

## Prevalence of Antibodies to *Neospora caninum* and *Toxoplasma gondii* in Swedish Dogs

*Neospora caninum* is a newly described coccidian parasite which has been found in various species such as the dog, cattle, horse, sheep and goat. Morphologically it resembles *Toxoplasma gondii* with which it is related (Holmdahl *et al.* 1994), and with which it has earlier been confused. The life cycle of *N. caninum* is only partially known. Tachyzoites and tissue cysts are the only known stages of the parasite, and transplacental transmission is the only known route of infection. Subclinically infected dams can transmit the parasite to their fetuses and successive offspring from the same mother might be born infected (Dubey *et al.* 1990b). Clinical neosporosis is mostly seen in pups or young dogs, and the majority or all pups in a litter are often affected. The disease is characterized by ascending paralysis of the legs, with the hind legs more severely affected than the front legs, paralysis of the jaw, difficulty in swallowing and muscle flaccidity and atrophy (Dubey 1992, Dubey & Lindsay 1993). Fatal infections with *N. caninum* in dogs have been reported from many countries, e.g. Norway (Bjerkås & Presthus 1988), USA (Dubey *et al.* 1988), Sweden (Uggla *et al.* 1989a,b) and the United Kingdom (Dubey *et al.* 1990a). Serological surveys for antibodies to *N. caninum* in dogs from Kansas, USA and England have shown a prevalence of 2 and 13%, respectively (Lindsay *et al.* 1990, Trees *et al.* 1993).

This study reports the prevalence of antibodies to *N. caninum* and the related parasite *T. gondii* in a sample of Swedish dogs.

Sera from 398 dogs were included in the study. The sera had been submitted to the Department of Parasitology, National Veterinary Institute, because of suspected sarcoptic mange. The dogs were from all districts of Sweden, except Gotland. They were of 68 different breeds and their age varied between 3 months and 12 years. Fifty per cent of the dogs were females. It was not known if the dogs had any neurological disturbances which might be due to *Neospora* infection. The sera were heat treated at 56°C for 30 min and stored frozen at -20°C until analysed.

The presence of antibodies to *N. caninum* was analysed with an ELISA technique in which detergent extracts from *N. caninum* tachyzoites were incorporated into iscoms and used as antigen, and a monoclonal antibody to dog IgG was used as a secondary antibody. The agreement between this ELISA and the indirect immunofluorescent technique (IFAT) used for earlier prevalence studies of antibodies to *N. caninum* in dogs (Lindsay *et al.* 1990, Trees *et al.* 1993), has been found to be 96%. Both false positive and false negative results were obtained when the ELISA was compared with the IFAT, but no serum sample with an IFAT titre above 1:80 was negative in the ELISA (Björkman *et al.* 1994). In the

present study, sera found positive in the ELISA were also tested with the IFAT as described by Björkman et al. (1994). Antibodies to *T. gondii* were assayed by a direct agglutination test (DAT; Toxoscreen, BioMérieux, Marcy l'Etoile, France).

Of the 398 dog sera tested, 2 (0.5%) were positive in the *Neospora* ELISA (absorbance values >0.18). When these positive samples were analysed by the *Neospora* IFAT, only 1 was positive, with a titre of 1:80. One hundred and nineteen (30%) of the tested sera were positive in the DAT (titre  $\geq$  1:40). The serum which was positive in both the *Neospora* ELISA and IFAT was negative in the Toxoscreen, whereas the serum which was positive in the ELISA but negative in the IFAT had a titre of 1:540 in the DAT.

The prevalence of antibodies to *N. caninum* of 0.5% in Swedish dogs found in the present study is low compared to the 13% found in English dogs (Trees et al. 1993). Furthermore, we found no sample with a high IFAT titre, whereas in England 2.4% of the dogs studied had an IFAT titre of 1:3,200. The prevalence of antibodies to *N. caninum* in Swedish dogs seems to agree better with the situation in Kansas where 2% of the tested dogs were positive in the IFAT and the highest titre found was 1:400 (in one of 229 dogs tested). The 30% prevalence of antibodies to *T. gondii* tallies with the 23% reported in an earlier Swedish study (Uggla et al. 1990).

We have also analysed serum from 12 dogs submitted to the Small animal clinic of the Swedish University of Agricultural Sciences, because of neurological signs possibly attributable to neosporosis, but we have so far found none to be seropositive to *N. caninum*. Clinical neosporosis has been verified in Swedish dogs after necropsy and immunohistochemistry (Uggla et al. 1989a,b), but our results suggest that *N. caninum* is not wide-

spread as a latent infection in the Swedish dog population.

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