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ORIGINAL PAPER

Isospora plectrophenaxia n. sp (Apicomplexa: Eimeriidae), a new coccidian parasite found in Snow Bunting (*Plectrophenax nivalis*) nestlings on Spitsbergen

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Abstract Faecal samples were collected from four 8 days old snow bunting nestlings from one nest in Ny-Ålesund, Spitsbergen, in summer 2006. After sporulation, samples were examined for coccidian parasites using flotation centrifuging. We found isosporan oocysts in three birds, intensity of infection varied between individuals from 35 to 6,000 oocysts per defecation. All oocysts belonged to one species, which is described here as a new species. The spherical or subspherical oocysts (Fig. 1) have a brownish, smooth, relatively thin (about 1.1 μm) bilayered wall. Average size of sporulated oocysts was 26.2±0.13×23.6± 0.16 μm (24.1–28.4×21.5–26.9; n=10) with a shape index (length/width) of 1.11±0.01 (1.01–1.29). The sporulated oocysts have no micropyle or residuum but enclose one large (3.3×2.8 μm) ring-formed polar granule. The sporocysts are ovoidal, slightly pointed at the end opposite the Stieda body, 18.2±0.06×9.9±0.03 μm (17.1–19.0×9.0–10.8; n=14), shape index 1.85±0.008 (1.70–1.99). The Stieda body has a prominent knob-like cap and a well-visible round substieda body. Sporocysts contain compact sporocyst residuum composed of small, uniform granules and sporozoits with usually three large refractile bodies and a smaller nucleus. The prepatent period is less than 8 days. This is the first description of an avian isosporan parasite that succeeds transmission while in the High Arctic.

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Introduction

The genus *Isospora* is the most common coccidian parasite in passerine birds as more than 90% of all coccidia species infecting wild passerine birds belong to this genus (e.g. Pellerdy 1974), and nearly each investigated passerine bird species is a host of at least one isosporan parasite species (Svobodová 1994; Dolnik 2002). Description of new isosporan species is traditionally based on oocyst morphology (e.g. Pellerdy 1974; Upton et al. 2001). Considering the well-known high degree of host specificity in many eimeriids (e.g. Long 1982), *Isospora* species are believed to be narrow host-specific on the level of genus. Levine (1982) assumed that "a coccidian species may be transmissible from one species to another in the same genus, but not from one genus to another in the same family until otherwise demonstrated." This was proved by cross-transmission experiments for different coccidian species (McDougald 1979; Levine and Ivens 1988) and specifically for *Isospora* species of passerine birds (Černá 1973; Box 1980; Dolnik 2002). Therefore, each *Isospora* species found for the first time in a bird genus can be considered a new species.

Ny-Ålesund is situated on the most northern edge of the breeding range of passerine birds and is inhabited by only one passerine species, the snow bunting. Up to now, there are no Eimeriidae parasites described from the bird genus *Plectrophenax*. The aim of our study was to check whether isosporan parasites follow their passerine hosts up to the very north of their range and if transmission of these parasites occurs in the High Arctic.

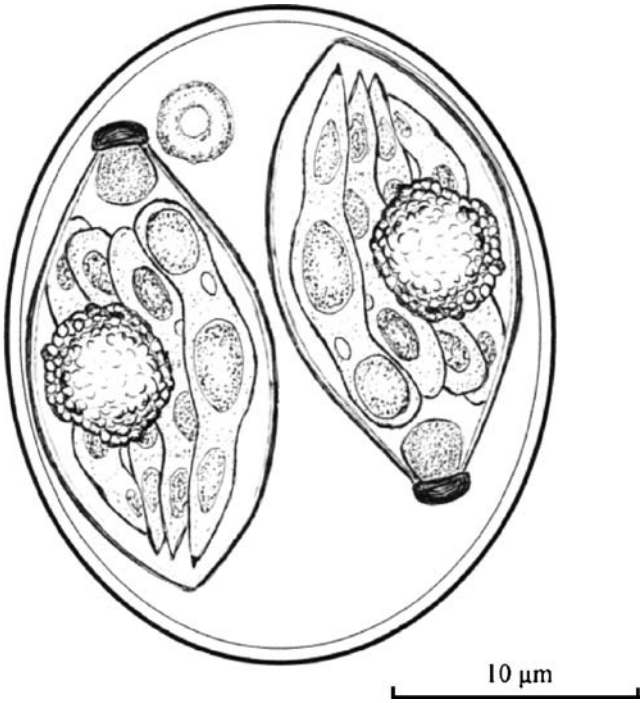

Fig. 1 Composite line drawing of a sporulated oocyst of *Isospora plectrophenaxia* n. sp

Materials and methods

Studies were undertaken during the end of breeding season of the local snow bunting population in the Norwegian village Ny-Ålesund on Spitsbergen (Svalbard), (78°55′N; 11°55′E). On 19 July 2006, fresh faecal samples, one pellet per bird, were collected from four 8 days old snow bunting nestlings that belonged to the same nest. Samples were kept in 2.5% water solution of potassium dichromate ($K_2Cr_2O_7$) for several days to allow sporulation. After flotation centrifuging in saturated NaCl solution for 5 min at 1,500 R.P.M., the surface layer was placed on slides and immediately examined under 100× magnification to determine the presence and the number of oocysts. The whole slide was checked to avoid mistakes caused by oocyst clustering. Infection intensity was counted in opd (oocysts per defecation) according to the method described in Dolnik 2006. Detailed morphological structure of more than a hundred of oocysts was studied under 1,000× magnification with immersion oil. A dozen sporulated oocysts were measured. Measurements are in micrometers (mean ± SE µm) with range and number (*n*) of stages measured in parentheses.

Results

Oocysts of only one genus *Isospora* were found in three out of four nestlings and described as a new species. All infections detected were monospecific and intensity of infection varied between individuals from 35 to 6,000 oocysts per defecation.

Description

Isospora plectrophenaxia n. sp (Figs. 1, 2)

Description of sporulated oocyst The spherical or subspherical oocysts have a brownish, smooth, relatively thin (1.1 µm) bilayered wall. Average size of sporulated oocysts was 26.2± 0.13×23.6±0.16 µm (24.1–28.4×21.5–26.9; n=10) with a shape index (length/width) of 1.11±0.01 (1.01–1.29). The

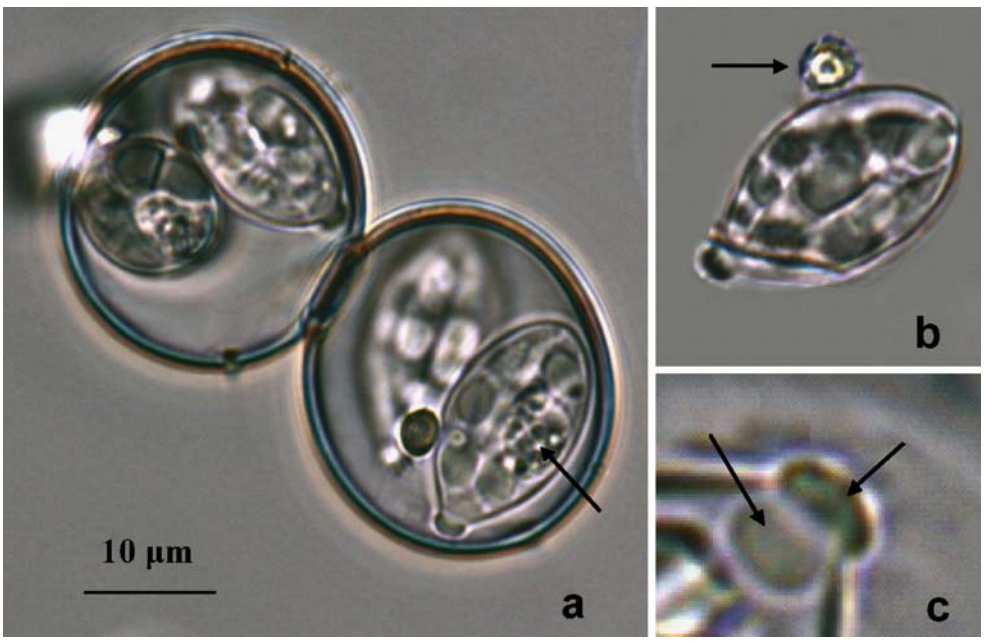

Fig. 2 Microphotograph of sporulated oocysts of *Isospora plectrophenaxia* n. sp. **a** oocysts, note a compact sporocyst residuum (*arrow*); **b** sporocyst, note ringed-form polar granule (*arrow*) and slightly sharpened end of sporocyst; **c** Stieda body, note a prominent cap and rounded substieda-body (*arrows*) (all features also seen in **a**)

sporulated oocysts have no micropyle or residuum but enclose one large (3.3×2.8 μm) ring-formed polar granule.

Description of sporocyst and sporozoites Sporocysts are ovoidal, slightly pointed at the end opposite the Stieda body, 18.2±0.06×9.9±0.03 μm (17.1–19.0×9.0–10.8; n=14), shape index 1.85±0.008 (1.70–1.99). The Stieda body is with prominent knob-like cap, and a well-visible round substieda body is present. Sporocysts contain compact sporocyst residuum composed of small, uniform granules and sporozoits with usually three large refractile bodies and a smaller nucleus.

Taxonomic summary

Type host: *Plectrophenax nivalis nivalis* L. 1758, snow bunting

Type locality: Ny Ålesund (78°55′N; 11°55′E), North-West Spitsbergen.

Prevalence: In 3 of 4 (75%).

Sporulation time: Unknown, oocysts were partly sporulated at room temperature, 3 days after sampling.

Prepatent and patent periods: Prepatent period is less than 8 days, patent period unknown.

Site of infection: Unknown. Oocysts recovered from faeces.

Material deposited: Photosyntype (see Duszynski 1999) of sporulated oocyst deposited in the US National Parasite Collection no. 99939.

Etymology The name is derived from the scientific name of the type host, *Plectrophenax nivalis nivalis*.

Remarks Oocysts were found in 8 days old nestlings. Intensity of infection was up to 6,000 oocysts per defecation.

Discussion

As there is no *Isospora* species described from the bird genus *Plectrophenax*, we assume *Isospora* sp. occurring in the snow bunting to be a new species. Infection of nestlings proves that sporulation and transmission of *Isospora plectrophenica* can take place in the High Arctic despite low temperature and high sun radiation. As the infected nestlings were about 8 days old, we can assume that prepatent period of these parasites is less or equal to 8 days. Definitely parent-nestling transmission took place, as the nest was placed in a cavity where no contact with other individuals of the same species was possible.

The experiments comply with the current laws of Norway.

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