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A pathological case caused by Philometra madai Quiazon, Yoshinaga & Ogawa, 2008 (Nematoda: Philometridae) in the ovary of the onespot snapper fish Lutjanus monostigma (Teleostei, Lutjanidae) from the Red Sea

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Abstract

Lutjanus spp. (Teleostei, Lutjanidae) rarely recorded as hosts of gonad-infecting species of *Philometra* Costa, 1845 (Nematoda: Philometridae). Here, gravid females of *Philometra madai* Quiazon, Yoshinaga & Ogawa, 2008 which parasitizes the ovary of the bream *Pagrus major* (Teleostei, Sparidae) and the only species of the genus described from the Red Sea fishes, is recorded for the first time from the ovary of the onespot snapper fish *Lutjanus monostigma* (Cuvier, 1828) (Teleostei, Lutjanidae). Histopathological changes in the ovary of this fish associated with this infection were significant, and may thus affect the reproductive potential and success of the fish.

Key words: Teleostei, *Lutjanus monostigma*, Nematoda, *Philometra*, histopathology.

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INTRODUCTION

Philometra Costa, 1845 (Nematoda: Philometridae) is a large cosmopolitan genus (Moravec 2006) and its members are histozoic parasites (wedged between tissue cells) in freshwater and marine fishes. Most species of this genus are known only from the large-sized gravid females (usually >100 mm in length), whereas the minute males (usually <5 mm in length) of many species have not yet been described (Moravec *et al.* 1998). However, many species are still biologically and taxonomically poorly known, and their identification is usually very difficult and problematic because of difficulties associated with their morphological and biological peculiarities (Moravec *et al.* 2003, Moravec & Genc 2004). Moreover, the life cycles of most species are still completely unknown.

Gonad-infecting species of *Philometra* are usually highly pathogenic (due to their large-sized females), and may cause considerable damage to ovarian tissues of their fish hosts, affecting the fish reproductive success (Ramachandran 1975; Sakaguchi *et al*. 1987; Hesp *et al*., 2002; Moravec *et al*. 1997, 2002; Clarke *et al*. 2006; Moravec & Justine 2009; Perez *et. al*. 2009; Chavez & Oliva 2011). During recent years, the importance of *Philometra* spp. parasitizing marine fishes has increased due in particular to the rapid development of marine aquaculture, because these pathogenic parasites may cause serious damage to infected fishes or, when parasitic in gonads, significantly decrease fish reproduction (Ramachandran 1975; Sakaguchi *et al*. 1987; Moravec 2004).

To date, *Philometra madai* Quiazon, Yoshinaga & Ogawa, 2008 (synonym: *Philometra lateolabracis* Yamaguti, 1935) (see Quiazon *et al*. 2008), which parasitizes the ovary of the bream *Pagrus major* Temminck & Schlegel, 1843 (Teleostei, Sparidae) is the only species of the genus described from the Red Sea fishes. Although, Al-Jahdali, & Hassanain (2010) recorded Ovarian abnormality caused by Myxidium sp. (Myxozoa, Myxosporea) in onespot snapper fish *Lutjanus monostigma* (Teleostei, Lutjanidae) from the Red Sea, The *Philometra madai* parasite is herein recorded for the first time from the ovary of the onespot snapper fish *Lutjanus monostigma* (Cuvier, 1828) (Teleostei, Lutjanidae), and its pathological lesions is histologically described.

It is important to describe and report such parasites and their pathological conditions when they are recorded, because such information may be useful in the future as a "baseline" data for assessing ecosystem health in the face of threats from global warming (Harvell *et al*. 2002).

MATERIALS AND METHODS

During April and May of 2011, specimens of the onespot snapper fish, *Lutjanus monostigma* (Cuvier, 1828) (Teleostei, Lutjanidae), were examined in order to estimate the dynamics of multiple spawning. These fish were caught by net in the Red Sea off the coast of Jeddah, Saudi Arabian, identified according to Randall (1983) and their names follow Froese and Pauly (2004/2011). During laboratory examination and dissection, four ovaries were found infected with a long tightly coiled nematode. Two of them were teased from the ovary, fixed in 70% ethanol and cleared in glycerin. After clearing, nematodes were mounted on slides; only the anterior and posterior portions were mounted on slides after measuring the total body length. Observations were performed using a high power research microscope. The other two infected ovaries taken for histological assessment; fixed in Bouin's fixative, embedded in paraffin wax, and 4 µm-thick sections were cut and stained with hematoxylin and eosin, then dehydrated, cleared and mounted on microscope slides using standard techniques (see Luna 1968) to investigate pathologies associated with the parasite.

RESULTS

In 4 specimens of examined fishes of *L. monostigma* (ca.16-21 cm in total length), the normal ovary (Fig. 1A) was infected by a single living gravid female of a philometrid worm (Fig. 1B), tightly coiled, dark red in color and 23.4-31.7 mm in length; the male never seen in the ovary. The characteristics and body measurements of this female worm are typically conformable to those of *Philometra madai* Quiazon, Yoshinaga & Ogawa, 2008 (see Quiazon *et al*. 2008) which is so far, the only species of the genus known from the Red Sea. The worm mouth was close to the ovarian wall (in 1 case) or firmly attached to a relatively large blood vessel in the ovarian wall (in 3 cases).

Histological examination

In histological section of healthy ovarian tissue (Fig. 1C), healthy oocytes in various developmental stages were densely packed, the connective tissue were few and no cellular infiltrates. In histological section of infected ovary (Fig. 1D), *Philometra madai* occupied a considerable part of the ovary and some areas within the ovarian tissues appeared to be vacuolated or degenerated, suggesting that the worm can induce histological lesions in the neighboring ovarian tissue. The worm intestine was packed with numerous oogonia and erythrocytes and the worm uteri were packed with numerous numbers of larvae (Fig. 1E). However, the worm was surrounded by few oocytes at all stages of development, i.e. from the chromatin nucleolar to hydrated stages. In addition, there is severe interstitial hemorrhage and necrosis of ovarian tissue, with heavy cellular infiltration. Thus, the typical ovarian structure of *L. monostigma* was greatly affected and lost its normal architecture. Therefore, the infection caused by *P. madai* is presumed to negatively affect the reproductive capacity of the fish host.

DISCUSSION

Lutjanus spp. rarely recorded as hosts of gonad-infecting species of *Philometra*. Linton (1907) and Rees (1970) reported *Philometra* spp. from the gonads of *L. synagris* Linnaeus and *Lutjanus* sp., respectively, from Bermuda, which were considered by Moravec *et al*. (1988) to be probably *Philometra lateolabracis*. However, with respect to the redescription of *P. lateolabracis* by Quiazon *et al*. (2008), these nematodes apparently belong to a different species and should be designated *Philometra* sp. until their detailed morphology, including that of the male, is described (Moravec 2008). Santos Cavalcanti *et al*. (2010) reported *Philometra* sp. from the ovary of *L. synagris* from off the Brazilian Atlantic coast. More recently, Moravec and Justine (2011) described *P. brevicollis* from the ovary of *L. vitta* Quoy & Gaimard from South Pacific Ocean, off Nouméa, New Caledonia.

Philometrids exhibit a fairly high degree of host specificity (Moravec 2006). *Philometra madai* seemed to be less specific, since it was originally described from the ovary of the bream *Pagrus major* (Teleostei, Sparidae) and is herein recorded from the ovary of *Lutjanus monostigma* (Teleostei, Lutjanidae).

In the present study, *P. madai* found in the ovary of *L. monostigma* were all living females. Thus, males presumably occupy another part of the host's body and the females had presumably already become fertilized before they were detected in the gonads. Such spatial segregation of the two sexes has been recorded for several other species of philometrid (see Molnár & Fernando 1975). As in many other studies of *Philometra* species, the search for the males of *P. madai* in the present study was unsuccessful, presumably due in part to the very small size of the philometrid males. Living females of *P. madai* in the ovary of *L. monostigma* during the spawning period of this fish were not encapsulated by a fibrous sheath and were able to shed their larvae into the lumen of ovary, from where they could then pass to the oviduct and finally out of the host. Once the spawning period is completed, the female worms may die and become encapsulated in a fibrous sheath produced by the ovary.

Histopathological changes in the ovary of *L. monostigma* associated with the philometrid *P. madai* infection were significant. The tissue degeneration, hemorrhaging, necrosis and cellular infiltration observed most likely reduce oocyte number and quality, leading to lower fecundity. The presence of numerous erythrocytes in the worm gut indicates that the worm was feeding on the blood of *L. monostigma*, thereby paralleling the situation with other species of *Philometra*, which likewise live in the gonads of fishes (Ramachandran 1975; Glazebrook *et al.* 1988); this diversion of nutrients to the parasite may exacerbate the impacts of the worm on ovarian tissue. However, the presence of living females of *P. madai* in the ovary of *L. monostigma* during the spawning period is probably stimulated by some function associated with sexual maturation of this fish, where their ovaries become larger and could thus provide a plentiful food supply (i.e. blood) to the parasite. Furthermore, intense infections can reduce the effective volume of the ovary and thus lead to lower fecundity. Generally, future studies are required to understand and to elucidate this host-parasite system. Such studied, especially with quickly developing cultures of marine fishes are highly desirable.

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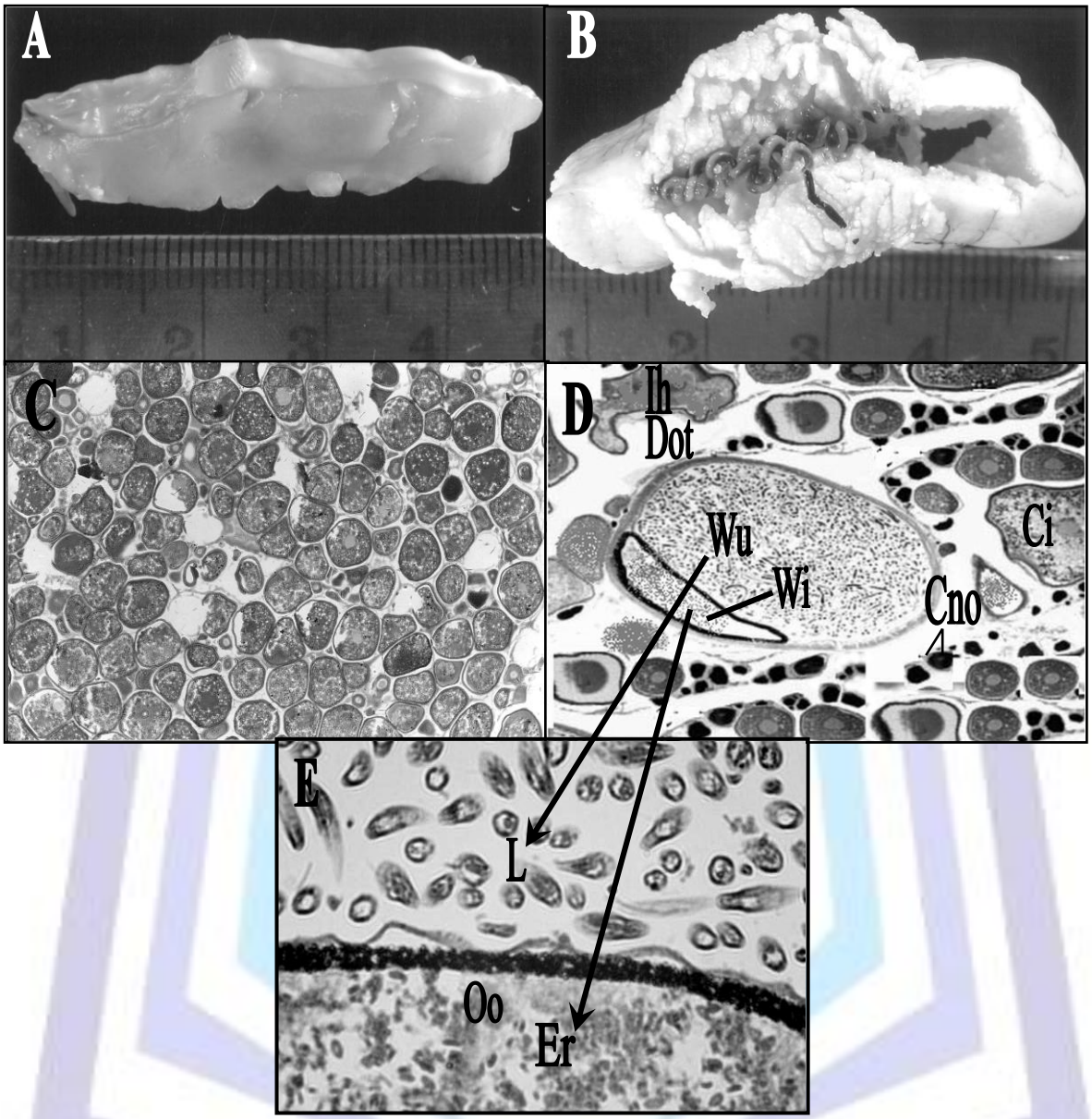

Fig. 1A-E: A) Healthy (uninfected) ovary of the fish *Lutjanus monostigma*. B) Ovary infected with the Philometridae nematode *Philometra madai*. C) Histological section through healthy ovarian tissue showing dense packing of healthy oocytes in various developmental stages, little connective tissue, and no cellular infiltrates (× 100). D) Histological section through ovary infected with *P. madai* showing the degenerated ovarian tissue (Dot), chromatin nucleolar oocytes (Cno), interstitial hemorrhage (Ih), cellular infiltration (Ci), worm uterus (Wu) and worm intestine (Wi) (× 100). E) Histological section through the worm *P. madai* showing the numerous oogonia (Oo) and erythrocytes (Er) in the worm intestine and the numerous number of larvae (L) in the worm uteri (× 200).