**Sarcocystis dubeyi** (Huong and Uggla, 1999) Infection in Water Buffaloes (*Bubalus bubalis*) from Egypt

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**ABSTRACT:** Water buffaloes (*Bubalus bubalis*) are intermediate hosts for 4 species of *Sarcocystis*, i.e., *S. fusiformis* and *Sarcocystis balfononis* with cats as definitive hosts; *Sarcocystis levinei* with dogs as definitive hosts; and *Sarcocystis dubeyi* with an unknown definitive host but thought to be zoonotic. Currently, the latter species has been identified with certainty only from Vietnam. In the present study, sarcocysts of *S. dubeyi* are reported in 11 (30%) of 35 Egyptian water buffaloes from which the esophageal muscles were examined histologically. Sarcocysts were microscopic, measuring 180–250 × 70–110 μm in size. Ultrastructurally, the sarcocyst wall was 3.5–6.5 μm thick and had palisade-like villar protrusions which gave it a striated appearance. The villar protrusions contained microtubules that were distributed along the whole villus. This is the first report of *S. dubeyi* from water buffaloes in Egypt.

*Sarcocystis* species are among the most common parasites of domestic ruminants (Dubey, Speer, and Fayer, 1989). Some *Sarcocystis* species, especially those forming microscopic cysts, induce economic losses and clinical disease while other macroscopic *Sarcocystis* species are mildly pathogenic and cause downgrading or total condemnation of the carcass (Dubey, Speer et al., 1989). Water buffaloes are intermediate hosts for 4 species of *Sarcocystis*, i.e., *S. fusiformis* Rafflet, 1897, *Sarcocystis levinei* Dissanaike and Kan, 1978, *Sarcocystis balfononis* Huang, Dubey, Nikkali and Uggla, 1999, and *Sarcocystis dubeyi* Huang and Uggla, 1999. Cats are definitive hosts for *S. fusiformis* and *S. balfononis* and dogs are definitive hosts for *S. levinei*. The definitive host for *S. dubeyi* is unknown, but primates are suspected as its definitive host (Huong and Uggla, 1999). Sarcocysts of *S. fusiformis* and *S. balfononis* are macroscopic while those of *S. levinei* and *S. dubeyi* are microscopic. Herein, we report *S. dubeyi* infection in water buffaloes from Egypt.

Esophagi of 35 water buffaloes (>5 yr-old), slaughtered at the main slaughterhouse of El-mahalla city, El-gharbia Governorate, Egypt were obtained in January to April 2009. Pieces (1 cm3) of the esophageal muscle were fixed in neutral-buffered 10% formalin for histological examination and small pieces were fixed in 2.5% glutaraldehyde for transmission electron microscope examination (TEM). The formalin-fixed tissues were processed by standard histological techniques, sectioned at 5 μm, stained by hematoxylin and eosin, and examined by light microscopy. When the *S. dubeyi*-like (microscopic thick-walled cysts) were identified in paraffin-embedded tissue sections, the corresponding glutaraldehyde-fixed portion was processed for TEM.

*Sarcocystis dubeyi*-like sarcocysts were located in 1-μm-thick resin sections stained with aqueous toluidine blue. Ultra-thin sections were obtained from the sarcocysts at a thickness of 60–80 Å by means of diamond knife, collected on copper grids, stained with uranyl acetate and then lead citrate, and examined by TEM.

Microscopic examination of paraffin-embedded sections revealed *S. dubeyi* sarcocysts were found in esophageal muscles from 11 of 35 Egyptian water buffaloes. Sarcocysts were 180–250 μm long × 70–110 μm wide. The cyst wall was 3.5–6.5 μm thick (n = 11) and had palisade-like villar protrusions showing striated appearance.

Ultrastructurally, the sarcocyst wall was 5–7.5 μm thick (Fig. 1). The interior of the sarcocyst was bounded by an electron-dense layer identified as the primary sarcocyst wall; it consists of a parasitophorous vacuolar membrane (Pvm) and an electron-dense layer immediately beneath the Pvm. A granular layer (ground substance, Gs), measuring 0.3–0.5 μm, was located beneath the primary cyst wall. The Pvm formed numerous tightly packed, nearly cylindrical villar protrusions (Vp) which were arranged in a palisade-like structure bending laterally at an angle of 45° to the cyst wall. The length of the Vp ranged from 4–7.5 μm (n = 20). The diameter of its base measured 0.7–1 μm; the middle portion was dilated (1–1.5 μm) and a narrow distal portion (0.3–0.5 μm) possessed a blunt end. The Vp contained microtubules (Mt) that were distributed along the entire villus but were mainly condensed at the distal two-thirds. A few electron-dense granules were scattered inside the core of the villus. There were spaces between the villar protrusions that ranged from 150–180 nm in diameter. The interior of the sarcocyst was divided into compartments by septa arising from the granular substance of the cyst wall.

All the sarcocysts examined were mature and contained numerous bradyzoites and a few peripheral merocysts (Fig. 1). The bradyzoites were 8.5–10 × 2.5 μm (n = 15) in size. The bradyzoites contained organelles, typically found in *Sarcocystis* species, including the 500 × 300 nm conoid, numerous (200–250 in a given plane of section) micronemes in the anterior third, 8–12 rhoptries, a 200-nm-diameter micropore, and a mitochondrion. The nucleus was situated at the beginning of the posterior third of the bradyzoite; it was relatively large (2–2.4 × 3 μm) and surrounded by a typical nuclear envelope. Golgi apparatus was observed anterior to the nucleus. Some amyllopectin granules were present in the cytoplasm posterior to the nucleus and in the anterior third of the cytoplasm.

The 4 species of *Sarcocystis* in water buffaloes can be distinguished by ultrastructural characteristics of their sarcocyst walls. *Sarcocystis levinei* sarcocysts are thin walled (<1 μm thick) and the villar protrusions are filamentous and folded over the sarcocyst wall. The *S. fusiformis* sarcocysts are thick walled and have characteristic cauliflower-like villar protrusions. The *S. balfononis* sarcocyst walls are thick walled, but the villar protrusions...
are conical with a constricted base. The S. dubeyi sarcocyst walls are 3.5–6.5 μm thick and have palisade-like villar protrusions.

Sarcocystis dubeyi-like sarcocysts were first recognized in water buffaloes in India but not named (Dubey, Speer et al., 1989). Paraíro et al. (1988) found similar sarcocysts in buffaloes from the Philippines but confused them with S. levinei. In the present study, the ultrastructure of the cyst wall was distinct from the previously described cyst wall and was identical to that of S. dubeyi reported by Huong and Ugga (1999). This is the first report of S. dubeyi in Egypt.

**LITERATURE CITED**


