RESEARCH ARTICLE

Said Noor El-Din A. Noor El-Din
Amal I. Khalil
Hussein E. El-Sheekh
Nahla A. Radwan

HISTOPATHOLOGICAL EFFECT OF THE SPIRUID NEMATODE PROCAMALLANUS LAEVICONCHUS IN THE STOMACH AND INTESTINE OF NILE CAT FISH CLARIAS GARIEPINUS

ABSTRACT:

Examination of the intestinal tract of Clarias gariepinus showed that Procamallanus laeviconchus infects both the stomach and hind gut of the intestine. In the stomach of the infected fish, the parasite penetrated to the submucosal layer. The presence of the parasite was found to be accompanied by goblet cell hyperplasia, cellular infiltration, degeneration of connective tissue, and formation of compact fibrous capsule around the cephalic end of the parasite. In the intestine, the nematode parasite was found to penetrate through the mucosal and submucosal layers. In the mucosal layer, the parasite caused complete elimination of the epithelial cells at the point of attachment and degeneration of host tissue, accompanied by blood cell leakage into the lumen of the intestine. In the submucosal layer, the loose connective tissue was completely eroded.

KEY WORDS:
Procamallanus laeviconchus, Clarias gariepinus, Nematoda, histopathology.

CORRESPONDANCE:
Said Noor El-Din A. Noor El-Din
Department of Zoology, Faculty of Science, Tanta University, Egypt.

E-mail: s_noor2000@hotmail.com

ARTICLE CODE: 13.01.09

INTRODUCTION:

Pathogenicity of nematode parasites is determined by the relationship between the parasite and the host defense mechanisms. Intestinal parasites may cause different forms of injury such as passive obstruction, irritative and inflammatory actions, migration to unusual sites, pyogenic, exfoliative and toxic reactions (Rees, 1967; Aldridge and Schireman, 1987; Paperna, 1991; Gratzek et al., 1992; Meguid and Eure, 1996; Longshaw et al., 2004).

The degree of injury depends on the nematodes location, abundance, mode of feeding, and excretory-secretory products (Margolis, 1970; Cheng, 1976; Limsuwan and Chinabut, 1983; Moravic et al., 1987; Gratzek et al., 1992; Heupel and Bennet, 1998; Frantova and Moravec, 2003; Menezes et al., 2006).

Although a big deal of information is available on the pathogenicity of human nematodes, yet studies concerning the pathology of tissue dwelling fish nematodes are somewhat limited. The most important of which are those of Keppner (1975) on Spinitectus micrancanthus infecting the bluegill fish, Lepomis macrochirus; Jilek and Crites (1982) on Spinitectus carolini infecting the bluegill fish; Miyazaki et al. (1988) on Hysterothylacium dollfusi infecting the gastric mucosa of paddlefish, Polyodon spathula; Meguid and Eure (1996) on Camallanus oxycephalus and Spinitectus carolini infecting the intestine of green sunfish, Lepomis cyanellus; Heupel and Bennet (1998) on adult Proleptus australis from the stomach of Hemiscyllium ocellatum; Khatoon and Bilqees (1998) on adult Raphidioascaris sp. from the stomach of Rachycentron canadus; Ramallo et al. (2000) on the nematode Spinitectus jamundensis in the stomach of the shad Prochilodus lineatus; Frantova and Moravec (2003) on adult Cystidicoloides ephemeraldarum infecting the stomach of brown trout Salmo trutta fario and Menezes et al. (2006) on the nematode Camallanus cotti from aquarium fishes Beta splendens and Poeicilia reticulate.
Procamallanus laeiconchus is a common parasite of African fresh water fish. It has been recorded from 23 host species, mainly siluriod fish (Khalil, 1970). In Egypt, the parasite was recorded from stomach and intestine of Clarias lazera (syn: Clarias gariepinus) by many authors (Noor El-Din, 1981; Varjabedian, 1993). Live parasites are slender, reddish in colour with a distinct yellow brown buccal capsule.

The present study aims to detect the pathological effects associated with the nematode Procamallanus laeiconchus infecting the stomach and intestine of the cat fish Clarias gariepinus.

MATERIALS AND METHODS:

Adult C. gariepinus, collected from Tanta fish market, were sacrificed, their alimentary canals were opened and parts of the stomach and intestine containing the parasites were removed and fixed in Bouin's fluid for 24 hours. Tissue samples were processed for histopathological studies, according to Luna (1968).

Specimens were impregnated and embedded in paraffin wax, sectioned at five micrometers and stained with hematoxylin and eosin. Slides were examined by light microscope. The histopathological changes of the infected organs were detected and photographs were taken using Leiz photomicroscope. Goblet cells in the mucosal layer were counted according to Miller and Nawa (1979).

RESULTS:

Examination of the intestinal tract of adult C. gariepinus showed that P. laeiconchus infects both the stomach and hind part of the intestine. The presence of this nematode parasite was accompanied by mucus secretion, where mucus forms a film that covered the mucosal epithelium.

Figure 1 illustrates the uninfected stomach with normal mucosal and submucosal layers.

Nematodes, which were reported in the stomach, were found to penetrate as deep as the submucosal layer (Fig. 2). The presence of nematodes was accompanied by cellular infiltration, degeneration of connective tissue and formation of compact fibrous capsule around the cephalic end of the nematode. Fibrous reaction was only observed when worms reached the submucosal tissue (Figs 2&3).

Fig. 2. Infected stomach showing deep penetration of the parasite in the submucosal layer, degeneration of connective tissue and formation of compact fibrous capsule around the parasite. D: degenerated connective tissues; FC: compact fibrous capsule. (Scale bar = 0.1 mm).

Fig. 3. High magnification of fig (2) showing degenerated connective tissue and aggregation of lymphocytes around the fibrous capsule. D: degenerated connective tissues. (Scale bar = 0.05 mm).

Figures 4, 5, and 6 Illustrate the uninfected intestine; normal serosa, muscularis, submucosa, and mucosa.

Fig. 4. Uninfected intestine showing serosa, muscularis, submucosa, and mucosa. (Scale bar = 0.3 mm).

Fig. 5. Uninfected intestine showing mucosal and submucosal layers. (Scale bar = 0.1mm).
Histopathological Effect of the Spiruroid Nematode Procamallanus Laeviconchus in the Stomach of C. gariepinus

Cross examination of heavily infected intestine showed that the sites of infection were marked by nodules in which nematodes were coiled entrapping cell debris. These nodules were surrounded with tissue fragments and extensive mucous secretion. Nematodes were found to penetrate through the mucosal and submucosal layers (Figs 7 and 8).

Pathological changes in the intestine can be classified into two categories: shallow and deep. In the first category, penetration was shallow and generally limited to the mucosal layer. There was an elimination of the epithelial cells at the point of attachment and degeneration of the host tissue, accompanied by blood cell leaking into the lumen of the intestine (Fig. 9). Some deposition of what appeared to be collagen fibers at the point of attachment was also observed. In the second category, worms penetrate deep into the intestinal wall, where the mucosal epithelium and the loose connective tissue in the submucosa were completely eroded (Figs 7, 8, and 10). The number of goblet cells/mm is significantly greater in heavily infected hosts (6-10 worms/cm²) than in uninfected fish (Figs 5, 6, and 11). The mean number of goblet cells increased from 70 cells/mm in uninfected fish to 118 cells/mm in heavily infected ones.

DISCUSSION:
The present results showed that P. laeviconchus penetrated deeply in the stomach and intestine of C. gariepinus until they reached the submucosal layer. Similarly, Keppner (1975) reported the penetration of Spinitectus sp. into the intestinal mucosa of the bluegill sunfish, Lepomis macrochirus. Jielk and Crites (1982) found that the third stage larvae of Spinitectus carolini were able to penetrate the gut wall and then encapsulate in the mesenteries of the bluegill sunfish. Khatoon and Bilqees (1996) found that the nematode Raphidascaris sp.
infected with (Meguid and Eure, 1996), in green sunfish Spinitectus and in Camallanus oxycephalus and Spinitectus carolini infected with (Khatoon and Bilqees, 1996) in bluegill sunfish infected with (Menezes et al., 1988), in aquarium fishes infected by (Gratzek JB, Shotts EB Jr, Dawe DL. 1992). Meguid and Eure (1996) declared that the nematodes Camallanus oxycephalus and Spinitectus carolini penetrated deep into the intestinal wall of the green sunfish Lepomis cyanellus, even to the circular muscle layer. Heupel and Bennet (1998) found that the nematode Prolleptus australis was observed within the lamina propria of the stomach of Hemiscyllium ocellatum and occasionally penetrated the muscularis. Ramallo et al. (2000) declared that the nematode Spinitectus jamundensis enters the mucous membrane reaching muscular mucous membrane of the cardiac region of stomach of Prochilodus lineatus or the epithelial plaits in the pyloric region reaching up to the muscular layer without crossing it.

Penetration of P. laeviconchus was always associated with substantial damage and loss of mucosal epithelium at the site of infection. Similar observations were described in bluegill sunfish infected with S. carolini larvae (Jielil and Crites, 1982), in paddlefish infected with Hysterotheriacium dollfusi (Miyazaki et al., 1988), in Rachycentron canadus infected with Raphidascaris sp. (Khatoon and Bilqees, 1996), in green sunfish infected with Camallanus oxycephalus and Spinitectus carolini (Meguid and Eure, 1996), in the shad infected with Spinitectus jamundensis (Ramallo et al., 2000), in brown trout infected with Cystidicoloides ephemeridum (Frantova and Moravec, 2003) and in Beta spendens and Poecilia reticulate infected with Camallanus cott (Menezes et al., 2006). The mechanical damage of the mucosal epithelium may result from the mechanical destruction, pressure atrophy and toxins produced by the parasites. In this respect, Frantova and Moravec (2003) declared that the only specialized attachment devices of Cystidicoloides ephemeridum are the flexible overlapping margins of the cortical annuli which are elongated in the first third of the body. Together with the sucking pressure of the oesophagus, they seem to play a role in the penetration and mechanical damage of the host’s tissue.

Generally, when the parasite invades fish tissue the latter develops a series of reactions to localize it, suppress its activities and limit further possible reinfection. Such reactions were reported in the present study.

The most pronounced form of host reaction observed in the present study was the inflammatory reaction, which was in the form of variable degrees of mononuclear cellular infiltration observed particularly around the head capsule. This inflammatory reaction is probably the response of the body to the presence of the parasite and to the tissue injury evoked by the penetration of the parasite. It is believed that this response serves to destroy, dilute or wall off the injurious agent. Inflammatory response in relation to nematode infection was also reported by Meguid and Eure (1996), Ramallo et al. (2000), Frantova and Moravec (2003) and Longshaw et al. (2004). On the other hand, Heupel and Bennet (1998) declared that there is a little to non inflammatory response was observed, except in one case where a worm was being degenerated by a host tissue reaction.

In the stomach, the penetration was deep in the submucosal layer and was accompanied by degeneration of connective tissue, which may result from the activation, and release of lysosomal enzymes. In addition to the parasite itself, dead cells and their lysosomal enzymes evoke an inflammatory reaction, which brings polymorphonuclear leucocytes to the area.

Fibroblastic reaction observed at the site of infection with P. laeviconchus, lead to the formation of a compact fibrous capsule around the anterior end of the worm. This reaction is an attempt of the host to replace the injured cells with fibrous cells and wall off this injurious agent. Meguid and Eure (1996) reported similar fibrous capsule formation in the stomach of green sunfish infected with Camallanus oxycephalus and Spinitectus carolini.

REFERENCES


