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Coccidiosis in farmed silver foxes (*Vulpes vulpes*) and blue foxes (*Alopex lagopus*) in Finland: a case report:

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Summary

Fur animal farming was initiated during the 1890s on Prince Edward Island in Canada. Farmed silver foxes descend from animals caught from the wild on the island. Finnish fur farming increased during the post war period and in mid-1980s, there were about 6000 fur animal farms, mostly located in Southern Ostrobothnia (Fig.), producing about 8 million fur animals yearly. Currently, there are approximately 1300 fur farms and the yearly production in 2007 was about 2 million fox and 2 million mink furs. The global production at the same time was about 7 million fox and 58 million mink furs.

An outbreak of clinical enteric coccidiosis was encountered at a fox farm with silver foxes (*Vulpes vulpes*) and blue foxes (*Alopex lagopus*) in intensive farming district of Ostrobothnia in Finland during summer 2008. The breeding animal stock of the farm consists of 1500 silver fox females and 4000 blue fox females. The whelping period of the silver foxes was from April 20 to May 25, and the whelping period of the blue foxes was from ay 5 to June 10.

The first clinical signs were seen on silver fox whelps at the age of three weeks. The whelps were unthrifty, their stools were watery, and they littered the floors of the wooden whelping boxes. Their fur was moist and clumped. The females also had moist fur coat, which clumped in the cervical and abdominal areas. There was not increased mortality. The morbidity was about 50 %, with all the whelps in affected culls showing the symptoms. At this time the females are still nursing their whelps, and the whelps keep themselves mostly inside

the whelping boxes. After these first symptoms, all whelps were studied clinically. They showed marked unthriftiness and poor growth. The body size of the animals was significantly smaller than the normal at this age. Affected whelps were submitted to post-mortem examination to Finnish Food Safety Authority Evira laboratory in Seinäjoki. In parasitological flotation test from intestinal contents, coccidian oocysts were detected. Faecal samples were submitted for quantitative parasitological analysis and species identification.

Of the six silver fox whelp faecal samples, coccidian oocysts were found in 4; max 5600 oocysts per gram (opg), and of the four blue fox whelp faeces, oocysts were found in two, max 120 opg. Two species of *Isospora* were found. Oocysts of the first one were 30-37x24-28 µm (mean [n=20] 35.3 (SD 0.9) x 26.2 (SD 0.4) µm, and sporocysts measured 15-16x14-15 µm (mean [n=20] 15.5 (SD 0.2) x 14.8 (SD 0.5)). Sporozoites measured within sporocysts within oocysts were about 13x5 µm (cannot be measured very accurately). The oocyst surface is colourless, smooth and clear. There is neither Stieda body nor micropyle in the oocyst or sporocyst. No oocyst granule, but sporocyst residuum sometimes present. This species was identified as *Isospora canivelocis* (Weidman, 1915) Wenyon, 1923. Duszynski et al. [1] consider it possible that this species is identical with *Isospora buriatica* Yakimoff and Matschoulsky, 1940 in Matschoulsky, 1941 from the Corsac fox and Indian fox, and, more interestingly, with *Isospora canis* Nemeseri, 1959 from the domestic dog.

The other species oocysts measured 21-26x16-21 µm (mean [n=10] 23.4 (SD=1.2) x 18.4 (SD=1.0) µm, and sporocysts measured 11-13x10-13 µm (mean [n=10] 12.2 (SD=1.0) x 11.4 (SD=1.0)). The oocyst of this

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species is slightly smaller but essentially indistinguishable from *Isoospora ohioensis* Dubey, 1975, which was described to be 24x21 (21-27x19-23) µm in size. Variation in oocyst size can be caused by e.g crowding in heavy infections. Also the infection phase can affect oocyst size.

The animals were treated with oral sulfadiazine-trimethoprim (ratio 5:1) medication at a dose of 120 g per ton of semimoist feed for five days, the effect was variable, but the whelps later gained their normal condition and started to gain weight. The treatment was judged to be satisfactory.

A second outbreak was observed on the same farm in blue fox whelps, when they reached the age of three weeks. The symptoms were similar to that of the silver foxes earlier, but more severe. The mortality was low also at this outbreak, but morbidity was higher, and the weight development was more affected. Whelps were submitted to post-mortem examination, and coccidiosis was confirmed. The affected whelps were treated with one individual oral dosing of toltrazuril by syringe at 10 mg per whelp and with oral sulfadiazine-trimethoprim medication for five days, similar to the silver fox whelps. The recovery in the blue fox outbreak was pronounced, and better than that of the silver fox outbreak.

Discussion

The whelps most probably received the infection from their dams, which are known to shed parasites at puerperal period. Also horizontal infection within litters in the whelping boxes is to be considered. The hygienic conditions on the farm deserve attention, and on this farm they may have contributed to the outbreak.

The farm is located in the intensive fur farming district with proximity to other fur animal farms. The spread of the parasites within the farm and possibly also between other farms may have been facilitated by black-headed gulls (*Larus ridibundus*), which frequently feed under the cage nettings and the feeding boards of the foxes. They may be vectors for the parasite spread with their feet.

Clinical coccidiosis is reported on fur animals [2], clinical case of this severity is the first one encountered in Finland. From the Internet, it appears that in Chinese veterinary medical literature, silver fox coccidiosis is described as a well-known disease and an important problem [3].

This reported outbreak calls for closer examination of the occurrence of clinical coccidiosis amongst Finnish fox farms, the coccidian species capable of infecting both blue foxes and silver foxes, and the control measures of the clinical coccidiosis including potential infection routes, vehicles, and the therapy.

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