LETTERS

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Neospora caninum in Axis Deer (*Axis axis*) and Fallow Deer (*Dama dama*) in Northern Mexico

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ABSTRACT: Serum samples from 18 axis deer (*Axis axis*) and 19 fallow deer (*Dama dama*) were analyzed with an enzyme-linked immunosorbent assay for *Neospora caninum* antibodies. Two axis (11%) and two fallow deer (11%) were positive for *N. caninum* antibodies.

Neospora caninum is an intracellular protozoan parasite first found in dogs in 1984 that affects many domestic and wildlife species worldwide (Almeria 2013), causing Neosporosis, a common disease in cattle. *Neospora caninum* can cause high abortion rates in cattle and affects the neurologic system in dogs (Gondim 2004a). The parasite is a major problem in livestock operations as it can cause stillbirths, abortions, or births of weak calves (Monney et al. 2011).

The role of some wildlife species in the life cycle of *N. caninum* has been demonstrated, but the role of others is still unknown. The life cycle of *N. caninum* requires both a definitive and an intermediate host. Dogs (*Canis familiaris*; Bandini et al. 2011), coyotes (*Canis latrans*; Gondim 2004b), gray wolves (*Canis lupus lupus*; Dubey et al. 1999), and dingoes (*Canis lupus dingo*; King et al. 2010) are definitive hosts that become infected by ingesting tissues of contaminated herbivores (Bandini et al. 2011; Almeria 2013). Herbivores are intermediate hosts that can become infected by ingesting contaminated food or drinking water containing sporulated oocysts from canid feces (Anderson 2008). The infection of *N. caninum* has been reported in Eld's deer (*Cervus eldi siamensis*) by Dubey et al. (1996) and in Californian black-tailed deer (*Odocoileus hemionus columbianus*) by Woods et al. (1994). Antibodies against *N. caninum* have been reported in at least 25 species of herbivores worldwide (Almeria 2013). Some of these species have been imported to northern Mexico and Texas, mainly for hunting purposes, and now coexist with local livestock and wildlife, raising concerns about the potential of introducing novel diseases and parasites to native wildlife and livestock (Texas Parks and Wildlife Department [TPWD] 1988).

Two of the most-numerous species introduced in Texas and northern Mexico are axis (*Axis axis*) and fallow deer (*Dama dama*). During a 1988 survey in Texas, axis deer were the most-numerous exotic species found, with 39,040 animals reported, and fallow deer were the fifth most-numerous exotic species found with 14,163 animals reported (TPWD 1998). In Mexico, axis deer can be found in at least 50 management units with a total area of 160,100 ha and fallow deer in at least 44 management units with a total area of 116,000 ha (Álvarez-Romero and Medellin 2005). Exotic ungulates may serve as hosts for *N. caninum* and play a role in its dissemination (Almeria 2013).

Our objective was to determine the presence of antibodies against *N. caninum* in axis and fallow deer in northern Mexico. This study was conducted on a privately owned 400-ha high-fenced ranch in Soto La Marina, Tamaulipas, México (23°34′108″N, 97°53′100″W). The work was performed under a scientific collection permit issued by the Government of the State of Tamaulipas, Comision Estatal para la

Conservación y el Aprovechamiento de la Vida Silvestre, and Texas A&M University-Kingsville Animal Care and Use Committee. We captured 18 axis deer and 19 fallow deer using a drop net, and blood samples were collected from the jugular using a 21 ga × 32-mm needle in a BD vacutainer tube containing clot activator (Becton Dickinson, Becton Drive, Franklin Lakes, New Jersey, USA). We extracted the serum from each sample, stored samples at 4 C, and transported sera to the National Center of Disciplinary Research in Animal Parasitology (Cuernavaca, Morelos, Mexico).

Serum samples were analyzed with a commercially available enzyme linked immunosorbent assay (ELISA) using a commercial *N. caninum* antibody test kit (IDEXX Laboratories, Westbrook, Maine, USA) for cattle, following the manufacturer's instructions.

The ELISA was positive for *N. caninum* antibodies in two axis deer (11%, 95% confidence interval: 1.9–32.1) and two fallow deer (11%, 95% confidence interval: 1.8–30.6). There are no reports of *N. caninum* in free-ranging axis deer or fallow deer; however, Basso et al. (2014) confirmed *N. caninum* infection in captive axis deer in Argentina, experiencing perinatal mortality, and *N. caninum* was reported in farmed fallow deer in Europe (Bartova 2007).

Neosporosis is a common disease in cattle in the state of Tamaulipas in Mexico; the presence of exotic ungulates positive for *N. caninum* antibodies might complicate the control measures for this disease in areas where livestock and native wildlife coexist.

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