FOLIA PARASITOLOGICA 50: 151–153, 2003

RESEARCH NOTE

HENNEGUYA CURVATA SP. N. (MYXOSPOREA: MYXOBOLIDAE) PARASITIZING THE GILLS OF *SERRASALMUS SPILOPLEURA* (CHARACIDAE: SERRASALMINAE), A SOUTH AMERICAN FRESHWATER FISH

Bianca Barassa[1], **Edson A. Adriano**[1], **Sarah Arana**[2] and **Nelson S. Cordeiro**[1]

[1]Departamento de Parasitologia, Instituto de Biologia, Universidade Estadual de Campinas (UNICAMP), Campinas, SP, Brasil;

[2]Departamento de Histologia e Embriologia, Instituto de Biologia, Universidade Estadual de Campinas (UNICAMP), Campinas, SP, Brasil

The class Myxosporea of the phylum Myxozoa contains 52 genera (Kent M.L., Andree K.B., Bartholomew J.L., El-Matbouli M., Desser S.S., Devlin R.H., Feist S.W., Hedrick R.P., Hoffmann R.W., Khattra J., Hallett S.L., Lester R.J.G., Longshaw M., Palenzeula O., Siddall M.E., Xiao C.X. 2001: J. Eukaryot. Microbiol. 48: 395–413), most of which parasitize fishes. *Henneguya* Thélohan, 1892 is the second most common of these genera and contains more than 150 species, some of which are important pathological agents (Dyková I., Lom J. 1978: J. Fish Biol. 12: 197–202; Kalavati C., Narasimhamurti C.C. 1985: Arch. Protistenkd. 129: 199–202; Lom J., Dyková I. 1995: In P.T.K. Woo (Ed.), Fish Diseases and Disorders. Protozoan and Metazoan Infections. Vol. 1. CAB International, Wallingford pp. 97–147; Martins M.L., Souza V.N., Moraes J.R.E., Moraes F.R. 1999: Rev. Bras. Biol. 59: 527–534). In South America, *Henneguya* is the most abundant genus, with 31 species. To date, two species of *Henneguya* have been reported in *Serrasalmus* spp.: *Henneguya iheringi* Pinto, 1928 parasitizing *Serrasalmus spilopleura* caught in the state of São Paulo, and *H. striolata* Casal, Matos et Azevedo, 1997 parasitizing *S. striolatus* collected in the Amazon River estuary near Belém, state of Pará, Brazil. Fish of the genus *Serrasalmus* are voracious carnivorous fish popularly known as piranhas and are widely distributed throughout South American rivers. In this study, we describe a new species of *Henneguya* parasitizing *S. spilopleura.*

Eighteen adult and juvenile specimens of *S. spilopleura* were collected locally from a lake on a farm in the municipality of Campinas, state of São Paulo, Brazil, and examined for the presence of myxosporeans. The fish were captured between January and June 2001, and transported alive to the laboratory where they were killed by transection of the spinal cord then measured and necropsied. The measurements of 30 fresh mature spores (Lom J., Arthur J.R. 1989: J. Fish Dis. 12: 151–156) were obtained using a micrometer incorporated into a microscope eyepiece. The dimensions were expressed as the mean ± standard deviation (SD). India ink staining was used to detect the mucus envelope. The spores were checked for the presence of an iodinophilous vacuole after adding a drop of Lugol solution. Smears containing free spores were stained with Giemsa's solution and mounted in low viscosity medium as permanent mounts (Adriano E.A., Arana S., Ceccarelli P.S., Cordeiro N.S. 2002: Folia Parasitol. 49: 259–262). For histological analysis, portions of the gills containing plasmodia were fixed in 10% buffered formalin for 24 h, embedded in paraffin, cut into sections 4 μm thick and stained with sirius red (Adriano et al. 2002, op. cit.), haematoxylin and eosin and PAS.

Henneguya curvata sp. n. Figs. 1–3

Vegetative stages. Small, white, round or ellipsoidal plasmodia measuring 0.1–0.5 mm were found in the gills of *S. spilopleura*. The plasmodia occurred in the interlamellar epithelium or the epithelium of the secondary lamellae. Plasmodia in advanced stages contained only mature spores.

Spores. Mature spores elongate (41.7 ± 2.7 μm long, 4.7 ± 0.2 μm wide). In frontal view, spore body fusiform (length 16.4 ± 0.8 μm), in lateral view, thin and curved, with thin suture line (Fig. 1). Valves thin, smooth and prolonged by long caudal process (length 25.3 ± 2.3 μm) (Figs. 1, 2). Polar capsules elongate (7.8 ± 0.3 μm long, 1.4 ± 0.2 μm wide). Polar filaments coiled in 10–11 turns aligned perpendicularly to longitudinal axis of capsule. Iodinophilous vacuole present but no mucus envelope. Two nuclei discernible in Giemsa-stained preparations.

Fig. 1. Photomicrograph of spores of *Henneguya curvata* sp. n. in a fresh preparation: note the thin and curved body of the spores seen in lateral view. Scale bar = 10 μm.

Address for correspondence: B. Barassa, Departamento de Parasitologia, Instituto de Biologia, Universidade Estadual de Campinas (UNICAMP), Caixa Postal 6109, CEP 13083-970, Campinas, São Paulo, Brasil. Phone: ++55 19 3788 6284; Fax: ++55 19 3788 6282; E-mail: b_barassa@hotmail.com.

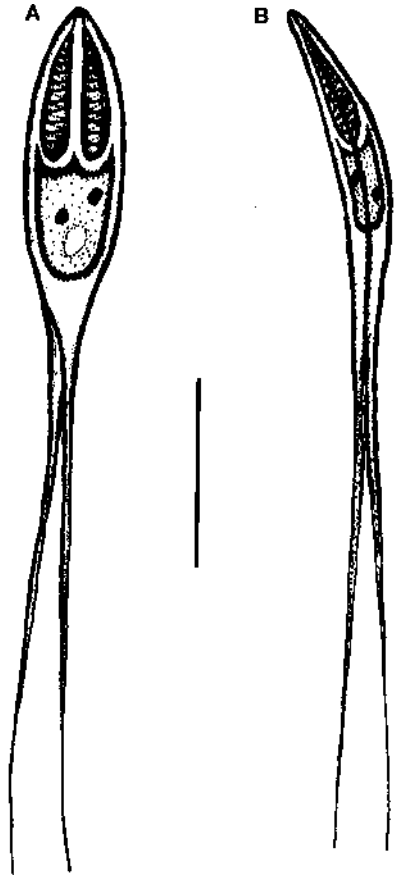

Fig. 2. *Henneguya curvata* sp. n., schematic representation of mature spores. A – frontal view, B – lateral view. Scale bar = 10 μm.

T y p e h o s t : *Serrasalmus spilopleura* Kner, 1858 (Pisces: Characidae: Serrasalminae).

S i t e o f i n f e c t i o n : Gills.

P r e v a l e n c e : 100% (18/18) of *S. spilopleura* were infected.

T y p e l o c a l i t y : Rio das Pedras farm, municipality of Campinas, state of São Paulo, Brazil.

T y p e m a t e r i a l : Slides with stained spores (syntypes) were deposited in the collection of the Museum of Natural History, Institute of Biology, State University of Campinas (UNICAMP) (Acc. Nos. ZUEC 06 and 07).

E t y m o l o g y *:* The specific name refers to the curved shape of spore body, seen in lateral view.

The morphometrics of spores of *Henneguya curvata* were compared with 31 other *Henneguya* species reported to date in South American fishes. Of these, only *Henneguya visceralis* Jakowska et Nigrelli, 1953 found in *Electrophorus electricus* and *H. striolata* described in *S. striolatus* have characteristics similar to those of *H. curvata*. In lateral view, spores of *H. curvata* resemble those of *H. visceralis* because of the curved body, but the spore dimensions are different. Spores of *H. striolata* are similar in size and shape to those of *H. curvata*, but the spores of the latter have a curved body, larger polar capsules and the polar filaments have 10–11 turns compared to 13–14 turns in *H. striolata.*

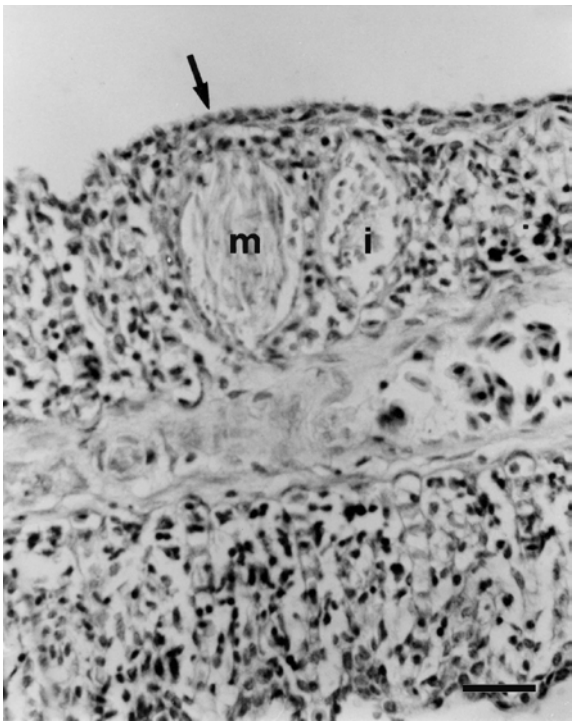

Fig. 3. Histological section of the gills of *Serrasalmus spilopleura*. Mature (m) and immature (i) plasmodia of *Henneguya curvata* sp. n.; note the fusion of the neighbouring lamellae and the proliferation of epithelial cells around the plasmodia (arrow). Sirius red staining. Scale bar = 20 μm.

The prevalence of the parasite was higher (100%) than that known for other *Henneguya* species of fish from natural environment from South America. In *S. striolatus* from the Amazon River, the prevalence of infection by *H. striolata* was 62.5% (Casal G., Matos, E., Azevedo C. 1997: Parasitol. Res. 83: 93–95). *Henneguya malabarica* parasitizing *Hoplias malabaricus* in the Amazon River had a prevalence of 6.7% (Azevedo C., Matos E. 1996: Parasitol. Res. 82: 222–224). *Henneguya pisciforme* Cordeiro, Artigas, Gióia et Lima, 1983/84 was described infecting *Hyphessobrycon anisitsi* with a prevalence of 20% in rivers around Campinas, state of São Paulo. In the same region, *Henneguya intracornea* infecting *Astyanax scabripinnis* had a prevalence varying from 2% to 11.5% in fish caught at different sites (Gióia I., Cordeiro N.S., Artigas P.T. 1986: Mem. Inst. Oswaldo Cruz 81: 401–407).

Histopathology. The plasmodia occupied the interlamellar epithelium or the epithelium of the secondary lamellae and were surrounded by a thin collagen capsule (Fig. 3). Development of the plasmodia caused deformation of the lamellar structures, including compression of the capillaries, which led to a slight oedema. In advanced stages, the neighbouring secondary lamellae were pushed aside to produce fusion of the lamellae. Epithelial cells proliferated around the plasmodia and there was thickening of the epithelial surface (Fig. 3). Similar observations were reported by Molnár (Molnár K. 1998: Folia Parasitol. 45*:* 261–269) for pikeperch parasitized by *Henneguya creplini* (Gurley, 1894), but he described also a formation of a thick layer of granular tissue.

According to Dyková and Lom (1978, op. cit.), the response of soft tissues of fish to myxosporidian infections involves displacement, atrophy or hyperplasia of the tissue surrounding the plasmodium during its growth and maturation. In more advanced stages, when the cysts are full of mature spores, an inflammatory reaction occurs, resulting in the rapid replacement of the cyst by granulomatous tissue. In addition to displacement of the secondary lamellae and epithelial hyperplasia, Martins et al. (1999, op. cit.) described epithelial displacement, haemorrhage and an intense inflammatory mononuclear infiltrate in the secondary lamellae of *Leporinus macrocephalus* infected with *Henneguya leporinicola* Martins, Souza, Moraes et Moraes, 1999. No haemorrhagic or inflammatory foci were observed in the present study, but the histopathological alterations indicated that *H. curvata* is pathogenic since there was a fusion of the neighbouring secondary lamellae with subsequent lamellar deformation, as well as proliferation of the epithelium and a loss of respiratory area. These changes could adversely affect the excretion of the fish since the gills are also involved in other physiological functions.

Acknowledgements. The authors thank Nilson Branco for collaboration in the field-work and Dr. Stephen Hyslop for editing of the English.

Received 28 May 2002 Accepted 18 October 2002