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PARASITIC NEMATODES OF FISHES OF VOJVODINA

Plavša N., Stanivuk J., Stanaćev V., Vuković V., Nikolić Lj., Babić J.[1]

SUMMARY: This paper presents an overview of the biology of the parasite (*Eustrongylus sp.*), his geographical spreadings, source of infection and mode of infection transmission, the clinical signs of disease, and the recommendations for prevention. Nematodes and their larvae are parasite of fish, in specific conditions they are potential risks for human health,but excepte that, they cause changes in the fish meat, and make it inappropriate for human nutrition. First confirmation of this parasite in Serbia was in 2006. The main sources of infection are infected fish-eating birds. The fertilized eggs are shed into the water with the faeces. They have indirect life cycle, and require two intermediate hosts- oligochaetes and small fishes. Human infestation is very rare, but there are isolated cases of infestation in pleaces where humans eat raw or undercooked fish. Exposure to temperature of 60 °C inactivate the parasite in 1 minute, also the temperature of -15 °C inactivate it in 96 hours.
Key words: *Eustrongylus sp.*; fish parasites;

Introduction

Larval and adult *nematodes* in fish meat can cause human disease or organoleptical changes due to which fish are evaluated as hygienically inadequate for human consumption. [9]

Global climate changes approached the Danube basin ecosystem to the tropics, and also common organic and thermal pollution of the open water, resulted as increased infestation of fish with this type of parasites.

Parasites are usually identified in fish species that live in stagnant or slow-flowing waters, with bigger infestation of predatory fishes, perch (*Stizostedion lucioperka*) European pearch (*Perca fluviatilis*), catfish (*Silurus glanis*), pike (*Esox lucius*), but also in cyprinids, cichlids etc. [2, 3, 5].

Because of the similar clinical signs in infected fish, several different parasitic nematodes, from species Contracaecum sp., Philometra sp. and recently Eustrongylus sp., are called with common name “Big Red Worm”.

Identification

The roundworms parasitic in fishes, with characteristic pronounced red, very long, cylindrical, and thin body, and if they are located outside of digestive system – encapsulated in muscle and peritoneal cavity, they can be identified us one of three genera of nematodes: *Eustrongylus sp.*(L), *Contracecum sp.(*L), *Philometra sp.(*A). For precise identification there is a need for elaborated examination under the microscop.

The larvae of *Eustrongylids* are typically very long, coiled, and red (due to presence of hemoglobin), and an infected fish often has more than one nematode in its body cavity. *Eustrongylides* species can be found in muscles, “free” within the body cavity, or encapsulated on the liver and other organs, but they are found outside the intestinal tract of fish [21].

Length of last larval stage of Eustrongylus, which parasites in fish, in different sources of literature defined by small deviations [21], 11-83 mm, 15-115 mm [10] to 150mm [7] . On top of the head larvae of *Eustrongylus* have a 12 or 18 papillae placed in two concentric circles. In wider circle papillaes are longer. Lips are not developed. In pre-adult stage is morphologically impossible to determine the species of *Eustrongylus* and therefore determination only by their families [11].

How Eustrongilide migrate from the digestive tract to other parts of the body, the only way of detection of parasites before death, is the autopsy of fish samples from suspicious environments.

Contracaecum sp., is also a parasite of fish in pre-adult stage larvae (L4). The microscopic examination differs from eustrongilides by well-developed lips [16].

Philometra rubra and P. cylindracea– this family of nematodes has a lot of determined species, but this two species have the characteristic red color. Fish is final host for this parasite, and because of that in the capsules, excepte larvaes, could be found and adult females. Average of length of larvae of Philometra family were 50 mm [12] Cephalic papillae are very small, indistinct when viewed laterally. Oral aperture large, oval, surrounded by 14 small cephalic papillae arranged in two circles and slightly outlined lateral amphids; internal circle of papillae consisting of

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four submedian and two lateral single pappile. Infestation with Philometridaes can be identified by the fact that they are encapsulated close to the skin, and break the intactness of the same when they are ready to release the eggs [13].

Biology of the parasites

Eustrongilidoze pathogens in fish and fish-eating organisms are different stages of development of roundworms from the family Eustrongylidae (sin.Nematoda: Dioctophmidae). This family have 11 determinated species but E. Tubifex, E. Ignotus, E. Excisus [5], and E gigas are most common.

Roundworms of the family Eustrongilidae have indirect life cycles, and require the presence of two intermediate and the final host [5], an exception is E.ignotus which can suppress link first intermediate host (oligochaeta). [18] There are four stages of development between egg and sexually mature individuals. The first larval stage develops within the eggs that are shed in the feces of the bird host and are eaten by freshwater oligochaetes or aquatic worms. The oligochaetes serve as the first intermediate host. [5] The first larval stage develops within the egg. Larva (I), then hatch from egg and migrated into the ventral blood vessel of oligohete where grow throe the second and third larval stage. Other intermediate hosts are small fish species (*Fundulus* and *Gambusia*) and fingerlings of (carp, crucian carp), feed upon the infected oligochaetes. After entering the digestive tract of fish, larvae (III) migrate through the walls of the digestive organs and encapsulated in muscles, internal organs, or remain free in the peritoneal cavity [21]. The parasites here develop into infective fourth-stage larvae, and await ingestion by birds. In the case that the second intermediate host been eaten by some predatory fish or other carnivorous organisms, it will behave like paratenic or transport hosts, and not like final host-parasite will be in the larval stage (IV), during digestion of tissue they migrate to abdominal cavity , internal organs and muscle tissue, of paratenic host. [21] [17] When the final host consume second intermediate or paratenic host, the parasite passes from the larval stage (IV) in adult phase within 3–5 hours, and after 10-17 days postinfection begin shedding eggs. [5]. Eustrongilida eggs are very resistant and can survive outside the host in water up to two and a half years [6]. On the other hand, larvae in every stage, as well as adult form are sensitive to changes in temperature.

Contracaecum sp. (*Anisakidae*) life cycle is very similar to the Eustrongilidae.sp. Final host for Contracaecum sp., are fish-eating birds, but also could be the fish-eating mammal. The life cycle of Contracaecum sp. begins in the digestiv system of the final host where the female parasite shed eggs. 2 to 7 days after the egg reachs the water, larvae develops to second phase larvae which can swim freely without a host for several months. [8] First intermediate host are planktonic crustaceans [7].

Second intermediate host are oligochaetae or other invertebrates [15], whose function is not precisely defined, and even some literature sources do not mention it in the life cycle [8]. Parasite transforms to L4 stage and wait for the migration to the tissues of fish. Consumption of fish by the final host, and the transition to adult-stage parasites closes its life cycle. Human infestation with larvae Contracaeucuma sp. is more often than with Eustrongilus sp., but a source is mostly raw sea fish.

Philometra sp. –are the nematodes long up to 5 cm, they also have a characteristic red color. In difference to the earlier mentioned roundworms, his final host is fish parasites that are found encapsulated in the peritoneal cavity of the fish could be or in pre-adult larvae or adult stage. The life cycle of the parasite begins with shedding eggs, and releasing it through rupture in skin of infected fish. After that free swimming larvae attaches to the intermediate host- Cyclops, who will be consumed by fish. The larvae then migrate from the digestive tract to the subcutaneous areas, usually near the fins. The period from egg to adult stage takes about a year [12].

Geographical distribution

Eustrongylidosis is considered as a tropical disease, but in the time of global climate change, the appearance of this parasites are reported from much wider geographical range. There is a difference in the number of certain types of Eustrongylus in specific areas, most common species in Europe are E. tubifex and E. excisus, in USA E. tubifex and E. ignotus., and in Asia E. excisus [5, 20].

Contracaecum sp. is widespread in the tropics and in temperate climates, both in fresh and salt water. (FAO 2013).

The literature mentions different species depending on the geographical origin, defined by the U.S. Contracaecum Collier, C. Spiculigenon, C. Multipapillatum C. micropappilatumsu.

Source of infection and mode of transmission of infection

Main source of the disease are infected birds who flies over a thousands of kilometers with fertilized eggs in the digestive system. Further development of the parasites means that infected avian feces get into the water with two intermediate hosts limnodrilus, tubifex, and other oligocheates as the first, and fish as second intermediate hosts. [7, 21, 1] The eggs can live for 2.5 years before entering the intermediate hosts, and in both of the intermediate and paratenic host can survive for over a year.

Clinical sings of disease in fish and humans

Eustrongylus cause problems in the normal functioning of the fish body, especially if it's a strong infestation with large number parasites. At minnow fish- intermediate host of parasite- larvae is in the third stage of develop-

ment (L3). In this stage could be observed enlargement of abdomen. There are no other specific signs of infestation. The unspecific signs of disease in fish, are anemia, debility, and decreased vitality, and reproductive performance.

If fish with the live parasites, which are in the last larval stage (L4) instead of the final host- birds are consumed by man- paratenic host, parasite will migrate into the interior of the human body. The first symptom of infestation with Eustrongylus larvae, is the rapid development of gastritis and inflammation in the digestive organs. [14] Further migration through the peritoneal cavity, causing strong abdominal pain, which may be accompanied by vomiting, it could be described as pain characteristic for appendicitis. If the parasite reaches the urinary tract, it will cause haematuria and piuria. [19] [4] Tissue surrounding the parasite creates eosinophilic reaction, and the microorganisms that are found in the larvae (Proteus, Escherichia) developed a secondary infection.

Parasites after moving out of digestive system of host, does not react on anthelmintics, and only form of therapy is surgical removal of the larvae.

Philometra sp. do not cause the disease in humans.

Influence of the appearance of parasites in fish production

This type of parasite rarely occurs in fish pond, and there are several reasons: The regular disinfection of ponds; feeding of fishes in the form of pelets, which substitute natural food. The most important reason is the presence of regular control of birds, and their removal from the production facilities. More serious situation is in commercial fishing, because the fish is caught directly from open water, so the more frequent occurrence of infected fish.

Recommendation

Symptoms of human infestation with “big red worm”, larvae are very alarming, but they are also very rare. The reason of rear human infestation is that the parasite is visible and reduces consumption to minimum. Another reason is the extreme parasite sensitivity to temperature movements. In the literature there are sporadic cases of infection in humans (5 - U.S. [10], 1 - U.S., [1], 2-[17] USA) and in all cases is reported consumption of raw fish.

Reducing the level of infestation in fish, human population will lose the contact with this type of parasite. Recommendation is to disrupt nematode development cycle, with removal of the final host- fish-eating birds, or their intermediate host- oligochaete [21, 17]

As in Serbia, Hunting Law [22] prohibits hunting throughout the year, or a part of year in the great cormorant, northern grebes, herons, storks, swans, a small white-fronted goose, cranes, snipe, grebes, geese, wild ducks- removal of the final host of parasitic nematodes can be a problem.

Another solution is the removal of the oligochaetes, what is relatively easy if producers observe regular disinfection of pond bottom [21], but this would not be the solution for fishes from commercial catch. The only permanent solution for this problem is bringing the ecosystem to stage like before the expansion of the parasites, with reduction of organic and thermal pollution of water.

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