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Prevalence, intensity and gonadosomatic index of a nematode (*Philometra* sp.) infested in ovaries of *Otolithes ruber* from Southeast coast of India

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ABSTRACT

Objective: To carry out the prevalence, intensity, gonadosomatic index (GSI) of a nematode (*Philometra* sp.) infested ovaries of *Otolithes ruber* (*O. ruber*).

Methods: The specimen was encountered from January to December (seasons from post monsoon to monsoon), 2012. The *Philometra* nematode species are collected from a female specimen in the ovary of *O. ruber* and the worms were described. The ovaries were dissected and examined the prevalence intensity and GSI of nematode infection for each fish.

Results: The present study showed the result of the nematode body length of gravid female (294.70 ± 2.99) mm and (147.50 ± 4.11) mm in maximum width. The percent of overall prevalence is 28.66% ± 10.17% and intensity of 1–3 nematodes per fish. That may prevent proper development of oocytes and probably affect *O. ruber* fecundity. Because the average GSI was 2.04 per fish, the number of ova per gram body weight of fish was found as (158.00 ± 3.90) ova/g and the number of ova per cm of length of body was found to be (55 795.0 ± 149.4) ova/cm.

Conclusions: Philometrids parasitizing in the gonads of their hosts may cause serious damage to these ovaries by lapping blood, which leads to the atrophy of developing ova in the ovary, the fibrosis of ovarian tissue, and results in granulocytes and bleeds, thus negatively affecting the reproduction of *O. ruber*.

1. Introduction

Fish constitutes to be a major component of diet for the people of Southeast India, particularly in Tamil Nadu. Fishing is the mainly economic important for the people residing in Nagapattinam. The tiger toothed croaker [*Otolithes ruber* (*O. ruber*)] is a demersal fish living both in the bottom and on the surface of the water and obtains its food from the bottom, column and surface of the water[1]. Food of *O. ruber* generally consists of crustaceans such as shrimp and other invertebrates. The zoo penthouse has been suggested as the permanent food of juvenile and adult *O. ruber* in Alzobair creek[2]. The *O. ruber* diet composition in Khuzestan coastal waters consists of smaller fish such as the family of Mugilidae, the category of Engraulidae and shrimp as secondary food[3]. *Eleutheronema tetradactylum*

(Polynemidae) and *Johnius coitor* (Sciaenidae) fishes were infected with *Philometra rajani* in Indian Ocean[4]. Gonad-infecting species of *Philometra Costa* (Philometridae, Dracunculoidea) are widely distributed in marine fishes of the Indian, Atlantic and Pacific Oceans, sometimes also occurring in brackish–water environments[5]. In the Indian Ocean Region, a total of five nominal, gonad-infecting species of *Philometra* have been reported from a variety of marine fishes belonging to different families *Philometra pellucid*, *Philometra lateolabracis*, *Philometra rajani*, *Philometra cephalus* and *Philometra neolateolabracis*. In addition, several gonad-infecting philometrids from this same region have been reported only as *Philometra* sp[5]. The number of eggs contained in ovary of a fish is termed as fecundity. The term fecundity denotes the egg laying capacity of a fish or it refers to the number of ripe eggs produced by a fish in one spawning season. Knowledge about fecundity of a fish is essential for evaluating the commercial potentialities of its stock, life history, practical culture and actual management of the fishery[6]. It has

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been reported that relative fecundity is the number of eggs per unit of weight which is commonly used as an index of fecundity^[7–12]. The fecundity of an individual female also varies according to many factors including age, size, types of species, food availability and season. Other host species have indicated that their presence can have a negative effect on fecundity^[13,14].

During the anthology of *O. ruber* ovaries for another study, the nematode *Philometra* sp. was detected in the ovaries of adult *O. ruber* in the previous studies of *Philometra* sp. The purpose of this study is to investigate the prevalence, intensity, gonadosomatic index (GSI) and effect of a nematode in the ovaries of the *O. ruber*.

2. Materials and methods

The fish were collected from Nagapattinam (10°45′36.25″ N and 79°50′59.54″ E) Southeast coast of India (Figure 1). The length, weight and gonad weight of each collected sample fish were measured for GSI of the female fishes, which were determined separately by the following method (Barber & Blake 2006). The ovaries were dissected and examined the nematode infection, prevalence and intensity of each fish. Then the nematodes were carefully removed and washed in a 0.6% saline solution and fixed in 70% ethanol. Representatively, the nematodes were cleaned with glycerin and fixed in a solution of 95% glacial acid and 5% formalin for identification via light microscopy examination. Drawings were done using camera lucida. Specimens used for all measurements were in mm. The relationship between fecundity and total length, standard length, body weight and gonad weight was calculated.

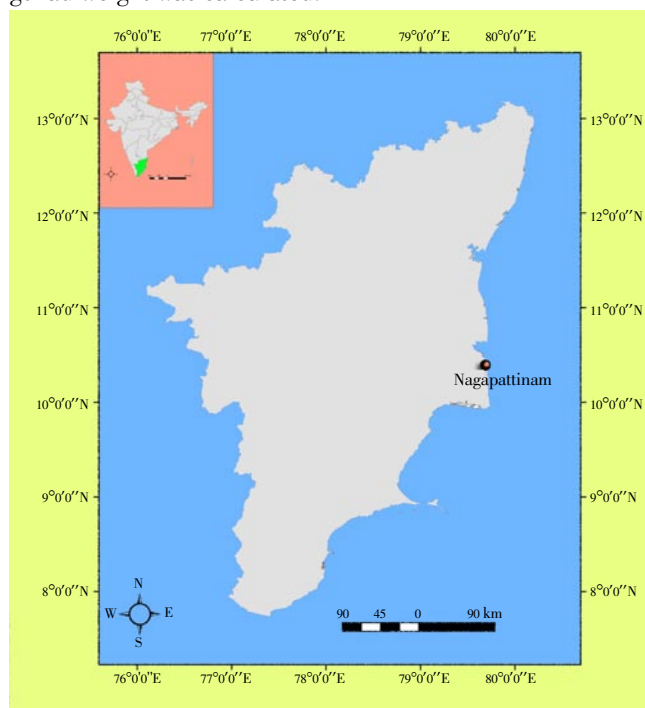


Figure 1. Map of sampling area.

3. Results

3.1. Location of worm

Philometra sp. (Philometridae) occurred in the gonads of female fish *O. ruber* (Aulopiformes: Sciaenidae) (Figure 2), ranging in size of 290–350 mm (fork length) in Nagapattinam Coast. The majority of gravid female's worms were found in the ovaries (Figure 3). Gravid female worms were visible microscopically and even visible before the initiation of ovary dissection. The maximum length of female worms was (294.70±2.99) mm and the maximum width of the female worm was (147.50±4.11) μm. Approximately, 25 juveniles were observed in the ovary of a female fish in 2012.



Figure 2. *O. ruber*.

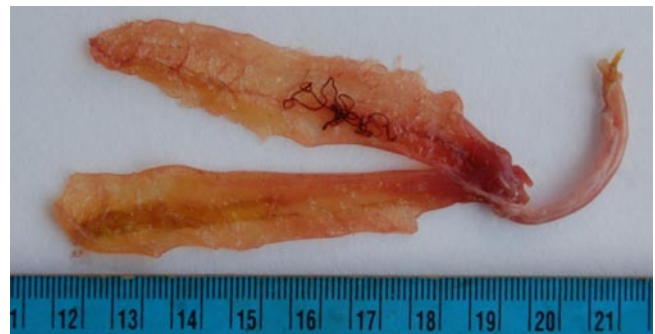


Figure 3. Ovary infected with nematode.

3.2. Description of the worm

Body of fixed specimen yellowish with distinct brown intestine, (294.70±2.99) mm long and (147.50±4.11) mm in width, markedly narrowed towards the anterior extremity; the maximum width/length ratio of body was 1:147; anterior part of body broader than a posterior part; width of cephalic end 204, that of caudal end 150. Cuticle smooth, cephalic end rounded, cephalic papillae small, almost indistinct in lateral view (Figures 4A and 4B and Figures 5A–5C). Oral aperture circular, large, surrounded by 14 cephalic papillae arranged in two circles. An external circle formed by four pairs of sub median papillae; papillae of each pair relatively far from each other, consisting of one circular and one more elongate papilla. An internal circle formed by four sub median single papillae and one pair of minute single lateral papillae. Lateral amphids outlined. Oral aperture followed by spacious buccal cavity formed by the internal surface of anterior esophageal inflation, bearing many conspicuous transverse lamella like structures (Figure 4C). Esophagus muscular,

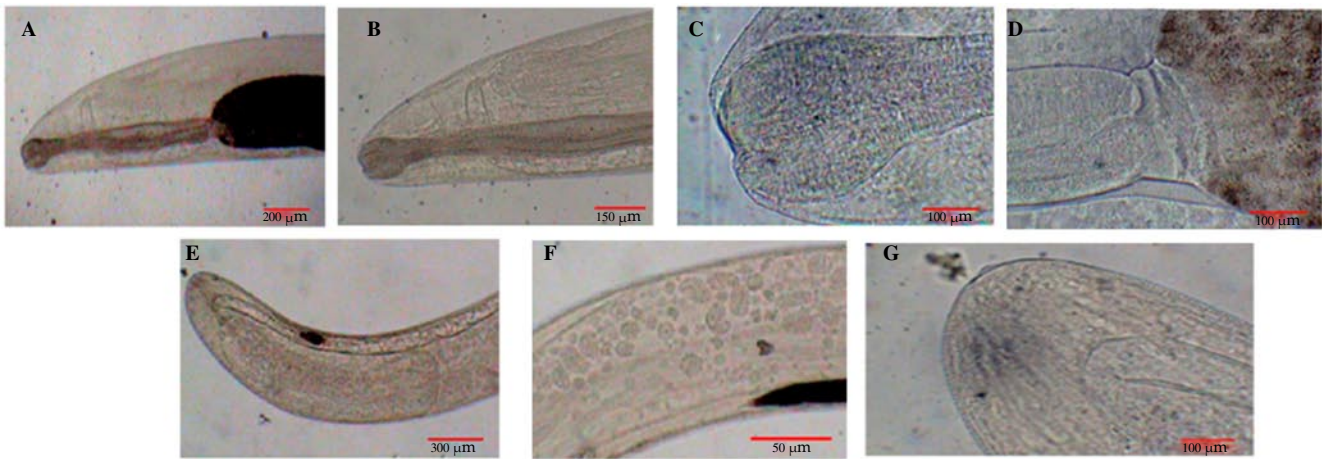


Figure 4. Description of the worm.

inflated at anterior end to form a distinct bulb, 933 long, comprising 0.5% of body length (Figure 4A). Oesophageal bulb was 120 long and 153 wide, with spacious lumen. Greater, posterior part of oesophagus slightly expanded, maximum width of oesophagus including oesophageal gland 150. Latter not well demarcated, extending from posterior end of esophagus to the level of nerve ring; its poorly visible nucleus at 571 from the anterior end of the body. Small ventriculus 41 long and 68 wide, open into intestine through valve (Figure 4A). Nerve ring encircling oesophagus 245 from anterior extremity (Figure 4A).

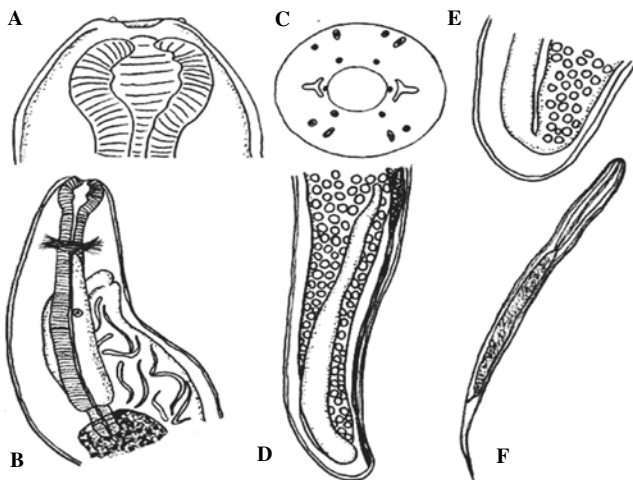


Figure 5. *Philometra* spp. gravid female.

A and C: cephalic end (lateral and apical views); B: anterior end of body (lateral view); D and E: posterior end of body (lateral view); F: larva from uterus (lateral view).

Intestine brown, straight, ending blindly; anterior end of intestine relatively narrow; posterior end of intestine atrophied, forming ligament 1.27 long attached ventrally to body wall close to posterior extremity (Figures 4D and 4E). Ovaries short, reflexed, situated near anterior and posterior body ends (Figures 4A and 4E). Uterus occupying major part of body, filled with numerous larvae and eggs (Figure 4F and Figure 5F). Larvae 426–459 long, maximum width 15–18; oesophagus 129–141 long (28%–32% of body length), length of tail 96–111 (23%–24%); cuticle of larvae densely transversely

striated, their cephalic end provided with large oral aperture surrounded by four sub median cephalic papillae, pair of large lateral amphids and conspicuous dorsal tooth (Figure 4C). Posterior end of body of gravid female rounded, without any caudal projections (Figure 4G and Figures 5D and 5E).

3.3. Prevalence and intensity

In Nagapattinam, the prevalence of nematode infection was 19.6% in January, 28.8% in February and 22.2% in March of the post monsoon season of the year. The post monsoon season was 23.1% prevalence which will be reached this season. Prevalence of live worms in April was 18.1%, in May 26.6% and in June 16.6%. The summer season was 18.5% prevalence which will be reached this season. Prevalence of live nematodes was 38.5% in July, 46% in August and 24% in September. The pre monsoon season was 36% prevalence which will be reached this season. Prevalence of nematode infection was 32% in October, 25.6% in November and 46% in December. The monsoon season was 26.6% prevalence which will be reached this season. In the middle of premonsoon August, 46% of *O. ruber* examined was infected with live *Philometra* sp., whereas in monsoon season in December the highest percentage of fish sampled that were infected was 46%. Whereas in August and December, the prevalence was highest at the other month. The overall prevalence was 28.66%±10.17% in the year. The seasonally prevalence was the lowest percentage in summer and also the highest percentage was in premonsoon season (Figures 6 and 7).

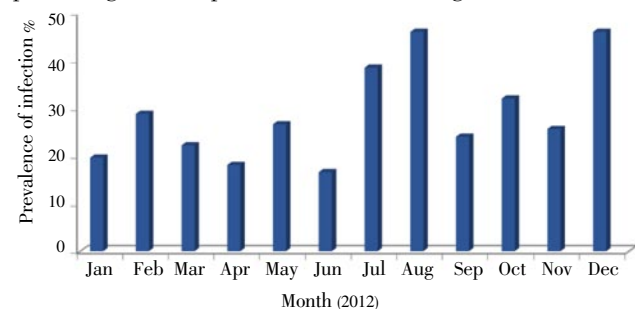


Figure 6. Monthly prevalence of infected fish.

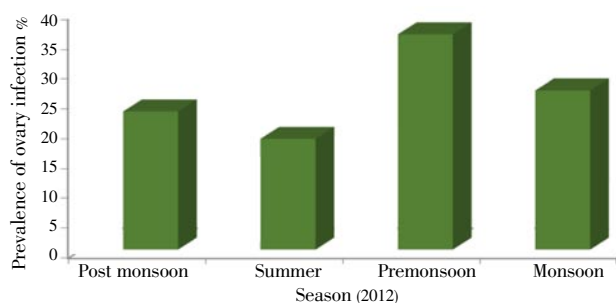


Figure 7. Seasonal prevalence of infected fish.

3.4. Fecundity

The ovaries of *O. ruber* fecundity varied from 12000 to 130450 based on 30 ovaries of fishes ranging in total length from (149.40 ± 34.99) mm and weight (15.80 ± 3.90) g. Mean GSI increased gradually from January and reached to peak in June and then decreased in December, 2012. The total fecundity of this fish ranged from 12000 to 130450 ova with an average of (55795 ± 51926) ova per fish. It is quite clear that female fish with greater weight had higher fecundity. The number of ova per gram body weight of fish was found as (158.00 ± 3.90) ova/g and the number of ova per cm of length of body was found to be (55795.0 ± 149.4) ova/cm (Figure 8).

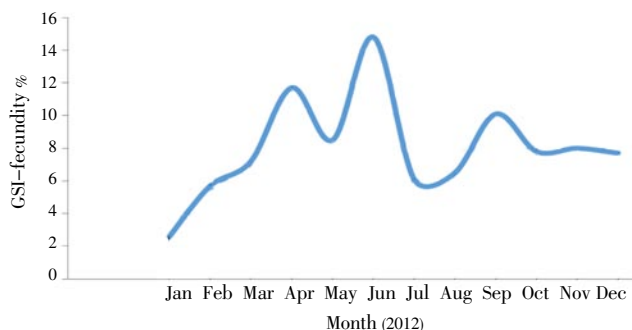


Figure 8. GSI of infected ovary.

4. Discussion

Tiger-toothed croaker (*O. ruber*) contributes to an important demersal fishery along the Indian Coast. Though they are caught by most of the indigenous units all along the coast, their landings are mainly by the trawlers. *O. ruber* along the Southeast coast of India appear to be heavily infected with the ovarian nematode *Philometra* sp. Although several reports provided descriptions of various *Philometrid* spp., very few provided information about the prevalence, intensity, GSI or effect of these nematodes. Results of this study show that the frequentative of *O. ruber* are reduced in the presence of *Philometra* spp. infection and the effect increases parasitic intensity. Intensity and prevalence of *Philometra* sp. cycle seasonally and appear to be

synchronous with the *O. ruber* fish spawning cycle. The life cycle of *Philometra* spp. is unknown and, for that reason, it is not clear whether initial infection coincides with the spawning season or if nematodes are acquired at an earlier time and reside in some other intermediate host tissue site earlier than migrating to the ovaries during the spawning season, perhaps they will be stimulated by hormonal cues from the host. Prevalence and intensity were much lower during the spring spawning season in Nagapattinam Coast. It is difficult to control whether this was due to geographical changes or the limited sampling that month. It is possible that we skipped the peak spawning period in 2012. The rapid decline in both prevalence and intensity after the summer spawning period indicates that *Philometra* sp. is released or migrated out of the host fish synchronously with the release of fish eggs. Fecundity in *O. ruber* from Nagapattinam, Southeast India correlated highly with length and weight, but not with age. Oocytes counts range from the total fecundity of this fish ranged from 12000 to 130450 ova with an average of (55795 ± 51926) ova per fish. It is quite clear that female fish with greater weight had higher fecundity. The number of ova per gram body weight of fish was found as (158.00 ± 3.90) ova/g and the number of ova per cm of length of body was found to be (55795 ± 149.4) ova/cm in the year of 2012 for fish ranging in total length ovary from (149.40 ± 34.99) mm and weight (15.80 ± 3.90) g. Gonadal development was studied by using the gonado somatic index of fishes[15]. A previous study has reported that the recorded *Philometra* sp. were from *Otolithes argentous* and from his account it appears to be the same species as described[16]. From Japan, it was recorded that philometrids were from the Sciaenidae fish *Sciaenas schegeli*[17]. The host specificity of the parasite is evident as it occurs chiefly in *Pennahia aneus* though rarely in other fishes of the same family such as *Johnius belengerii* and *Nibea maculata* of the same locality[16]. Similarly in hake, *Merluccius gayi* from Chile, the infection by nematode larvae was higher in females than in males[18], whereas statically no significant difference in parasitic infection of male and female fish, *Cyprinus carpio* was found from Turkey[19]. Similar observation has been made before in *Labeo calbasu*[11]. Other studies have been reported *Philometra genypteri* in *Genypterus chilensis* having 11% of infection and 1–99 (mean 11) intensity were recorded and *Philometra* sp. in *Johnius belengerii* ruber having 48% of infection and 8 intensity were recorded[20]. Moravec and Justine also reported that the prevalence and intensity of *Philometra brevicollis* in *Lutjanus vitta* was three fish infected in four fish examined; and 2–22 (mean 14) specimens per fish[21]. Recently, prevalence and intensity of *Philometra brevispicula* in *Lutjanus griseus* was 25% (four fish infected in 16 fish examined); and 1–10 specimens per fish and also the prevalence of *Caranx hippos* having *Philometroides grandipapillatus* was 14.2% infection[22].

The present documents recommend that *Philometra* sp. is widely spread parasites of marine Aulopiformes fishes in the Southeast coast of India. Philometrids parasitizing in the gonads of their hosts may cause serious damage to these ovaries by sucking blood, atrophy of developing ova, fibrosis, increased granulocytes and hemorrhages, thus negatively affecting the reproduction of *O. ruber*.

Conflict of interest statement

We declare that we have no conflict of interest.

Acknowledgements

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