Available online at www.worldnewsnaturalsciences.com

World News of Natural Sciences

An International Scientific Journal

WNOFNS 33 (2020) 1-19 EISSN 2543-5426

Prevalence and pathology manifestation of *Acanthocephalus ranae* infestation in finfishes of Tamil Nadu, southeast coast of India

Alagarsamy Sakthivel, Ayyaru Gopalakrishnan*

Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai – 608 502, Tamil Nadu, India

*E-mail address: aquagopal@gmail.com

ABSTRACT

The seasonal variations and pathological manifestation of the acanthocephala infestation were investigated from southeast coast of India. The adult worms' proboscis is cylindrical, the length and width ranging between 1.2-7.3 cm and 1.0-1.8 mm respectively. *Caranx ignobilis* was the major host in terms of prevalence and intensity among the other fish species examined for infestation and seasonal variation of *Acanthocephalus ranae* over three year period. The higher prevalence of infested fishes *Caranx ignobilis* (61.8% ±1.8), *Seriolina nigrofasciata* (48.6% ±1.3) and *Dayseiaena albida* (38.5% ±1.8) were observed. Mean intensities ranged between 5.8 and 12.6 worms per fish. Grossly, the parasites attached tissues were wounded, reddish, swollen, abraded and thickened. Histologically, the infested intestinal outer wall of the muscularies extema and tip of the proboscis is still inverted; Hyperplasia of the intestinal villi and lamina propria near the site of parasitic attachment were also evidenced. Cellular infiltrated area surrounding the proboscis, aggregation of lymphocytes and fibroblasts at the site of inflammation were observed from the parasitized intestine. The lesions were infiltrating with basophil-like inflammatory cells. The histological findings revealed that the pathological injure was depends on the density of the parasitic burden and depth of the proboscis penetration into the host intestine. Long live parasite increases the cellular infiltration and it may leads to the tumorous conditions of the infested hosts.

***Keywords*:** *Acanthocephalus ranae*, Finfish, Prevalence, Intensity, Pathology, *Caranx ignobilis*, *Seriolina nigrofasciata*, *Dayseiaena albida*

(Received 20 August 2020; Accepted 08 September 2020; Date of Publication 09 September 2020)

1. INTRODUCTION

Parasites infestation is a major threat in culture and capture fisheries [1]. The acanthocephalan infestations in marine fish were meagerly reported in India. Even though, Sakthivel et al has been reported the acanthocephala infestation in marine finfish from Tamil Nadu coastal waters in India, these acanthocephalan influences the health of their hosts either directly or indirectly making them less resistant to environmental stressors [2-5]. Some are capable of regulating host populations and influence community structure through their effects on different components and can decrease market value of their fish host [6].

The acanthocephalan parasite were attach to the hosts intestinal wall using their proboscis, which is causing extensive tissue damage and potential fatality in various hosts in globally. The infested fish intestines suffer irreversible mechanical damage due to the attachment of the acanthocephala proboscis affects the architecture of the intestinal tissues leading to pathological changes [7]. The harmful effects of many acanthocephala parasites on the digestive tract and associated the organs of different fish species were reported by many researcher. [8-10].

The ecological parameters prevalence, mean intensity and abundance were calculated to determine parasitic population [11]. Parasitic disease, either alone or in concomitant with other environmental stressors may influence weight or reproduction of the host, alter its population characteristics and affect its economic importance [12]. Therefore, the present study was aimed to evaluate the seasonal variation and histological manifestation of acanthocephalan infested fishes.

2. MATERIALS AND METHODS

2. 1. Sample collection

The present study was carried out for three years from January 2017 to December 2019. The host fish (*Caranx ignobilis, Seriolina nigrofasciata* and *Dayseiaena albide*) intestines randomly collected from the three different fish retail marker of Nagapattinam (10º 45' N and 79º 50' E), Pazhayar (11º 21' N and 79º 49' E) and Parangipettai (11º 30' N; 79º 46' "E) fish landing centre, Tamilnadu, southeast coast of India. The fish were caught by hook and line, trawler net and gillnets (mesh size 42 mm). The parasites were carefully removed from the host fishes using fine forceps and immediately stored in 70 % cold ethanol for further study. The site of the attachment and orientation of parasites on the host and the numbers of parasites in each fish were recorded. Further, the parasites morphology observed by stereo and scanning electron microscopy, the morphology was drawn with the help of Camera Lucida. The collected parasites were identified by the method of [13-16]. Parasite taxonomy was carried out as per World Register of Marine Species [17].

2. 2. Histopathology and histochemistry

The 12 (four individual per host) infected intestinal lesions were excised and preserved in 10 % neutral phosphate buffer formalin. The biopsies were dehydrated with graded series of ethanol, processed and embedded with paraffin wax. The thin section of 4 µm was incised with rotary microtome and stained with Harris Haematoxylin and Eosin [18]. Alcian blue staining method of Bancroft and Stevens followed [18]. The mast cells analysis was done with toluidine blue staining method of [19]. Lipid accumulation of the infected intestine was studied by Oil

Red O stain (Young and Heath 2002). The sections were treated with Azodye followed by [20] for detection of the activity of acid and alkaline phosphates. The stained sections observed under phase contrast microscope (20× magnification).

3. RESULTS

3. 1. Occurrence

The group of *Acanthocephalus ranae* embedded in host intestine and appear yellow to orange colour and maximum parasites observed in posterior region of the intestine (Fig. 1a and b). The cylindrical, sac like and slightly folded non-segmented intestinal worms measured from 1.2 cm to 7.3 cm in length and 0.050 – 0.72 g in weight. The proboscis penetrates through the fish intestine 0.5-0.9 mm deep. The total length and weight of the host fish varied upto 30 and 45 cm and weight ranged from 1.5 kg to 3 kg, respectively.

3. 1. Morphology

Based on 10 mature adult *A. ranae*, with characters of the species. All shared structures proportionally larger in females than in males. Proboscis, cylindrical ovoid, slightly broader than long; proboscis 12-20 longitudinal rows evenly curved hooks, in each row 4-6 hooks; longitudinal arrangement of the hooks in circular (Fig. 3a and 4a). Hooks in each row deferent in size and shape all rooted. Genital opening of female closed vaginal lips showed slightly curved slit-shaped opening.

Genital pore terminal and absent of genital spines. Reproductive system longer than broader 1.8 mm length, 605 unit width (Fig. 4c). The male *Acanthocephalus ranae* 2 bursal pockets, round and oval shape cement gland reservoir leading to 8 cement glands 270-620 (450) length, 130-315 (205) width. Bursa with sensory papillae, 425-650 (5154) length, 145-350 (290) width. Bursa at right side to the trunk. Reproductive system elongated post-equatorial, longer than broader 1.5 mm length, 665 width (Fig. 3d and 4d). The sensory pores observed from the proboscis anterior tip (Fig. 5 c).

3. 2. Prevalence and intensity

The prevalence and mean intensity of parasitic acanthocephala infestation were observed in three finishes (*Caranx ignobilis, Seriolina nigrofasciata* and *Dayseiaena albida*) landed at three different landing centers were given in Table 1, 2 and 3. Of, 21,698 individuals examined, 12,575 were infested with parasites, for an overall prevalence of 57.95% Station wise higher prevalence was recorded from Nagapattinam (61.8±1.8%) followed by Pazhayar (51.8±1.4 %) and Parangipettai (45.21±1.2%).

Maximum parasitic infestation 61.8±1.8 % was observed from Nagapattinam during post-monsoon 2017 where as minimum 10.6±1.3% was observed from Paragipettai during pre-monsoon 2015. The higher parasitic mean intensity (12.6±1.4%) observed in post-monsoon 2017 at Nagapattinam, whereas lower mean intensity 5.8±1.1 % recorded in summer 2015 at Parangipettai. The host wise higher prevalence and mean intensity was observed in *Caranx ignobilis* (61.8±1.8% and 12.6±1.4 %), followed by *Seriolina nigrofasciata* (48.6±1.3 % and 11.8±1.8 %) and *Dayseiaena albida* (38.5±1.8 % and 11.2±1.7 %).

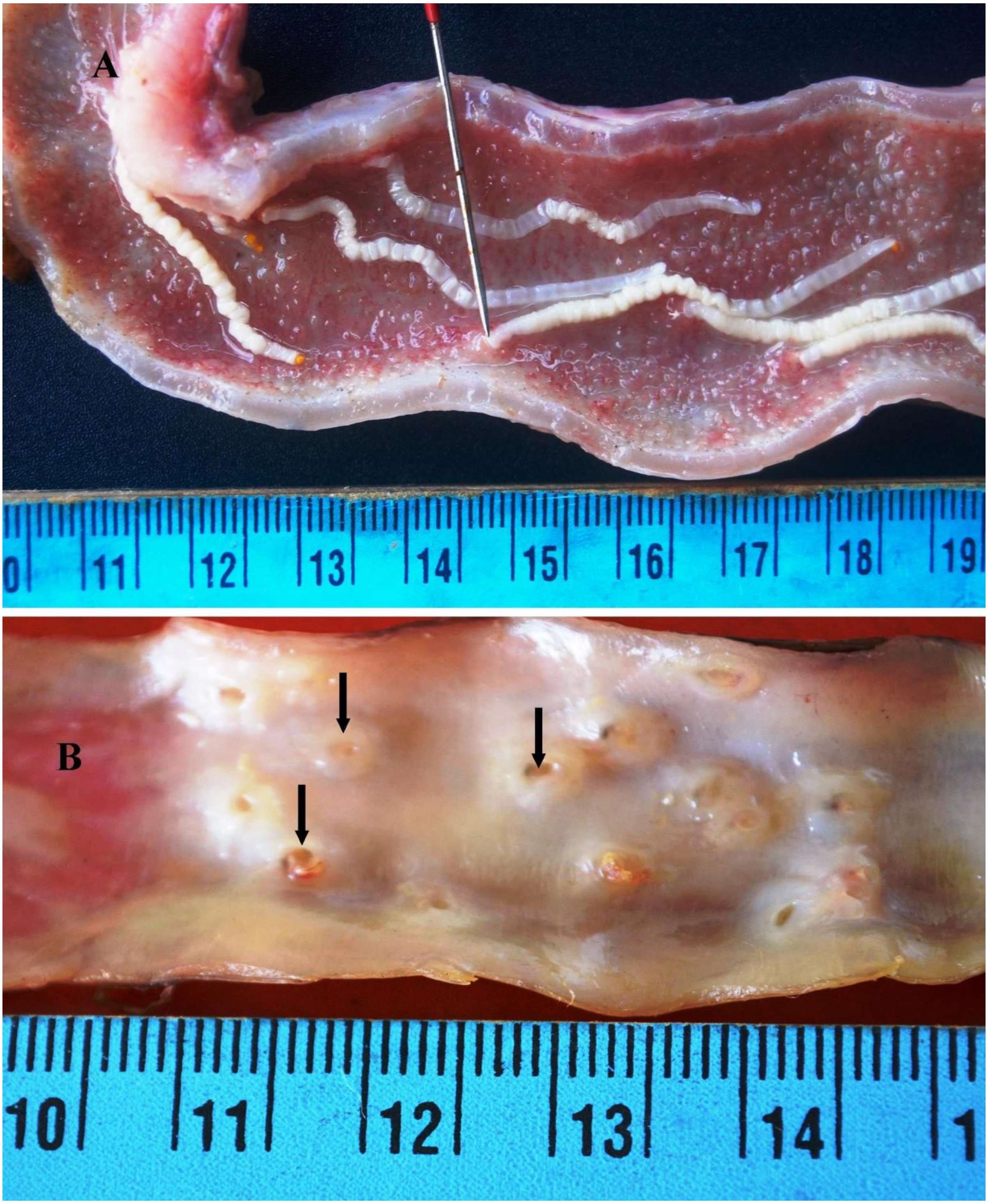

Fig. 1. *Caranx ignobilis* intestine infested with *Acanthocephalus ranae* **(A)**; Close-up view of the parasitic attachment sites (arrow) **(B)**.

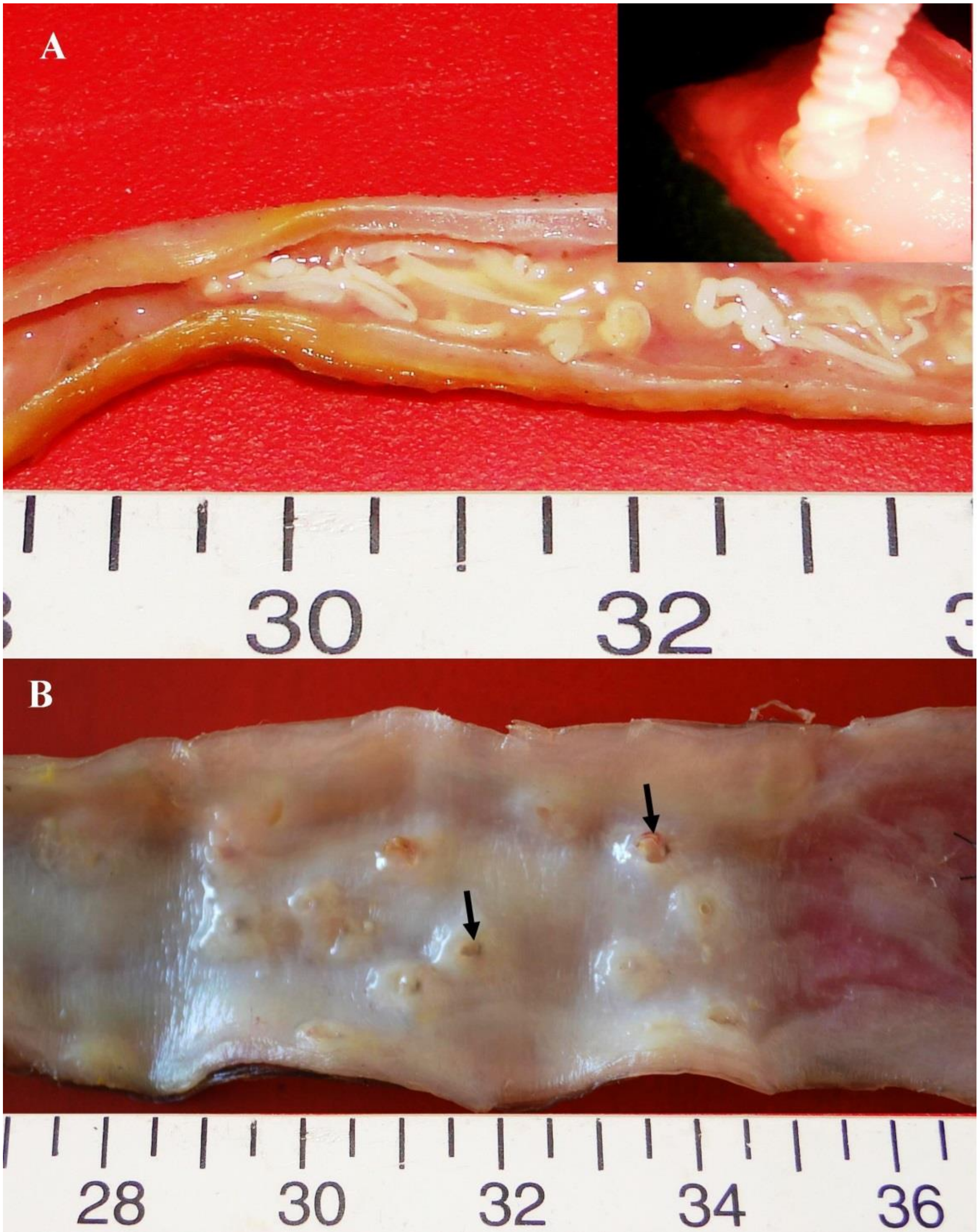

Fig. 2. *Thunnus albacares* intestine infested with *Acanthocephalus ranae* **(A)**; Swollen (arrow) at the site of the attachment **(B)**.

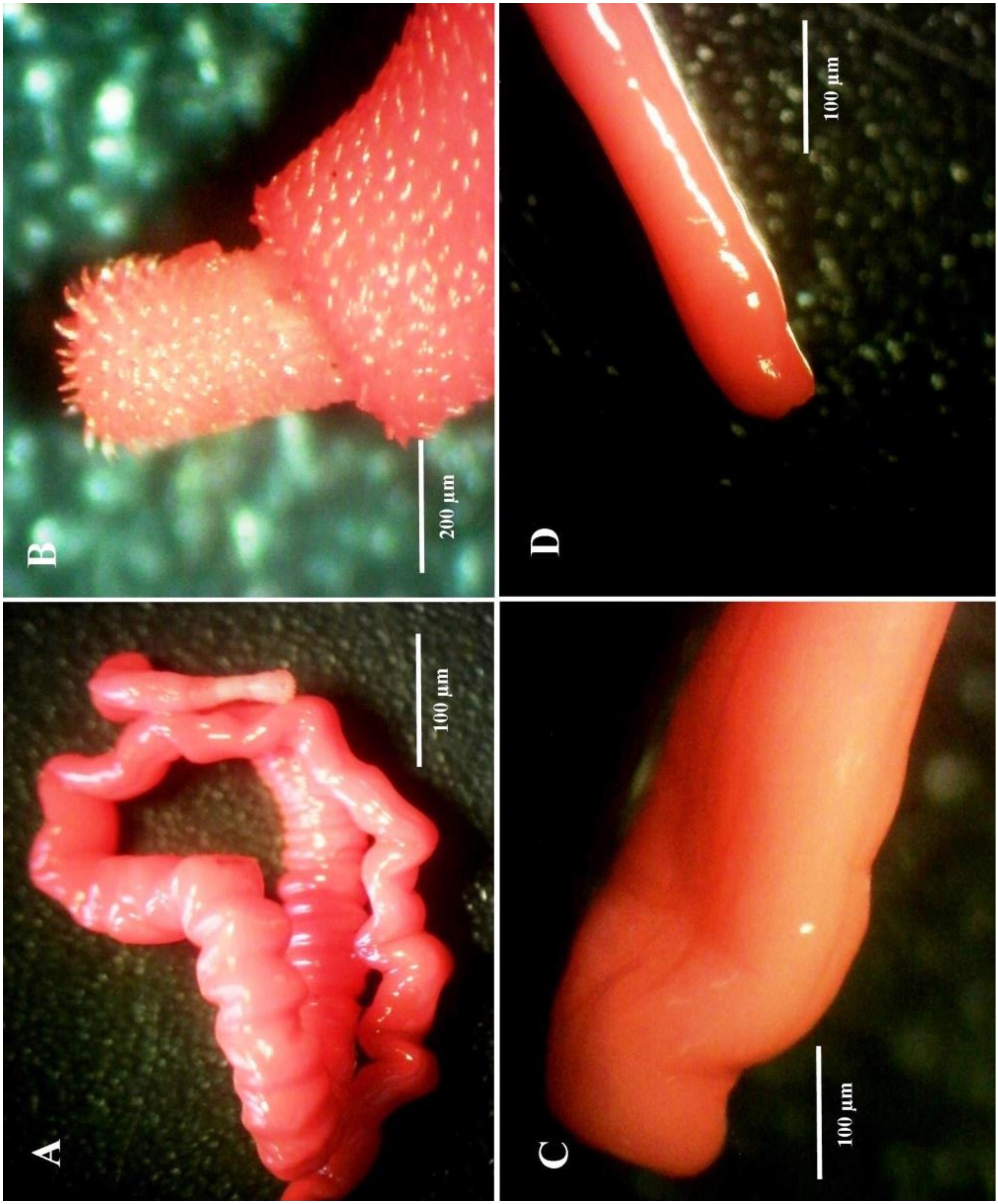

Fig. 3. Complete specimen of *Acanthocephalus ranae* **(A)**; Anterior end of proboscis **(B)**; Dorsoventral view of male reproductive system **(C)**; Dorsoventral view of female reproductive system **(D)**.

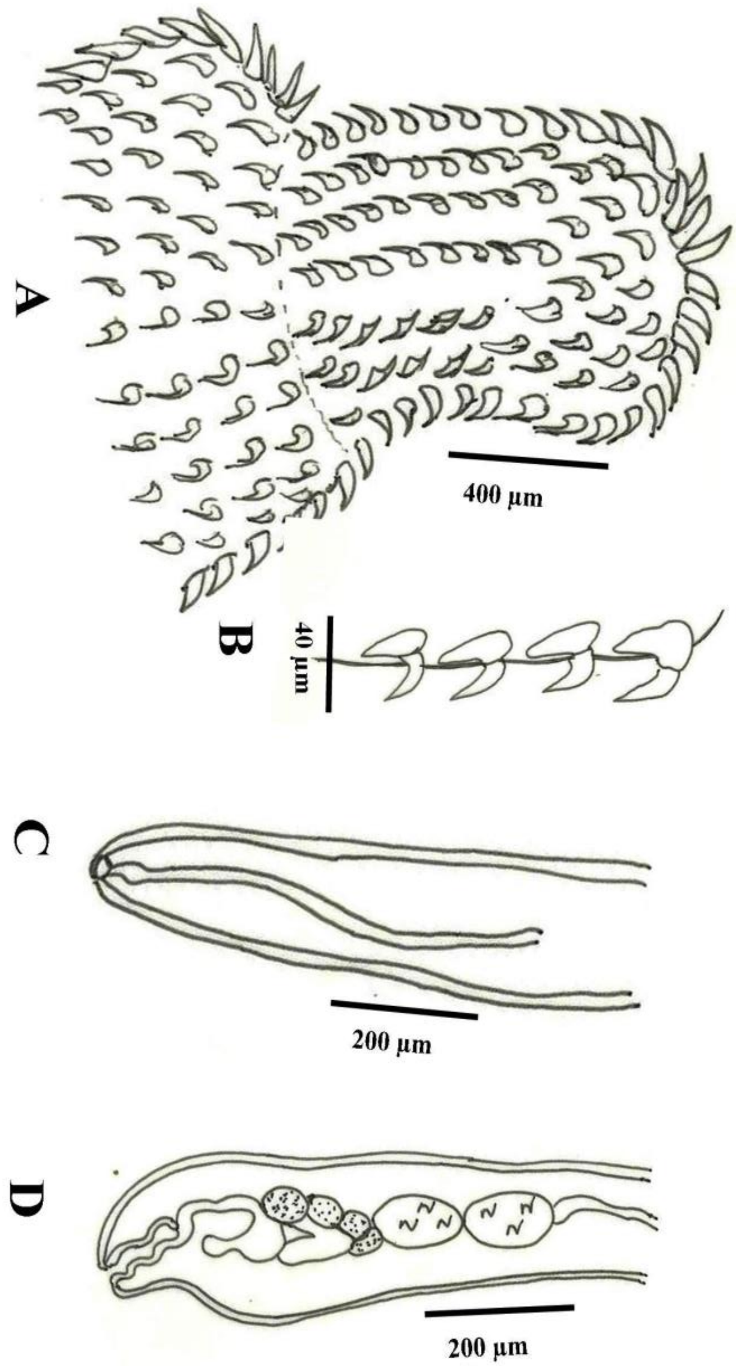

Fig. 4. Armature of proboscis with anterior end of *Acanthocephalus ranae* **(A)**; Detail of hook row showing roots **(B)**; Reproductive system and posterior end genital opening of a female **(C)**; Reproductive system and posterior end bursa of a male **(D)**.

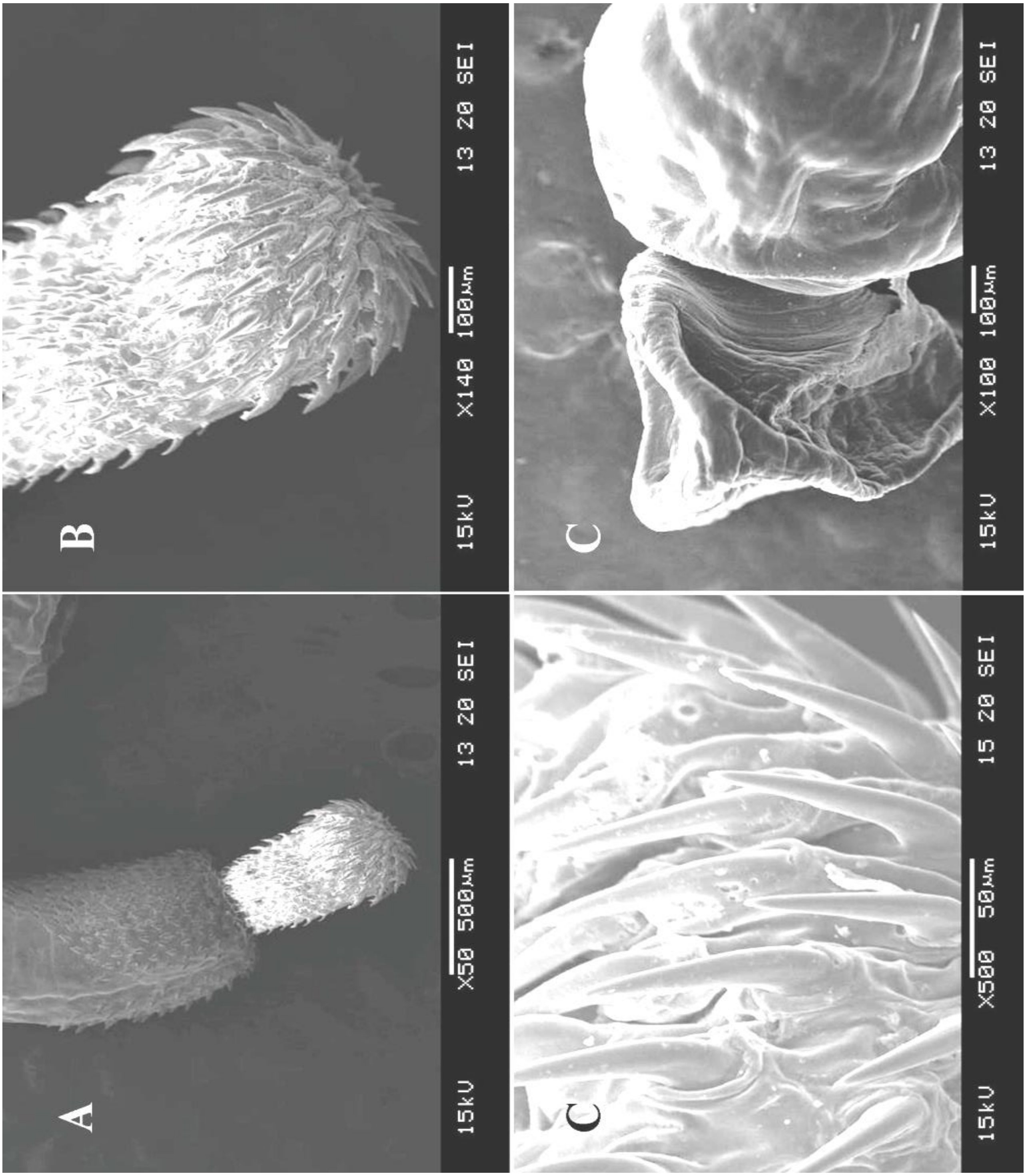

Fig. 5. The proboscis of a female worm cylindrical swollen **(A)**; The same proboscis in Figure 1 tipped to show the flat bare apical end **(B)**; Small posterior hooks, and sensory pit in proboscis **(C)**; Lateral view of a bursa at right angle to the trunk **(D)**.

Table 1. Seasonal variation of Acanthocephala infestations in *Caranx ignobilis* were landed at three locations in Tamil Nadu, southeast coast of India since 2017 to 2019. Seasons are based on calendar months (post-monsoon, Jan-Mar; summer, Apr-Jun; pre-monsoon, Jul-Sep; monsoon, Oct-Dec)

	Prevalence (%)								
	Parangipettai			Pazhayar			Nagapattinam		
Seasons	2017	2018	2019	2017	2018	2019	2017	2018	2019
Post-monsoon	36.8 ±1.8	41.6 ±1.7	45.2 ±1.2	38.3 ±1.8	46.7 ±1.1	51.8 ±1.4	43.7 ±1.6	52.7 ±1.3	61.8 ±1
Summer	14.6 ±1.6	21.3 ±1.5	24.7 ±1.4	16.7 ±1.2	23.8 ±1.4	25.2 ±1.7	21.4 ±1.3	24.8 ±1.5	27.2 ±1.4
Pre-monsoon	12.9 ±1.3	16.8 ±1.2	17.8 ±1.3	14.5 ±1.5	17.3 ±1.3	19.9 ±1.2	18.3 ±1.4	18.8 ±1.6	21.9 ±1.6
Monsoon	21.3 ±1.5	28.4 ±1.4	33.4 ±1.6	27.6 ±1.7	31.5 ±1.2	37.3 ±1.5	32.6 ±1.1	32.5 ±1.3	31.6 ±1.5
	Intensity (%)								
Post-monsoon	9.7 ±1.2	10.8 ±1.4	11.4 ±1.6	10.4 ±1.1	10.8 ±1.4	11.7 ±1.1	11.3 ±1.5	11.6 ±1.2	12.6 ±1.4
Summer	8.5 ±1.6	9.4 ±1.2	9.9 ±1.4	8.8 ±1.3	9.2 ±1.1	9.6 ±1.3	9.4 ±1.6	9.7 ±1.4	10.3 ±1.1
Pre-monsoon	9.3 ±1.3	10.1 ±1.7	10.5 ±1.2	9.6 ±1.1	9.8 ±1.6	10.4 ±1.4	10.5 ±1.1	10.8 ±1.5	11.2 ±1.3
Monsoon	9.7 ±1.5	10.5 ±1.1	10.8 ±1.3	9.8 ±1.84	10.2 ±1.2	10.6 ±1.5	10.8 ±1.3	11.2 ±1.2	11.6 ±1.5

Table 2. Seasonal variation of Acanthocephala infestations in *Seriolina nigrofasciata* were landed at three locations in Tamil Nadu, southeast coast of India since 2017 to 2019. Seasons are based on calendar months (post-monsoon, Jan-Mar; summer, Apr-Jun; pre-monsoon, Jul-Sep; monsoon, Oct-Dec)

	Prevalence (%)								
	Parangipettai			Pazhayar			Nagapattinam		
Seasons	2017	2018	2019	2017	2018	2019	2017	2018	2019
Post-monsoon	29.6 ±1.3	36.8 ±1.5	39.3 ±1.2	33.8 ±1.8	41.6 ±1.5	44.6 ±1.1	35.7 ±1.7	43.6 ±1.5	48.6 ±1.3
Summer	15.3 ±1.7	18.7 ±1.2	22.1 1.7	18.7 ±1.4	21.4 ±1.3	23.1±1.8	20.3 ±1.6	22.4 ±1.8	25.1 ±1.1
Pre-monsoon	11.4 ±1.2	14.2 ±1.4	15.3±1.5	14.3 ±1.6	15.9 ±1.4	16.8 ±1.7	15.1 ±1.3	16.9 ±1.3	19.8 ±1.7
Monsoon	18.8 ±1.1	23.8 ±1.6	31.8±1.2	24.9 ±1.3	24.7 ±1.6	33.6 ±1.5	26.8 ±1.1	29.7 ±1.2	34.6 ±1.4
	Intensity (%)								
Post-monsoon	7.8 ±1.7	8.5 ±1.6	9.8 ±1.6	8.6 ±1.7	9.3 ±1.8	8.7 ±1.6	9.8 ±1.8	10.4 ±1.7	11.8 ±1.8
Summer	6.1 ±1.4	7.2 ±1.5	7.6 ±1.4	7.1 ±1.6	7.4 ±1.3	7.5 ±1.2	7.6 ±1.1	8.8 ±1.3	10.4 ±1.2
Pre-monsoon	7.3 ±1.2	7.8 ±1.3	8.2 ±1.3	7.8 ±1.4	8.2 ±1.4	8.2 ±1.1	8.6 ±1.5	9.5 ±1.4	10.5 ±1.3
Monsoon	7.6 ±1.3	8.1 ±1.2	8.6 ± 1.5	8.2 ±1.3	8.6 ±1.7	8.4 ±1.4	9.5 ±1.2	10.3 ±1.6	10.7 ±1.5

Table 3. Seasonal variation of Acanthocephala infestations in *Dayseiaena albida* were landed at three locations in Tamil Nadu, southeast coast of India since 2017 to 2019. Seasons are based on calendar months (post-monsoon, Jan-Mar; summer, Apr-Jun; pre-monsoon, Jul-Sep; monsoon, Oct-Dec)

	Prevalence (%)								
	Parangipettai			Pazhayar			Nagapattinam		
Seasons	2017	2018	2019	2017	2018	2019	2017	2018	2019
Post-monsoon	20.7 ±1.5	28.4 ±1.7	31.5 ±1.8	25.3± 1.5	33.8 ±1.7	28.5 ±1.7	28.7 ±1.8	34.8 ±1.6	38.5 ±1.8
Summer	12.4 ±1.1	15.6 ±1.2	19.9 ±1.4	14.8 ±1.1	17.6 ±1.3	19.5 ±1.4	16.3 ±1.2	18.6 ±1.1	21.5 ±1.4
Pre-monsoon	10.6 ±1.3	11.5 ±1.4	15.5 ±1.5	12.5 ±1.3	10.8 ±1.6	13.7 ±1.1	10.8 ±1.4	11.8 ±1.2	14.7 ±1.2
Monsoon	15.3 ±1.4	20.4 ±1.5	22.4 ±1.7	17.2 ±1.6	20.4 ±1.4	23.3 ±1.6	18.2 ±1.5	22.4 ±1.4	24.3 ±1.5
	Intensity (%)								
Post-monsoon	8.1 ±1.4	8.8 ±1.7	9.3 ±1.6	8.4± 1.7	9.1 ±1.5	9.3 ±1.8	10.5± 17	10.8± 1.8	11.2± 1.7
Summer	5.8 ±1.1	6.4 ±1.3	7.3 ±1.2	6.5 ±1.3	7.4 ±1.1	7.7 ±1.3	8.4± 1.1	8.7 ±1.3	9.2 ±1.1
Pre-monsoon	6.9 ±1.5	7.6 ±1.6	7.8 ±1.4	7.3 ±1.4	8.2 ±1.3	8.4 ±1.5	9.6± 1.3	9.4 ±1.4	10.3 ±1.2
Monsoon	7.4 ±1.3	8.2 ±1.4	8.4 ±1.5	7.7 ±1.6	8.5 ±1.7	8.6 ±1.6	9.9 ±1.5	9.8 ±1.6	10.8 ±1.4

3. 3. Histopathology and histochemistry

The transverse section of normal intestinal lesion showed the architecture of muscle fibers of *Caranx ignobilis* (Fig. 6a). Adjacent to the wall of the proboscis were a layer of proliferated, rounded fibroblast cells and the layer bounded the neck of the parasite in the alimentary tract. Strips of smooth muscle fibers extended in-between intestinal glands, tall irregular intestinal villus were observed (Fig. 6b). In some parts of the connective sheath surrounding the proboscis there were large numbers of extravascular red blood cells mingled with lymphocytes and macrophage cells. Cellular infiltration was highly found in the proboscis penetrated area, and aggregation of lymphocytes and granular eosinophils were intermingled with fibroblasts at the site of inflammation (Fig. 6c and d). There was an area with a diffuse eosinophilic substance in the connective tissue layer beside the parasite wall (Fig. 6e). Scattered among the connective tissue were small arterioles occasionally surrounded by large numbers of eosinophilic granule cells (Fig. 6d). The penetration of *A. ranae* proboscis through the wall of the ileum is shallow, it reaches the mucosal and sub-mucosal layers and this is accompanied by blunting, shortening and destruction of the intestinal villi (Fig. 7a and b) and compression and erosion of their columnar epithelium opposed the everted Acanthocephala proboscis, with noticeable increase in the number of goblet cells which open in the inter-villous space (Fig. 7c). The enlarged view of the proboscis exhibited the connective tissue proliferation (Fig. 7d). The alveolar lobes (Al) and proboscis receptacle are visible in these sections (Fig. 7e). A marked destruction of intestinal gland (crypts) and an increase in the marked cellular infiltration was seen in the stromal connective tissue surrounding the everted proboscis in both sub-mucosa and muscularis (Fig. 7f).

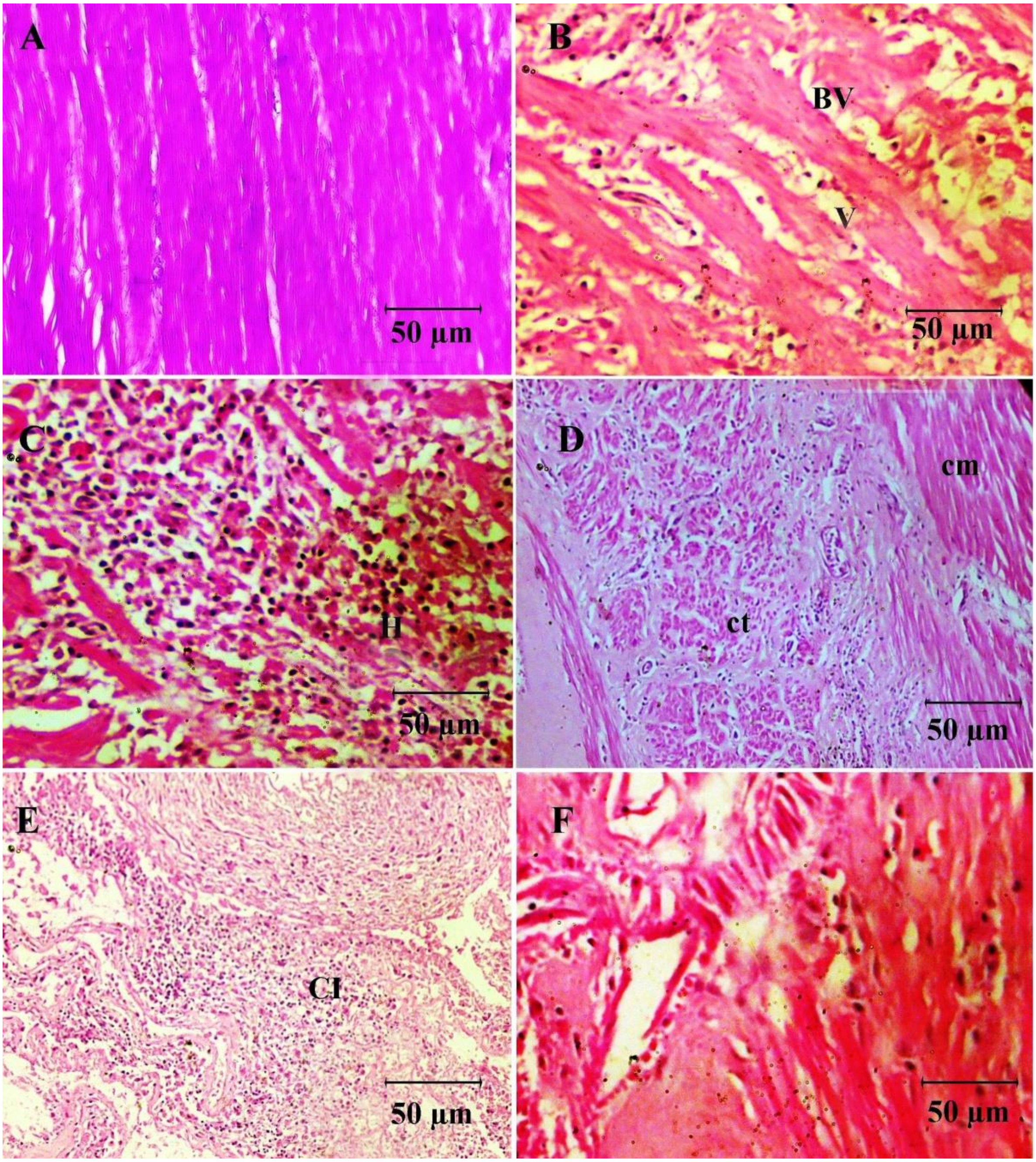

Fig. 6. Transvers section of the normal intestinal muscle **(A)**; Strips of smooth muscle fibers; Muscularies mucosa extended in- between intestinal glands, tall irregular intestinal villi Bv- blood vessels; V- villus **(B)**; Cellular infiltrated area surrounding the proboscis, aggregation of lymphocytes, eosinophil granulocytes and fibroblasts at the site of inflammation **(C)**; Intestinal mucosa to show crypts hyperplasia enlarged and congested blood vessels and stromal lymphocytic infiltration Ct- Connective tissue; Cm- Circular muscle **(D)**; Connective tissue layer with large number of extravascular red blood cells and infiltrating mononuclear cells Ci- Cellular infiltration **(E)**; proboscis enclosed in connective tissue jacket protruding into the peritoneal cavity **(F)**.

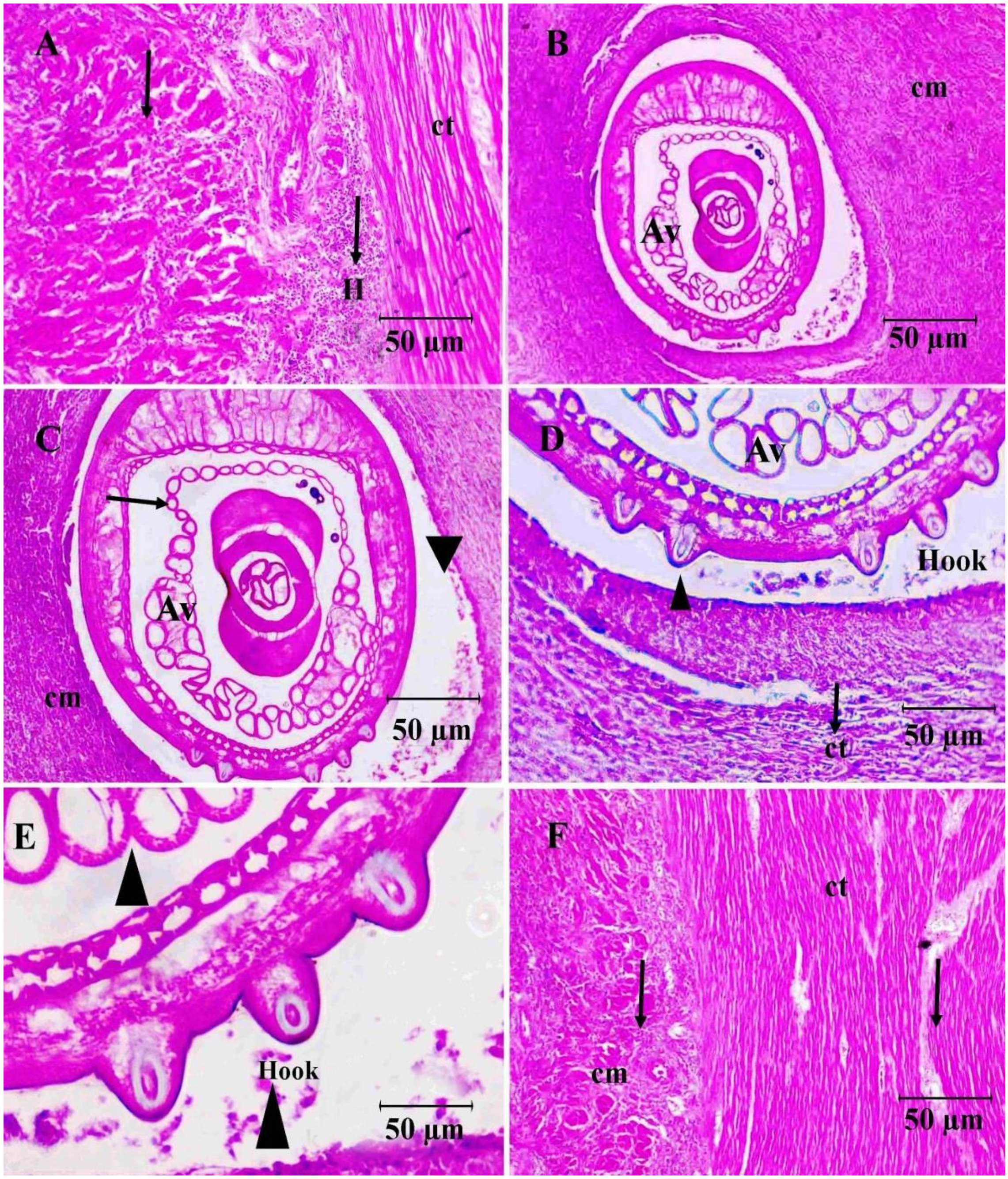

Fig. 7. Transvers section of the *Caranx ignobilis*; Proliferation of blood vessels in the hyperplasic intestinal villi, H- Hemorrhage; Ct- connective tissues **(A)**; Intact tegument of the anterior region of the proboscis (arrow) enclosed in the connective tissue capsule, Cm- connective muscles; Al- Alveolar lobes **(B)**; Proboscis of the parasite surrounded by a connective tissue capsule (arrow head), Cm- connective muscles; Al- Alveolar lobes **(C)**. Proboscis deeply penetrating the wall of the intestine Ct- Connective tissues; Al- Alveolar lobes **(D)**; Connective tissue necrosis **(E)**; Muscular layers is accompanied by destruction and blunting of the villi and crypts (arrow) and full thickening of the mucosa and sub-mucosa Cm- connective muscles; Ct- Connective tissues **(F)**.

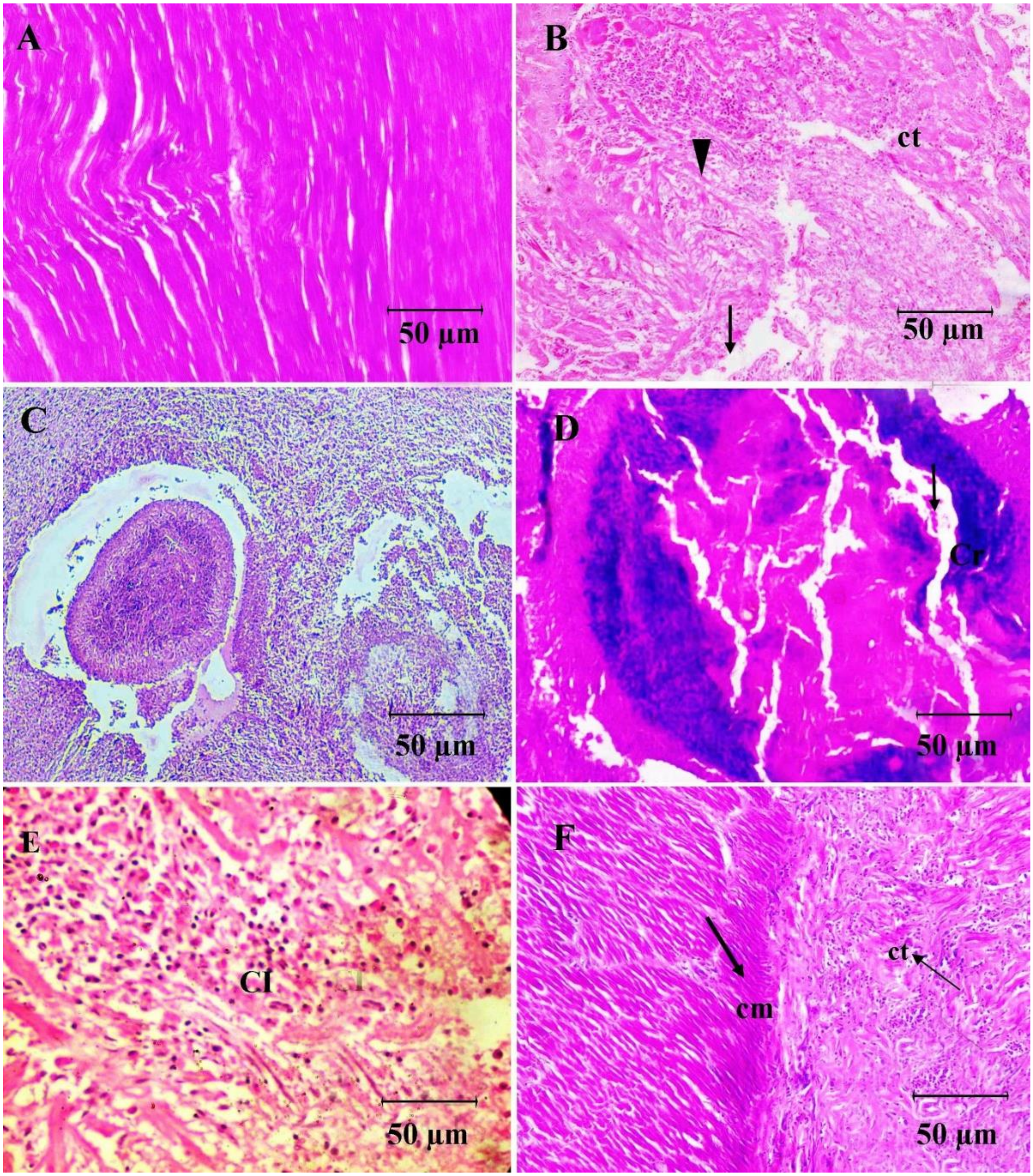

Fig. 8. Transvers section of the normal intestinal fibers **(A)**; Thickened intestinal epithelium (arrow) and vacuolation of stromal connective tissue Ct- Connective tissue (arrow head) **(B)**; Proboscis invaded the outer layers of the musculaRies extema and tip of the proboscis is still inverted (arrow) **(C)**; Hyperplasia of the intestinal villi and lamina propria near the site of parasitic attachment area, Cr- Crypts **(D)**; Cellular infiltrated area surrounding the proboscis, aggregation of lymphocytes and fibroblasts at the site of inflammation, Ci- Cellular infiltration **(E)**; Section of connective tissue capsule, cm—circular muscles, ct—connective tissue capsule lymphocytes, granulocytes and fibroblasts at the site of inflammation **(F)**.

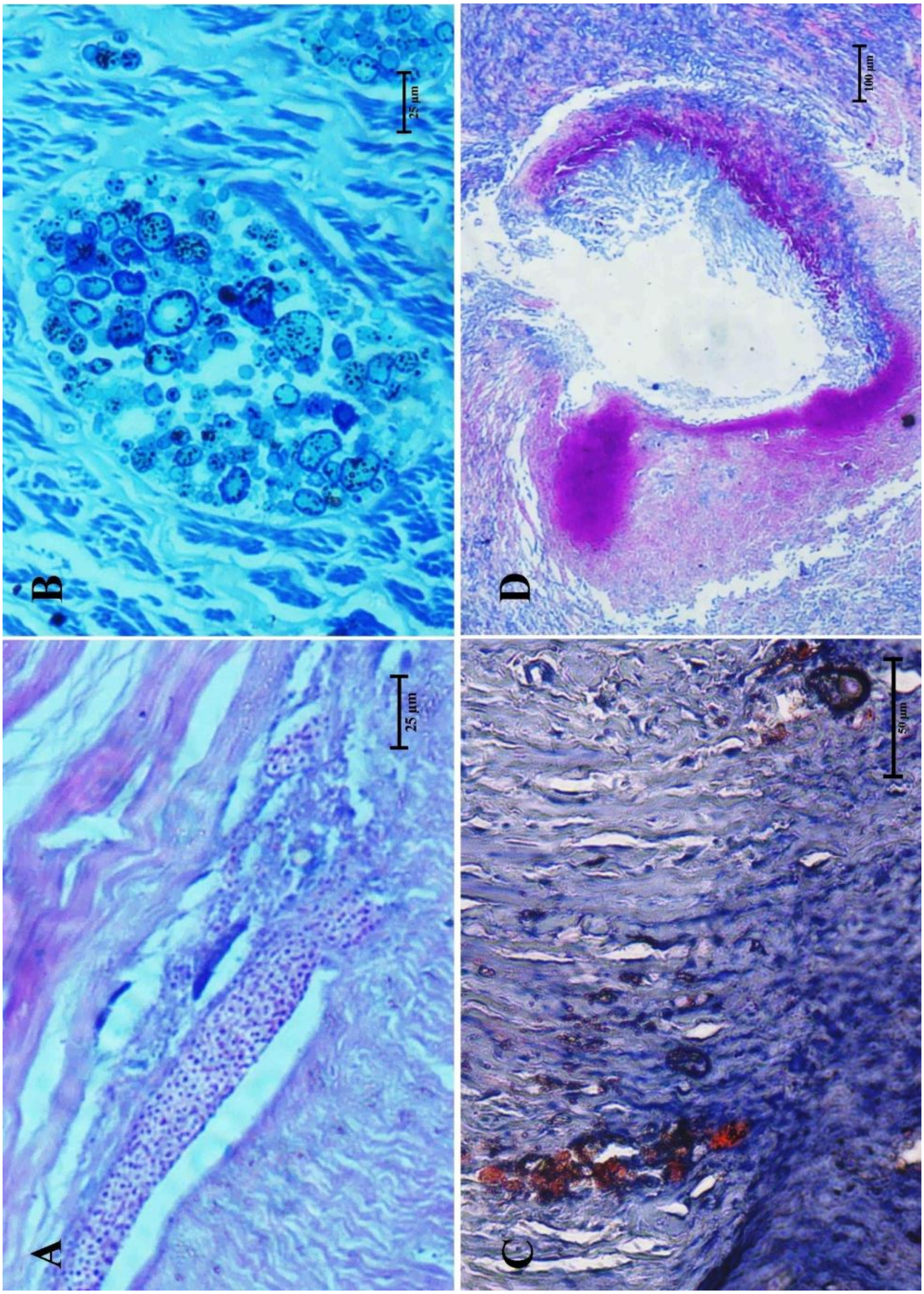

Fig. 9. *Acanthocephalus ranae* infested intestine; Stain alcian blue positive for acid mucopolysaccharide **(A)**. Stain toludine blue positive for matachromatic mast celles **(B)**. Stain oil red-O positive for oil droplet **(C)**; Stain azodye positive for acid and alkaline phosphatase **(D)**.

The transverse section of the non-parasitized *Dayseriaena albide* intestinal muscular fibers (Fig. 8a). The proboscis of the *A. ranae* within the intestine was surrounded by a connective tissue sheath clearly demarcated from the body of the intestinal tissue and thickened intestinal epithelium (Fig. 8b). There was a layer of compact fibroblast cells and infiltrating cells close to the proboscis, but further away the connective tissue was more scattered and there were fewer infiltrating cells (Fig. 8c). In some of the capillaries the numbers of RBCs visible were very low (Fig. 8d). Dense melanin macrophage centres occurred in the spleen stroma adjacent to the proliferated connective tissue, but those within the periphery of the connective tissue sheath were more diffuse (Fig. 8e). Deposits of an eosinophilic substance were observed among the proliferated fibroblasts adjacent and to the parasite wall (Fig. 8f).

Alcian blue stain positive for sulfated and carboxylated acid muco-polysaccharides and sialomucins, the parasite infested sites contain abundant acid muco-polysaccharides (Fig. 9a). The stain toluidine blue positive for the metachromatic mast cells were observed from the infested lesions (Fig. 9b). The infested host intestine numerous lipid droplets were observed with the facilitate of Oil-Red-O stain (Fig. 9c). The red granule of the Azodye deposits indicates the acid phosphatase sites and bluish granules indicate the alkaline phosphatase sites. The lesion exhibits the mild and moderate expression of acid and alkaline phosphatases, which indicates the intestinal cellular proliferation (Fig. 9d).

4. DISCUSSION

The results of the present study clearly showed that, there was significant variation found in the prevalence and mean intensity of parasitic infestation between the three stations. However, there was a significant variation found in the prevalence of parasitic infestation among the four seasons. Among the four seasons, the higher Acanthocephala infestation was observed during post-monsoon season. It may due to the higher nutrient, rain water drainage from the land at the end of the monsoon season. Formerly many researchers reported that, temperature as one of the most importance factors in controlling the parasitic infestation throughout the world [21-25].

Infections are highly reported in tropical seas than in temperate regions. However, the environmental conditions of the tropical waters are quite favorable in pre-monsoon for the transmission of intimidated host to the final host. The present study also supported the role of temperature was controlling the Acanthocephala infestation directly or indirectly in the different study areas [26]. The sea is calm and there may not be any disturbance during this season. This naturally corresponds to the peak in feeding activities of the fish. Recruitment of infection may take place after summer and reach their peak in winter months. There is a meager positive correlation between the host size and total parasitic infection. The impact of diet and feeding habits on the parasitic infection in the fish hosts were carried out by [27]. The variation in infection with age group may be because of younger fish have less capacity of feeding whereas older fish may be resistant and therefore do not allow new extra parasite burdens [28]. At the same time, the parasite life span also plays its role with number of parasites diminishing in the host with increasing age.

Acanthocephalans were actively selected the host intestine, because it is most suitable for nutrients. The selective pressures of parasites alive in the intestinal tract of the host fishes, where physical disturbance in the form of peristalsis and food movement can exert powerful drag on attached parasites. In this pathological study revealed that, the structural abnormalities such as disruption of infected intestine cells, degeneration, necrosis and also damage of blood vessels observed in the infested intestine. The longer praesoma of acanthocephala penetrate the wall and often enter the peritoneal cavity where it is encapsulated by proliferated connective tissue. The deposition of hemosiderin pigments in both healthy and diseased specimens of catla may probably have some relevance with the poor gonadal maturation of the fish. Haemosiderosis occurs in the form of brown intracellular granules which gives an intensely positive Prussian blue reaction [29]. Similarly, in the present study also exhibited, the numbers of goblet cells were found to be increased in affected region, and increased mucus secretion was observed on the intestine surface. Accumulation of lymphocytes and the presence of large number of granulocytes as well as fibroblasts suggest inflammatory responses.

The intestinal villi and lands (crypts), compression and erosion of their columnar epithelium apposed the penetrated worm, as well as an increase in the number of goblet cells in both villi and crypt epithelium [30]. In this study also closely observed the inflammatory infiltration was developed especially in muscular and stromal connective tissue layers. On the other hand the proboscis is directed obliquely, the penetration was deeper reached the muscular layer where the host inflammatory reaction were more pronounced and associated with hemorrhage and extensive cellular infiltration including aggregation of lymphocytes, presence of numerous eosinophilic granulocytes and the appearance of fibroblasts.

Pathogenicity was depends on the density of the parasite burden and depth of the proboscis penetration into the host intestine. Long live parasite to increase the cellular infiltration and it's may be leads to the tumors conditions of the infected fishes. The transvers section of the infested intestine inner layer compact, rounded fibroblast surrounded by outer layer of fewer, elongated fibroblast and connective tissue with variable amount of cellular infiltration, hemorrhage, and proliferative response wherein connective tissue attempt to seal off the parasite. Which is the more stress of the host fishes. There was evidence that irritation of the skin due to constant mechanical damage or parasitic encystrnent may lead to the formation of tumourous growths, mostly epidermal hyperplasias.

5. CONCLUSION

The prevalence and intensity of Acanthocephala infestation were observed in finfishes species is in consonance with the various findings and can be linked with many ecological factors. The severe pathological changes caused by the acanthocephalan have totally destroyed the architecture of the intestinal tissues. The damage was based on the parasitic proboscis' length, hooks' length and parasitizing durations. Therefore, in recent years there has been recognition that sub-lethal physiological effects on hosts which may lead to alterations in the behavior of infected fishes may also play an important role in regulating populations through demographic effects of marine fishes in Tamil Nadu coast.

Acknowledgment

Authors would like to acknowledge the Ministry of Human Resource Development. Government of India, New Delhi for the financial assist (Grant No. G4 (1)/1630/2013). We are also thankful to the fisherwomen and men on the Nagapattinam district coast for the supply of host fishes both on landing and also in the market.

References

[1] Bondad-Reantaso, M. G., Subasinghe, R. P., Arthur, J. R., Ogawa, K., Chinabut, S., Adlard, R., Tan, Z., Shariff, M. 2005. Disease and health management in Asian aquaculture. *Vet Parasitology* 132, 249-272

[2] Sakthivel, A., Selvakumar, P., Gopalakrishnan, A., 2014, Acanthocephalan (Echinorhynchus sp.) infection of yellowfin tuna (Thunnus albacares) from Nagapattinam, south east coast of India. *Journal of Coastal Life Medicine* 2, 596-600

[3] Sakthivel, A. Selvakumar, P., Gopalakrishnan, A., 2016. Acanthocephala (Acanthocephalus lucii) infection on Caranx ignobilis from Nagapattinam, south east coast of India. *Indian Journal of Geo Marine* 45, 448-452

[4] Sakthivel, A., Selvakumar, P., Gopalakrishnan, A., 2016. Morphological and histophathological studies of Acanthocephalus dirus infection in internal organ of Caranx ignobilis. *Indian journal of Geo marine sciences*. 45, 453-458

[5] Sakthivel, A., Selvakumar, P., Gopalakrishnan, A., 2016: Pathological manifestation of the Acanthocephalus dirus in Thunnus albacores. *Asian Pac J Trop Dis.* 6, 350-353

[6] Lambrechts, L., Chavatte, J. M., Snounou, G., Koella, J. C., 2006. Environ- mental influence on the genetic basis of mosquito resistance to malaria parasites. Proceedings of the Royal Society of London. *Biological Sciences* 273, 1501-1506

[7] Janovy, J., 2002. Concurrent infections and the community ecology of helminth parasites. *Journal of Parasitology* 88, 440-445

[8] Wanstall, S. T., Thomas, J. S., Robotham, P. W. J., 1988. The pathology caused by Pomphorhynchus laevis Muller in the alimentary track of the stone loach, Noemacheilus barbatulus. *Journal of Fish Diseases* 11, 511-523

[9] Dezfuli, B. S., Giari, L., Arrighi, S., Domeneghini, C., Bosi, G., 2003. Influence of enteric helminths on the distribution of intestinal endocrine cells belonging to the diffuse endocrine system in Salmo trutta (L.). *Journal of Fish Diseases* 26, 155-166

[10] Dezfuli, B. S., Pironi, F., Giari, L., Domeneghini, C., Bosi, G., 2002. Effect of Pomphorhynchus laevis (Acanthocephala) on putative neuromodulators in the intestine of naturally infected Salmo trutta. *Diseases of Aquatic Organisms* 51, 27-35

[11] Margolis, D. J., 2004. Parasites: small Players with Crucial Roles in the Ecological Theatre. *Ecohealth*. 1, 151-164

[12] Rohade, K., 1967. Ecology of marine parasite, an introduction to marine parasitology. 2nd ed. Trowbridge, UK: Redwood Books.

[13] Yamaguti, S., 1935. Studies on the helminth fauna of Japan. Part. Acanthocephala *I. Japanese J. Zoology* 6, 245–277

[14] Amin, O. M., 1985. Classification of the Acanthocephala. Cambridge University Press, London and New York, pp. 27–72

[15] Amin, O. M., 2013. Classification of the Acanthocephala. *Fol. Parasitol* 60, 273-305

[16] Bhattacharya, S. B., 2007. Handbook on Indian Acanthocephala. Zoological Survey of India, Kolkata, 1–255

[17] World Register of Marine Species; 2015. [Online] Available from: http://www.marinespecies.org/aphia.php?p=taxdetails&id=448669 [Accessed on 5th November, 2015].

[18] Dong, X. Y., Wang, Y. M., Yuan, C., & Zou, X. T. (2012). The ontogeny of nutrient transporter and digestive enzyme gene expression in domestic pigeon (Columba livia) intestine and yolk sac membrane during pre-and posthatch development. *Poultry Science*, 91(8), 1974-1982

[19] Migliaccio, A. R., Rana, R. A., Sanchez, M., Lorenzini, R., Centurione, L., Bianchi, L., 2003. GATA-1 as a regulator of mast cell differentiation revealed by the phenotype of the GATA1 low mouse mutant. *J Exp Med*. 197, 281-296

[20] Young, B., Heath, J. W., 2000. Wheater's functional histology: a text and colour atlas, 4th edn. Churchill Livingstone, Philadelphia. 2,12 (1), 1-222

[21] Rodrigues, A. A., Saraiva, A., 1996. Spatial distribution and seasonality of Pseudodactylogyrus anguillae and P. bini (Monogenea) on the gills of the European eel Anguilla anguilla from Portugal. *European Association of Fish Pathology* 63, 85-88

[22] Chapman, L. J., Lanciani, C. A., Chapman, C. A., 2000. Ecology of a diplozoon parasite on the gills of the African cyprinid Barbus neumayeri. *African Journal of Ecology* 38, 312-320

[23] Turner, H. M., 2000. Seasonality of Alloglossoides cardicola (Trematoda: Macroderiodea) infection in the cray fish, Procambarus acutus. *South Western Naturalist* 45, 69-71

[24] Wang, G. T., Yao, W. J., Nie, P., 2001. Seasonal occurrence of Dollfustrema vaneyi (Digenea: Bucephalidae) metaceraria in the bull head cat fish Pseudobagnus fluvidraeo in a reservoir in china. *Diseases of Aquatic Organisms* 44, 127-131

[25] Mouritsen, K. N., Poulin, R., 2002. Parasitism, climatic oscillations and the structure of natural communities. *Oikos* 97, 462-468

[26] Dogiel, U. A., Bykhovski, B. F., 1934. Parasite Fauna of the Fishes of the Arab Sea. Mag. *Parasit. Moscow*, 7, 1-149

[27] Luque, J. L., Amato, J. F. R., Takemoto, R. M., 1996. Comparative analysis of the communities of metazoan parasites of Orthopristis ruber and Haemulon steindachneri (Osteichthyes: Haemulidae) from the southeastern Brazilian littoral: I. Structure and influence of the size and sex of hosts. *Revista Brasileira de Biolo- gia*. 56, 279-292

[28] Zelmer, D. A.; Arai, H. P., 1998. The contributions of host age and size to the aggregated distribution of parasites in Yellow perch (Perca flavescens) from, Garner Lake Alberta, Canada. *J. Parasitology* 84, 24-28

[29] Bamidele, A. (2007). Histopathological study on the parasitised visceral organs of some fishes of Lekki Lagon, Lagos, Nigeria. *Life Science Journal*, 4(3), 70-76

[30] Nahla A. Radwan, (2012). Pathology Induced by Sphaerirostris picae (Acanthocephala, Centrorhynchidae) in the Hooded Crow Corvus coronecornix (Aves: Corvidae) from North Delta of Egypt. *Life Science Journal* 9(3), 48-56