastrointestinal parasitism in the sampled shelter cats as a proxy for parasite prevalence in the free-roaming cat populations in the area. Parasites identified with zoonotic potential include *Toxocara cati*, *Ancylostoma* sp., *Spirometra* sp., *Mesocestoides* sp., *Cryptosporidium* sp., and *Giardia* sp. Both tapeworms detected can infect humans, but are not directly transmissible from cats to people. Other parasite diagnostic stages found included *Aonchotheca putorii* eggs, *Cystoisospora felis* and *Cystoisospora rivolta* oocysts, and *Sarcocystis* sp. sporocysts. The mites *Lynxacarus radovskyi* and *Notoedres cati* were detected in feces likely from ingestion while grooming.

### 1. Introduction

Free-roaming cats include owned pets that are permitted outdoors and feral cats. These cats can serve as reservoirs for infectious diseases such as rabies and bartonellosis that threaten other felines, wildlife, and public health (Levy and Crawford, 2004). Annually, free-roaming cats kill an estimated 7.6–26.3 billion wild mammals and birds (Loss et al., 2013) and a global review by Medina et al. (2011) implicated these cat populations in the extinction of many island native wildlife. The predation behavior of free-roaming cats optimizes the life cycles of many cat parasites, increasing the environmental contamination of the parasite stages shed in the feces of the cat. In the United States, these populations increase exponentially each year and current estimates range from 10 to 114 million individuals, amplifying these threats (Levy and Crawford, 2004; Milius, 2013).

Feline viral, parasitic, and bacterial diseases which are considered potential risks to public health are commonly transmitted by contact with cat feces or by cat bite. (Plaut et al., 1996; Robertson et al., 2000; Day et al., 2012; Center for Disease Control, 2016b; Gerhold and Jessup, 2013; Torrey and Yolken, 2013). Many potentially zoonotic parasites are sustained in the cat populations through predation. Common parasites with zoonotic potential in the feces of free-roaming cats include intestinal nematodes (*Ancylostoma* spp., *Uncinaria stenocephala*, *Toxocara cati*,) and enteric protozoa (*Cryptosporidium* sp., *Giardia* sp. and *Toxoplasma gondii*). Two of these parasites, *T. cati* and *T. gondii*, are listed among the Center for Disease Control's (CDC) Neglected

Parasite Infections (NPI) in the US (Macpherson, 2013; Overgaauw and van Knapen, 2013; Woodhall et al., 2014; Center for Disease Control, 2017).

The objective of this study was to determine parasite prevalence, with a focus on those with zoonotic potential, by surveying fecal samples of shelter cats as a proxy for free-roaming cats in Citrus County, Florida. Collection of fecal samples from free-roaming cat populations is difficult because samples cannot be linked to specific cats and fecal material of other animals could be mistaken for cat feces. Surveying shelter cats, which were free-roaming prior to capture, for zoonotic parasites is an important tool for assessing the free-roaming cat population's risk to wildlife and the public and may influence policies regarding population control.

### 2. Methods

#### 2.1. Population

This study was conducted at Citrus County Animal Shelter which receives free-roaming cats from all cities and jurisdictions within Citrus County, Florida. The shelter capacity for cats is 120 and the average duration of shelter stay is approximately 2 weeks. The shelter receives animals from a variety of sources including animal control, owner surrendered, and confiscated with most cats (> 80%) being free-roaming/stray cats from animal control.

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**Table 1**  
Parasite prevalence in shelter cats ( $N = 76$ ) from Citrus County, Florida in 2016.

Parasite	Prevalence (%)
Internal	
Nematoda	
<i>Ancylostoma</i> sp.	27.6 ( $N = 21$ )
<i>Toxocara cati</i>	6.6 ( $N = 5$ )
<i>Aonchotheca putorii</i>	1.3 ( $N = 1$ )
Cestoda	
<i>Mesocestoides</i> sp.	1.3 ( $N = 1$ )
<i>Spirometra</i> sp.	7.9 ( $N = 6$ )
Protozoa	
<i>Cystoisospora felis</i>	1.3 ( $N = 1$ )
<i>Cystoisospora rivolta</i>	13.2 ( $N = 10$ )
<i>Cryptosporidium</i> sp.	6.6 ( $N = 5$ )
<i>Giardia</i> sp.	3.9 ( $N = 3$ )
<i>Sarcocystis</i> sp.	1.3 ( $N = 1$ )
External <sup>a</sup>	
Acari (Mites)	
<i>Lynxacarus</i>	10.5 ( $N = 8$ )
<i>Notoedres cati</i>	1.3 ( $N = 1$ )

<sup>a</sup> Incidental findings based on the technique used.

## 2.2. Fecal collections

At minimum four grams of feces were collected from the litterbox of cats ( $N = 76$ ) housed in Citrus County Animal Shelter in January and February of 2016. Feces was collected directly from litter boxes requiring no direct animal contact and no IACUC protocol. Collections occurred in conjunction with a larger study on *T. gondii* in Florida

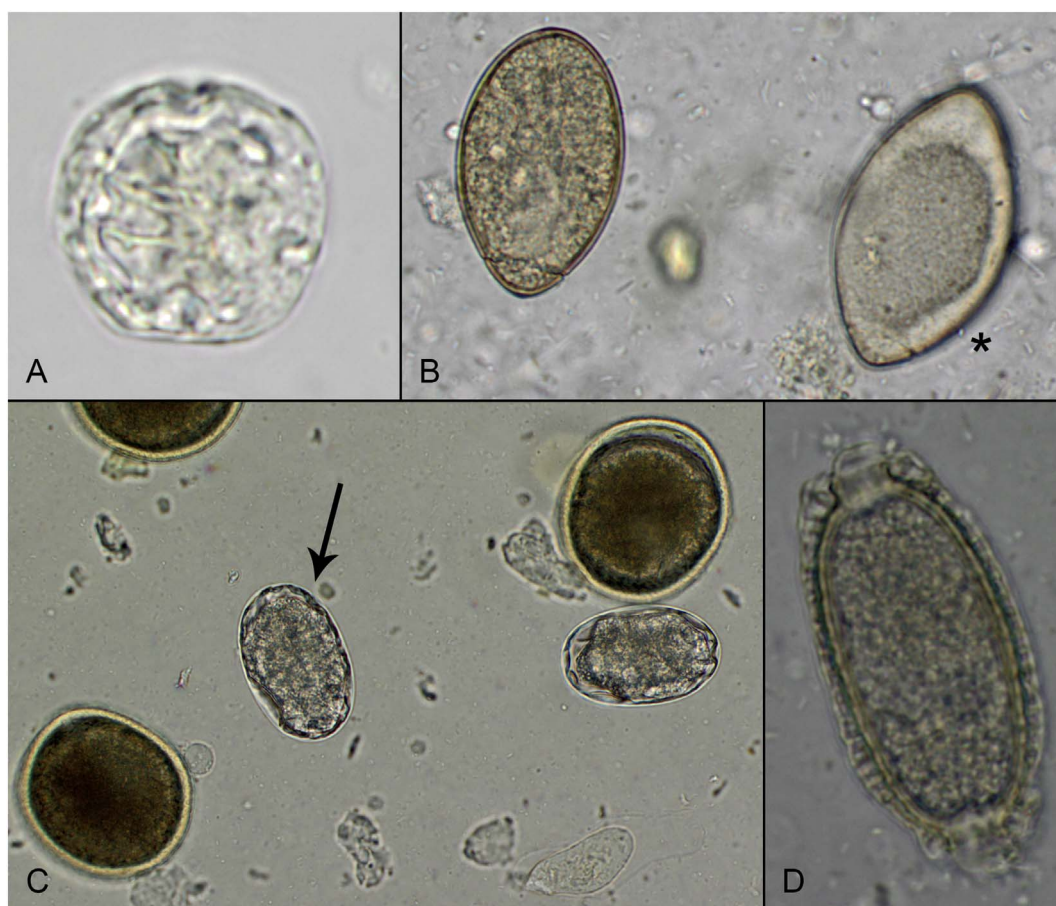
manatees. Most cages ( $N = 57$ ) housed individual cats, but 18 cages housed two animals and one cage housed five animals. Pooled samples were collected from cages with multiple animals. Six cats were re-sampled upon the second collection. Fecal samples were transported on ice to University of Tennessee College of Veterinary Medicine's Diagnostic Parasitology Laboratory where they were refrigerated at 4 °C for a maximum of two days until examination. Parasite prevalence was determined based on total samples analyzed minus the six duplicate cats ( $N = 76$ ).

## 2.3. Parasite screening procedure

Double centrifugal flotations as described by Bowman (2013) using Sheather's sucrose solution (sp. gravity = 1.275) for concentration and microscopic examination were performed on all fecal samples. Parasite diagnostic stages detected were identified using morphological characteristics (Foreyt, 2001; Zajac and Conboy, 2012; Bowman, 2013). Images were taken using an Olympus BH2 and DP25 camera system.

## 3. Results

Coinfections were found in seventeen samples (22%). *Ancylostoma* sp. was the most common parasite found among the cat samples (Table 1). Two other nematode species detected in these samples were *Aonchotheca putorii* and *T. cati*. Two species of cestode eggs were detected including *Spirometra* sp. and *Mesocestoides* sp. (Fig. 1A, B, C, D). Of the six cats with duplicate samples over the two collection periods, only one cat was positive for *Mesocestoides* sp. on the second collection which was initially negative for parasite diagnostic stages. Only six of the 18 cages housing two cats were positive for endoparasites and the



**Fig. 1.** Helminth eggs in shelter cats from Citrus County, Florida in 2016. A = *Mesocestoides* sp. egg (diameter ~ 28  $\mu$ m). B = *Spirometra* sp. egg (61.5  $\times$  36.5  $\mu$ m). \* denotes collapsed *Spirometra* sp. egg. C = *Toxocara cati* egg (70.4  $\times$  62.8  $\mu$ m), *Ancylostoma* spp. egg (arrow) (61.3  $\times$  38.5  $\mu$ m). D = *Aonchotheca putorii* egg (57.5  $\times$  27.5  $\mu$ m).

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