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Prevalence of *Toxoplasma gondii* in Raptors from France

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ABSTRACT: Little is known about the prevalence or importance of *Toxoplasma gondii* infections in raptors. Sera from Eurasian Buzzards (*Buteo buteo*, $n=14$), Tawny Owls (*Strix aluco*, $n=12$), Barn Owls (*Tyto alba*, $n=18$), Eurasian Sparrowhawk (*Accipiter nisus*, $n=1$), and Common Kestrels (*Falco tinnunculus*, $n=8$) were examined for agglutinating antibodies using the modified agglutination test at 1:25 dilution. Antibodies were not detected in Common Kestrels and the Eurasian Sparrowhawk but were detected in 11 Eurasian Buzzards (79%), six Tawny Owls (50%), and two Barn Owls (11%). *Toxoplasma gondii*, genotype II, was isolated from the brain of an adult Tawny Owl.

Key words: *Accipiter nisus*, *Buteo buteo*, *Falco tinnunculus*, seroprevalence, *Strix aluco*, *Toxoplasma gondii*, *Tyto alba*.

Toxoplasma gondii affects most species of warm-blooded animals, including birds. Little is known about the prevalence of *Toxoplasma gondii* infections in raptors, but experimental studies indicate that Red-tailed Hawks (*Buteo jamaicensis*; Lindsay et al., 1991) and owls (Dubey et al., 1992) are susceptible. The purpose of the present study was to determine the prevalence of antibodies of *T. gondii* in naturally infected wild birds and to attempt to isolate the parasite from raptors.

Birds were sampled in 1989 at the Care and Rehabilitation Center for birds in Chizé, France (46°11'N, 00°34'E). Sera from Eurasian Buzzards (*Buteo buteo*, $n=9$), Tawny Owls (*Strix aluco*, $n=8$), Barn Owls (*Tyto alba*, $n=14$), Eurasian Sparrowhawk (*Accipiter nisus*, $n=1$), and Common Kestrels (*Falco tinnunculus*, $n=8$) were tested using the modified agglutination test (MAT). Dubey (2002) has shown that the MAT is the most

sensitive and specific test for *T. gondii* antibodies and can be used effectively for testing birds. The test was performed as previously described with mercaptoethanol (Sigma, St. Quentin Fallavier, France) added to the serum sample to remove IgM (Dubey and Desmonts, 1987). Sera were diluted twofold starting at a 1:6 dilution in phosphate-buffered saline (pH 7.2). Sera agglutinating the antigen at a dilution of 1:25 or higher were considered positive for antibodies to *T. gondii*. In attempts to isolate *T. gondii* from raptors, one Eurasian Sparrowhawk (*Accipiter nisus*), five Eurasian Buzzards, four Barn Owls, and four Tawny Owls were obtained during the 2003 nestling season, and in 2004, from a Center for Wildlife Rescue located near Limoges (45°51'N, 01°08'E), Haute-Vienne district, France. Sera obtained from heart fluid were tested for *T. gondii* antibodies by MAT. The brain and/or heart of seropositive birds were bioassayed in mice after digestion in pepsin as described previously (Dubey, 1998). Briefly, tissues were ground in five volumes (w/v) of aqueous 0.9% NaCl (saline), mixed with five volumes of acidic pepsin, and this mixture was incubated in a shaker water bath for 1 hr at 37 C. The digest was centrifuged, neutralized, and mixed with gentamicin (40 mg/l). Tissue imprints of mice that died were examined for *T. gondii* tachyzoites or tissue cysts. Mice were bled at 4 wk postinoculation, and sera samples were tested with MAT at 1:25 dilution. DNA from brains of infected mice was extracted and tested by a multiplex polymerase chain reaction (PCR) assay as described in Ajzenberg et al. (2005).

TABLE 1. Prevalence of *Toxoplasma gondii* in raptors from France.

Hosts	No. examined	No. positive	% positive	No. bioassayed
<i>Buteo buteo</i>	14	11	79	2
<i>Strix aluco</i>	12	6	50	1
<i>Tyto alba</i>	18	2	11	1
<i>Falco tinnunculus</i>	8	0	0	0
<i>Accipiter nisus</i>	1	0	0	0

Antibodies to *T. gondii* were found in 79% of Eurasian Buzzards, 50% of Barn Owls, and 11% of Tawny Owls, while antibodies were not detected in Common Kestrels or the European Sparrowhawk (Table 1). Parasite isolation was attempted from four seropositive birds with antibody titers of 50, and *Toxoplasma gondii* was isolated from the brain of an adult tawny owl. This isolate was a genotype II and was avirulent for mice.

Antibodies to *T. gondii* have previously been reported from kestrels (Inci et al., 2002). Literak et al. (1992) also reported isolation of *T. gondii* from tissues of a kestrel in the Czech Republic. Our seropositive results from Barn Owls are consistent with results from Kirkpatrick et al. (1990), who detected antibodies in three of 28 (10.7%) adult and zero of 24 nestling owls, and Niederehe (1964), who detected antibodies in one of 14 Barn Owls. Attempts to isolate *T. gondii* from six Barn Owls were negative (Lindsay et al., 1993).

Although our observed antibody prevalence (50%) was high, there have been no previous reports of *T. gondii* infection or antibodies in Tawny Owls. Isolates of *T. gondii* have been previously reported from 8.1% of 123 Eurasian Buzzards (Literak et al., 1992). Seropositive birds in this study presumably became infected by consuming prey (principally sparrows for *Accipiter nisus*, common voles for *Tyto alba* and *Falco tinnunculus*, and small mammals for *Strix aluco*), and differences in prevalence may reflect variable infection rates in prey species, especially in small mammals.

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