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Research Note

Sarcocystis capracanis (Protozoa, Apicomplexa) in goats in Japan

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Four species of the genus *Sarcocystis* have been reported in goats: *S.capracanis* (Fischer, 1979); *S.hircicanis* (Heydorn and Unterholzner, 1983); *S.moulei* (Neveu-Lemaire, 1912); and *S.orientalis* (Machulskii and Miskaryan, 1958). In Japan there have been no reports concerning caprine *Sarcocystis*. This paper deals with the detection and identification of *Sarcocystis capracanis* in goats in Japan.

The study was performed from October 1986 to December 1989. The Sarcocysts used in the present study were obtained from 15 domestic goats, 10 from in Kanagawa Prefecture and 5 from Niigata Prefecture. The sarcocysts were collected from the heart, tongue, oesophagus, diaphragm and skeletal muscles. Tissues from each organ were minced with scissors, then digested by incubation in 0.5% (w/v) trypsin solution for 30 min at 37°C. The suspension was homogenized at 1,000 rpm for 30 sec, and the sarcocysts isolated under a light microscope. Small pieces of tissue from each sample were squash-pressed between glass slides and examined. Tissues positive for sarcocysts were fixed in 10% (v/v) formalin, embedded in paraffin, sectioned, and stained with hematoxylin and eosin (H-E) using routine procedures. For ultrastructural study, freshly isolated sarcocysts were fixed in glutaraldehyde, postfixed in osmium tetroxide, dehydrated and embedded in resin. Ultra-thin sections were cut, stained with uranyl acetate and lead citrate, and examined with a JEOL 100-CX transmission electron microscope. The sarcocysts were detected in 2 of 5 goats from Niigata Prefecture, but in none of the 10 goats from Kanagawa Prefecture. The isolated sarcocysts were long and elliptical in shape and enveloped in thin cyst walls. Under high magnification, many palisade-like protrusions were oberved on the surface of both fresh and prepared sarcocysts. Fifteen sarcocysts and 100 bradyzoites, isolated from cardiac muscle, were measured. The sarcocysts averaged $1030.7 \pm 254.5 \times 65.9 \pm 14.9$ μm in size and the thickness of the cyst wall averaged 1.51 ± 0.43 μm. The bradyzoites were crescent shaped, and measured $13.79 \pm 0.98 \times 3.11 \pm 0.54$ μm. The metrocytes obtained from some of the sarcocysts were semicircular or oval in shape. Ultrastructurally, the primary cyst wall had thumb-like protrusions measuring 2.2×1.9 μm, and the surfaces of the protrusions were smooth. Osmiophilic granules were also presented within the protrusions. Septa separated the sarcocyst into compartments containing closely packed bradyzoites. According to Heydorn and Unterholzner (1983), *S.hircicanis* has a thin cyst wall (<1 μm) with hair-like protrusions up to 2,500 μm in size. *S.moulei* has larger sarcocysts than *S.hircicanis*, and its cyst wall is thick and has striations (Neveu-Lemaire, 1912), *S.orientalis* has been detected in mountain

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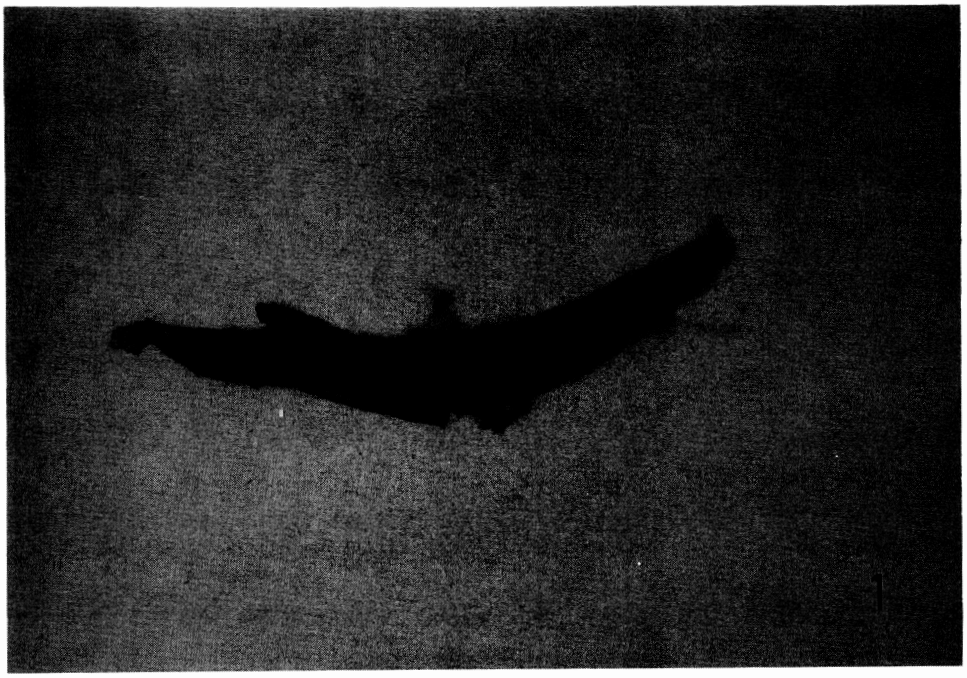

Fig. 1 Sarcocyst isolated from cardiac muscle. ×20

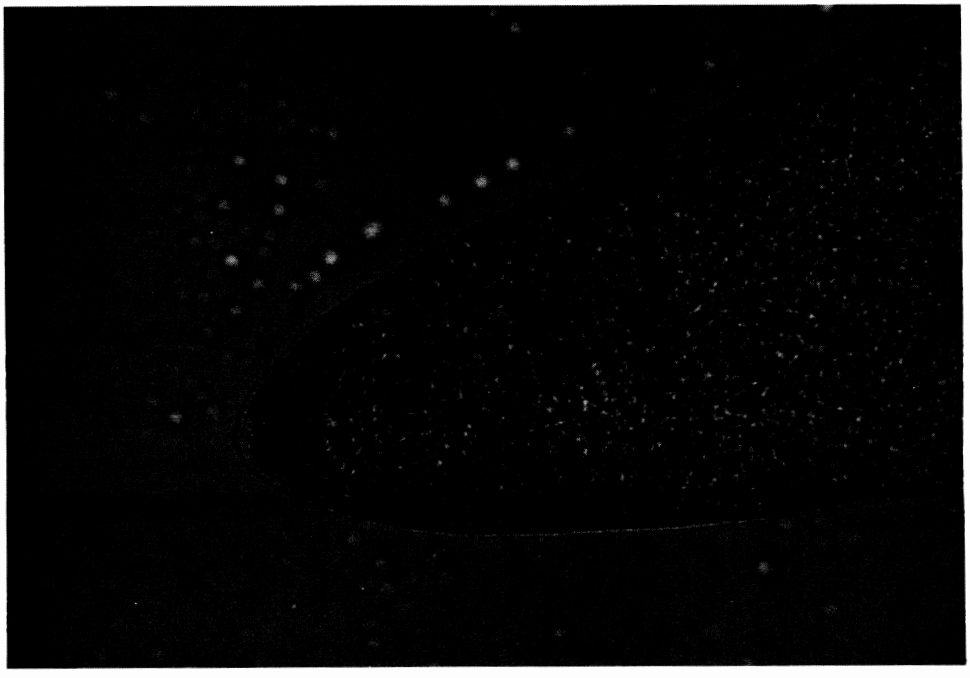

Fig. 2 Sarcocyst with palisade-like cyst wall. ×100

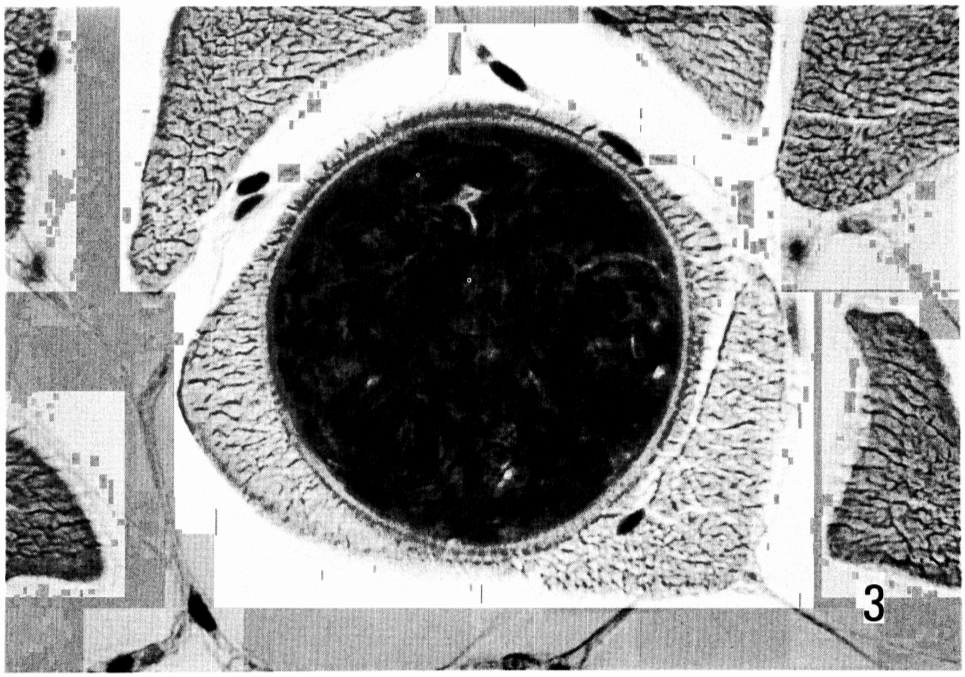

Fig. 3 Cross section of a sarcocyst in the oesophagus. A thin cyst wall is seen. H-E, ×200

goats in the U.S.S.R., with sarcocysts measuring 3.5 to 7.5 × 2.5 mm in size (Machulskii and Miskaryan, 1958). Levine and Ivens (1986) claim that *S.orientalis* does not appear to differ significantly from *S.moulei* of the domestic goat. However, the same authors also report that sarcocysts were not found in domestic goats from the same region.

As mentioned above, *S.hircicanis* is clearly distinguishable from *S.capracanis* by its hair-like protrusions and size of its sarcocyst. The organism found in this study differs from *S.moulei* and *S.orientalis* by the size of its sarcocyst and in its thick cyst wall. On the other hand, it appears to be very similar to *S.capracanis* as reported by Fischer, 1979. The sarcocysts of *S.capracanis* are up to 1000 μm long and have a thin cyst wall (up to 3 μm) with finger-like villar protrusions. The parasite of the present study coincides with *S.capracanis* in the shape and size of its sarcocyst, but the cyst wall protrusions are slightly shorter than those of *S.capracanis*. Böttner et al. (1987) reported that the development of the cyst wall of *S.capracanis* continues without the formation of new protrusions, and that changes in the structure of the sarcocysts can occur with age. Therefore, we interpret the moderately short protrusions we observed as indicating cyst walls of juvenile stages, and because the metrocytes were observed under a light microscope.

Hence, the *Sarcocystis* sp. isolated from domestic goats in Niigata Prefecture was identified as *Sarcocystis capracanis,* and represents the first report that deals with *S.capracanis* in goats in Japan.

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Fig. 4 A transmission electron micrograph of a sarcocyst showing thumb-like protrusions (×9,000) AP, amylopectin; BZ, bradyzoite; GS, ground substance; HC, host cell cytoplasm; NU, nucleus; OG, osmiophilic granules; PC, primary cyst wall; SE, septum.

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