

Toxocara pteropodis in Free-Ranging Indian Flying Foxes (*Pteropus medius*) in Sri Lanka

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ABSTRACT: *Toxocara pteropodis*, an intestinal nematode, occurs in several captive and free-ranging pteropid bat species. We report infection in free-ranging Indian flying foxes (*Pteropus medius*) in Sri Lanka and contribute to our understanding of parasites in free-ranging *P. medius*.

Pteropus medius (formerly *Pteropus giganteus*), the Indian flying fox, is found in many South Asian countries including Pakistan, India, Bangladesh, Bhutan, Nepal, and Maldives (Molur et al. 2008). The species is native to Sri Lanka and is the most abundant among the four fruit bats that occur on the island (*P. medius*, *Cynopterus sphinx*, *Cynopterus brachyotis*, and *Rousettus leschenaultii*) (Kryštufek 2005).

Toxocara pteropodis is an intestinal nematode of pteropid bats (Prociv 1985). It is transmitted from mother to pup via the transmammary route, with ingested larvae developing to the adult stage in the intestine. Infected bats start to pass eggs in their feces at about 2 mo of age until the adult nematodes are shed spontaneously after weaning. Adult bats become infected through ingestion of contaminated feces, with larvae migrating to the liver and then to the mammary gland in lactating females (Prociv 1989).

Although identified in several fruit bat species (Prociv 1985), we identified *T. pteropodis* in free-ranging *P. medius* bats from a colony located in an urban area in Sri Lanka. We collected 92 *P. medius* carcasses from January 2014 to December 2015 in a colony of 24,000 bats (Kryštufek 2009) residing in a botanic garden (7°16'N, 80°36'E) in Perade-

niya, Sri Lanka. We sexed individuals and categorized them as mature or immature based on secondary sexual characteristics: penile barbs in mature males and elongated and white tipped teats in mature females (McLaughlin et al. 2007). During postmortem examination, we assessed body condition by the extent of pectoral muscle mass (McLaughlin et al. 2007) and body fat reserves. The entire intestinal tract was examined, and all adult nematodes were enumerated. Fecal samples collected directly from the rectum were tested for the presence of nematode eggs using a sedimentation-concentration technique (Garcia 2006). We examined the relationship between the number of adults in the intestine and the body condition score (dichotomized to poor vs. moderate/good) by multiple logistic regression, controlling for sex and maturity using the glm function in R (R Development Core Team 2015).

Of the 92 bats, 25 were mature (14 females, 11 males) and 67 were immature (31 females, 36 males). Twelve (13%) bats had *Toxocara* spp. eggs in their feces. All infected animals were immature, and nematode intensity ranged from 1 to 18. We identified the nematodes as *T. pteropodis* based on the large lips and other major morphologic features of the body and the eggs (Baylis 1936).

The association between number of adult *T. pteropodis* present in the alimentary tract and body condition score was significantly ($P=0.02$) negative. In some bats, the nematodes appeared to cause partial obstruction of the intestine (Fig. 1), and in three individuals, infection appeared to be ultimately responsi-



FIGURE 1. *Toxocara pteropodis* infection in Indian flying fox (*Pteropus medius*) collected in Sri Lanka. Moderate to severe distension of the small intestine from *T. pteropodis* nematodes (arrows).

ble for death. We found intestinal volvulus in two bats and intestinal intussusception in one. Nematodes also were observed in the stomach and the esophagus in three bats.

Relatively few studies document *T. pteropodis* in wild bat populations; therefore, the clinical and population-level significance of the parasite are unknown. In this study, infection was associated with poor body condition and death in a few pups. The poor body condition could be due to interference with gastrointestinal function, but perhaps bats in poor condition are more susceptible to extensive infections. Intestinal volvulus, also reported by Heard et al. (1995), and aberrant migration of the adult nematodes, as seen in a few of the bats, can be associated with mortality in captive bats (Prociv 1990).

Eggs from *Toxocara* spp. can result in serious clinical disease in humans, including visceral and ocular larva migrans. (Despommier 2003). These cases usually are associated with domestic dogs and cats. However, *T. pteropodis* was implicated in an outbreak of hepatitis-like illness in humans in Palm Island, Grenadines (Moorhouse 1982). Experimental infections in primates have cast doubt on the ability of this nematode to cause disease in humans (Prociv 1989), but the seroprevalence of toxocarasis was high among children in the same geographic area where our study colony

of *P. medius* is located (Iddawela et al. 2003). Although this could be a result of contact with domestic and feral dogs, the density of *P. medius* in Sri Lanka is sufficiently high that the potential for human infection with *T. pteropodis* should be explored.

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