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Petchimuthu M
Department of Fish Pathology and Health Management, Fisheries College and Research Institute, Thoothukudi, Tamil Nadu, India

M Rosalind George
Department of Fish Pathology and Health Management, Fisheries College and Research Institute, Thoothukudi, Tamil Nadu, India

K Riji John
Department of Fish Pathology and Health Management, Fisheries College and Research Institute, Thoothukudi, Tamil Nadu, India

D Kaviarasu
Department of Fish Pathology and Health Management, Fisheries College and Research Institute, Thoothukudi, Tamil Nadu, India

R Dinesh
Department of Fish Pathology and Health Management, Fisheries College and Research Institute, Thoothukudi, Tamil Nadu, India

Correspondence
M Rosalind George
Department of Fish Pathology and Health Management, Fisheries College and Research Institute, Thoothukudi, Tamil Nadu, India

Occurrence of parasites in aquaculture systems of South Tamil Nadu

Petchimuthu M, M Rosalind George, K Riji John, D Kaviarasu and R Dinesh

Abstract
A survey was conducted to investigate the prevalence and abundance of parasite infestation of cultured finfish in different fish farms of South Tamil Nadu region during August, 2015 to May, 2016. A total of 215 fishes were first examined for ectoparasites using wet mount under a light microscope. Parasite infestation was present mainly on the gills, skin mucus, pectoral fin, pelvic fin, anal fin and caudal fin of cultured fin fish in the present investigation. Parasitic infestations were harmful and limiting factors in breeding and rearing of ornamental and food fish industry. The most commonly encountered parasites were *Argulus* sp., *Lernaea* sp., *Dactylogyrus* sp., *Ichthyophthirus* sp., *Caligus* sp., *Capsalid* sp. The highest parasite prevalence (34.28%) was observed in the month of May, March and September but lowest (0%) was found in month of August, November and February. The caudal, pectoral, pelvic fins and gills were the favourite target of the parasites. In the current study area, total parasitic infection of food and ornamental fishes were found with a prevalence of 21.86% and abundance of 1.60. The current study also revealed that the monogenean infections are very common among ornamental fishes.

Keywords: Fish, parasites, prevalence, abundance, Tamil Nadu

1. Introduction
Fish is a primary source of food particularly rich in high quality of proteins followed by lipids, vitamins and minerals. Also, freshwater ornamental fish culture is a popular hobby all over the world. Ornamental fish trade is a multimillion dollar industry which is of freshwater origin and farm-raised. With the increase in demand for fish the practice of aquaculture has been intensified. Consequently, aquaculture has been facing various hazards with virus, bacteria, fungi and parasites [1].

Parasitic infection and diseases are some of the factors hindering the productivity in aquaculture affecting both food fishes and ornamental fishes. These parasites cause mortality in cultured fin fishes resulting in economic loss to the farmers [2]. Seasonal environmental changes of water quality such as temperature, pH, water depth and stocking density affect the incidence of parasites in fishes [3]. Improper water aeration would affect feed-remnants and faecal deposits at the bottom of pond and become a suitable medium for parasite growth [4]. Fish parasites can inflict a different variety of damages such as irritation, wound, injury or atrophy of tissues and occlusion of the alimentary canal and blood vessels [5].

Fish lice (*Argulus* sp.) are obligate ectoparasites, and contrary to most aquatic parasites, they retain the ability to swim freely throughout the whole of their life. The morphology of *Argulus* sp. including their sensory organs is suitable for both parasitism and free-swimming [6]. *Lernaea* sp. (anchor worm) is another important ectoparasite found to affect the freshwater fishes of the world [7]. Anchor worm infection in fish leads to weight loss, growth retardation, alterations in blood and behaviour of fish [8]. *Ichthyophthirus multifilis* infection is otherwise called as white spot disease or Ich. This infection typically develops small blisters along the body and fins. Matured parasite size ranges up to 1000 µm in diameter and is dark in color due to the thick cilia covering the entire cell, and moves in an amoeboid motion [9]. Monogenea (flukes) is a group of parasites commonly found on the gills (*Dactylogyrus* sp.), skin or fins (*Gyrodactylus* sp.) of fishes [10]. Most monogeneans are browsers, moving about the body surface and feeding on dermal (skin) mucus and gill debris. Caligid parasites (sea lice), especially those living in marine water, live as parasites on the external surface of fish host causing serious harm to host fishes by feeding on the epidermal tissue, blood, and mucus of fishes [11, 12]. Capsalid monogenean parasites are found on the fish skin, scales and eye, which can move actively on the body surface feeding on epithelial cells and mucus.

The most common fish parasitic diseases, particularly in freshwater aquaria and food fishes include gill flukes, skin fluke, velvet disease, white spot disease, fish lice, *Costia* and *Chilodonella* [13]. The paper deals with the prevalence and abundance of parasites of ornamental aquarium and food fishes.

2. Materials and Methods

2.1 Sample collection

Fishes were collected randomly from different fish farms in south Tamil Nadu during a period of 10 months from August, 2015 to May, 2016. Collected fish samples were kept in polythene bags filled with pond water to sustain the fish prior to laboratory analyses. The weight and total length of the fishes and date and site of collection of host specimens were recorded. The fishes were brought either alive or fresh to the research laboratory, Department of Fish Pathology and Health Management, Fisheries College and Research Institute, Thoothukudi.

2.2 Wet mounts preparation: Mucus and Gills

Skin samples were taken from different spots including lesions. The skin mucus from the dorsal fin, pectoral fin, pelvic fin, anal fin and caudal peduncle of the fish were scraped using cover glass. Mucus was then placed on a glass slide with a drop of distilled water and examined under the light microscope (Leica DM2500) for observing the presence ectoparasites in the mucus. In case of gills the operculum was removed by dissection with the use of scissors to expose the gills. A small piece of gill spread on a clean glass slide to which a drop of distilled water was added. Glass slide with a piece of gill was covered with a cover slip and examined under the light microscope at magnification of 40 X for observation of monogenean parasites.

2.3 Identification and preservation of parasites

Parasites were placed under the light microscope and identified following the description and figures of Dash [14] and Stopskopf [15]. Parasites were magnified 40×, 100× by the help of a light microscope and parasites were identified. Identified parasites were carefully preserved in 10% formalin acetic acid alcohol solution for long time storage.

2.4 Statistical analysis of data

Statistical analysis of the data on occurrence of parasites from the fishes was carried out using the following formulae [16].

Prevalence (%) = Number of infected hosts/ Number of hosts examined X 100

Abundance = Number of parasites recovered/ Number of hosts examined

3. Results and Discussion

During the present study, a total of 215 specimens of food fishes and ornamental fishes (*Pterophyllum scalare, Cyprinus carpio, Iodotropheus sprengerae, Aulonocara nyassae, Nimbochromis venustus, Carassius auratus, Poecilia sphenops, Balantiocheilos melanopterus, Aulonocara maulana, Sciaenochromis fryei, Anomalochromis thomasi, Betta splendens, Aulonocara* sp, *Poecilia reticulate, Galeocerdo cuvier, Paraneetroplus synspilus, Trichopodus trichopterus, Catla catla, Labeo rohita* (Jayanthi rohu), *Rachycentron canadum* and *Oreochromis niloticus* were examined to investigate the prevalence and abundance of parasitic infections. A total of six ectoparasite species were identified from the food and ornamental fishes during the study period. The parasites isolated from investigated host fishes were *Argulus* sp., *Lernaea* sp., *Ichthyophthirus* sp., *Dactylogyrus* sp., *Caligus* sp., and C*apsalid* sp.

3.1 Month wise parasite infestation in the cultured finfish

The overall prevalence and abundance of the total parasites are shown in Table 1 and Fig 1. The prevalence of parasites was ranging from 9.30% to 34.28% during the study period. The highest parasite prevalence (34.28%), (33.92%) and (33.33%) was observed in the month of May, March and September respectively, but lowest (0) were found in month of August, November and February. The abundance of parasites were also recorded highest (5.74), (4) in May and December but lowest (0) in month of August, November and February. Allumma and Idowu [17] reported that parasitic infection was found higher in May - June when in compared to other months of study. Many other researchers such as Akhtere *et al.*, [18] Banu *et al.* [19] and Chandra *et al.* [20] have also found similar observations and heavy infections in the particular month of the year.

3.2 Prevalence and abundance of cultured finfish in different length groups

Present study revealed that the infections are size dependent. An attempt was made in the present study to find out the relationship between length of the fish and the percentage of infected fishes. The fishes belonging to different size in different length classes are given Table 2 and Fig 2. It is revealed that lengthy fishes are more susceptible to infections in comparison with small fish i.e. larger fishes were heavily parasitized than smaller ones. The highest prevalence value (23.71%) was found in length groups above 10 cm and lowest prevalence value (14.28%) was found in 3-5cm length groups. The highest abundance value (3.32) was found in 5-10cm length groups but lowest (0.35) was bound in 3-5cm length groups. The present findings agree with those of Bhuiyn *et al.* [21] who described highest prevalence of parasite (88.00%) was recorded from medium length group (18.28%) and the lowest (71.43%) from smaller length group (<18cm). Highest abundance value was recorded from medium length group (34.00) but lowest abundance value from larger length group (31.80). Farhaduzzaman *et al.* [22] reported the highest prevalence of total parasites found as 75% in the length group (160-180mm) and lowest as 33.34% in the length group (80-100mm). The highest abundance value of total parasites found as 1.56 in the length group (80-100mm) and lowest as 3.52 in the length group (100-120 mm).

3.3 Prevalence and abundance of each parasite species during the study period

The analysis for finding the prevalence and abundance were carried out (Table 3 and Fig 3). Among the different fish parasites recorded, *Dactylogyrus* sp. had the highest prevalence 7.44% while *Argulus* sp. *and Lernaea* sp. had prevalence value of 6.97% and 6.04% respectively. All the three species of parasites, *Ichthyophthirius multifiliis*, *Caligus* sp. and *Capsalid* sp. had lowest prevalence value 0.46%, as they were recorded only from one farm each. The highest abundance value (0.97) was recorded for *Dactylogyrus* sp. *Argulus* sp., *Lernaea* sp. and *Caligus* sp. had abundance value for 0.33, 0.24 and 0.03 respectively. The parasites *Ichthyophthirus multifiliis* and *Capsalid* sp. had the lowest abundance value for 0.004 and 0.004 respectively. *Argulus* sp., *Lernaea* sp., Ich and gill fluke were found in ornamental and food fishes. *Caligus* sp. and *Capsalid* sp. infested in

marine net cage cobia fishes. Stocking density, water depth, temperature along with other physico-chemical parameters lead to stressful conditions for fish and they become susceptible to parasitic infection. Adel *et al.* [23] recorded that *I. multifiliis* had the highest infection rate in *C. auratus*. The highest prevalence of *Gyrodactylidae* and *Dactylogyridae* were observed in *C. Auratus* and the lowest in *P. scalare* and *S. discus*, respectively. Post [24] found *Dactylogyrus extensus* which is also known as gill fluke as a common parasite on gills of fishes, feed on dermal and gill debris. The damage caused by *Dactylogyrus* to gill epithelium made opening for secondary bacterial, fungal, protozoan infection on gill surface. Heavy infection result trauma and injuries on gill surface, lamellar hyperplasia, excessive mucus production.

Table 1: Prevalence and abundance in the cultured finfishes from August 2015 to May 2016

Month	No of host examined	No of host infected	Prevalence (%)	Abundance
August	10	-	-	-
September	12	4	33.33	0.75
October	14	4	28.57	0.85
November	11	-	-	-
December	12	3	25	4
January	10	1	10	0.1
February	12	-	-	-
March	56	19	33.92	1.17
April	43	4	9.30	0.20
May	35	12	34.28	5.74

Table 2: Prevalence and abundance of parasitic infection of finfish in different length groups.

Length groups (cm)	No of hosts examined	No of host infected	Total no of parasites recorded	Prevalence (%)	Abundance
3- 5	42	6	15	14.28	0.35
5-10	76	18	253	23.68	3.32
Above 10	97	23	78	23.71	0.80

Table 3: Prevalence and abundance of parasitic infections in South Tamil Nadu

Parasites	No.of host examined	No.of host infected	No. of parasites recovered	Prevalence (%)	Abundance
Argulus sp.	215	15	73	6.97	0.33
Lernaea sp.	215	13	53	6.04	0.24
Ichthyophthirus multifiliis	215	1	1	0.46	0.004
Dactylogyrus sp.	215	16	210	7.44	0.97
Caligus sp.	215	1	8	0.46	0.03
Capsalid sp.	215	1	1	0.46	0.004

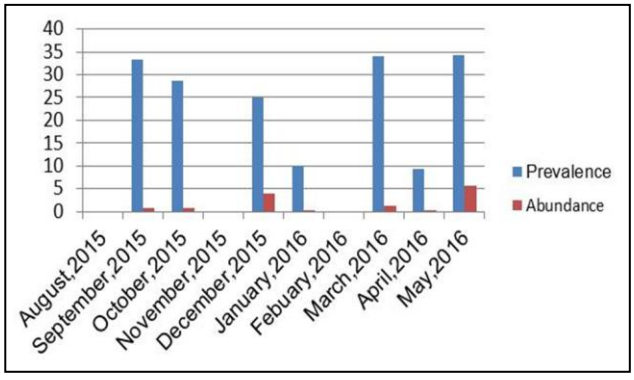

Fig 1: Monthly prevalence and abundance of parasites in cultured finfishes of South Tamil Nadu

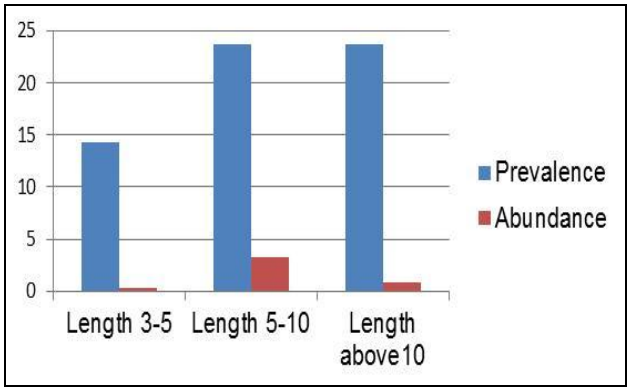

Fig 2: Prevalence and abundance of parasitic infection in length wise

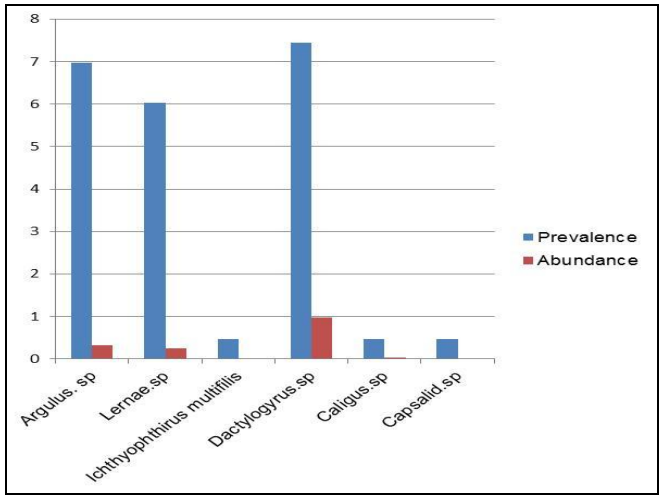

Fig 3: Prevalence and abundance of each parasite in cultured finfish

4. Conclusion

Parasite infestation is the greatest threat in fish culture system. Many fish species are affected by various types of parasite every year and as a result, production of fishes decreases significantly in South Tamil Nadu. Proper steps should be taken to prevent parasitic infection and to protect these important fish species from extinction. Therefore, management of these parasitic infections should be given top priority to save the aquaculture industry from this huge economic loss every year at farmer level.

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