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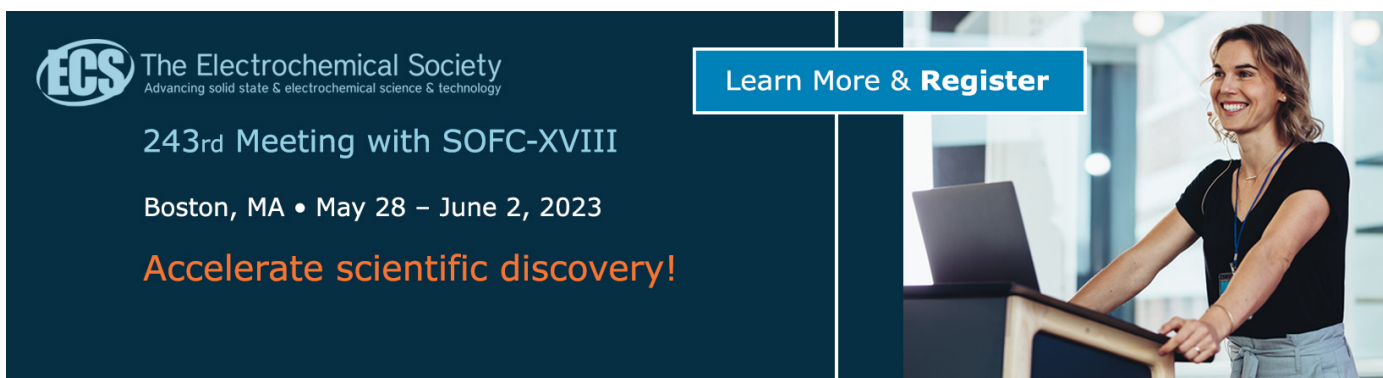
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Their great diversity and potential makes the development of marine and fisheries resources a priority for Indonesia, and a key orientation of long-term development planning. The development of valuable maritime and fishery resources has been encouraged by the government as a means to achieve food security and economic independence.

These abundant marine and fisheries resources are the mainstay of Indonesia's efforts to achieve Sustainable Development Goal (SDG) number 14: "Conserve and sustainably use the oceans, seas and marine resources for sustainable development".

As a contribution towards achieving SDG 14, each year the Faculty of Marine Science and Fisheries at Universitas Hasanuddin holds a national and international marine and fisheries symposium. The theme of the 2019 Symposium is "**Managing Aquatic Resources for Sustainable Development**". This symposium will provide opportunities for participants to exchange information, knowledge and experience, as well as to initiate partnerships for research and outreach activities in the field of marine science and fisheries. These exchanges and partnerships will contribute towards enhancing the potential, development and utilization of marine and fishery resources in sustainable ways.

A warm welcome to the researchers and participants from a wide cross-section of the marine and fisheries sector and thank you for coming to taking part in this Universitas Hasanuddin Marine Science and Fisheries Symposium. A heartfelt thank you is also due to the many people and organisations that have provided support or contributed in any way towards the successful realisation of this Symposium. May all the contributions made during this event provide valuable input to support marine and fisheries development in Indonesia.

Makassar, 5 September 2019
Dean,

Dr.Ir.St Aisjah Farhum, MSi



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Table of contents

Volume 370

November 2019

◀ Previous issue Next issue ▶

The 2nd International Symposium on Marine Science and Fisheries (ISMF2) - 2019 22 June 2019, Makassar, Indonesia

Accepted papers received: 08 October 2019

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Meristic characters and length-weight relation of climbing perch (*Anabas testudineus*) from wetlands in Sigi District, Central Sulawesi, Indonesia

S Ndobe, Rusaini, A Masyahoro, N Serdiati, Madinawati and A M Moore

+ Open abstract  View article  PDF

OPEN ACCESS 012002

Environmental Geochemistry of Heavy Metals and Plagioclase Background Enrichment Factor in Coastal Sediments at Lumpue - Parepare, South Sulawesi, Indonesia

A Tongggiroh, A M Imran and S Haerany

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Participatory mapping and unmanned aerial vehicle (UAV) images for developing village level coastal geoinformation

N Nurdin, D F Inaku, A R Rasyid, A R Jalil, A Alimuddin, Agus, M Akbar As and S Q Al Azizi

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Mapping distribution patterns of skipjack tuna during January-May in the Makassar Strait

M Zainuddin, M I Amir, A Bone, S A Farhum, R Hidayat, A R S Putri, A Mallawa, Safruddin and M Ridwan

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OPEN ACCESS 012005

Production of Pacific whiteleg shrimp, *Litopenaeus vannamei* through implementation of rapid biofloc technology

N A Kasan, A S Kamaruzzan, A I A Rahim, A N Ishak, I Jauhari and M Ikhwanuddin

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012006

Physico-chemical characteristics and amino acid profile of fermented sauce made from tuna loin by-product

M R Wenno and C R M Loppies

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012007

Preliminary note on the morphological characters of *penja* (amphidromous goby postlarvae) in West Sulawesi and Gorontalo Bay

Nurjirana, A Haris, F M Sahami, P Keith and A I Burhanuddin

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012008

Effect of oceanographic conditions on skipjack tuna catches from FAD versus free-swimming school fishing in the Makassar Strait

A R S Putri, M Zainuddin, M Musbir, M A Mustapha and R Hidayat

[+ Open abstract](#) [View article](#) [PDF](#)

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012009

Quality of giant clam (*Tridacna derasa*) juveniles as non-target organisms after exposure to clove oil in concentrations suitable for anaesthetising ornamental fish

S W Rahim, K Yaqin, L Fachruddin and H Kudsiah

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012010

Biological condition and carapace width frequency distribution of blue swimming crabs (*Portunus pelagicus*) in Gresik and Lamongan, East Java

M A Rahman, F Iranawati, A B Sambah and D G R Wiadnya

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012011

The effect of commercial feed enrichment with *Piper betle* leaf extract on the growth and survival rate of tilapia (*Oreochromis niloticus*)

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012012

A Microcosm Multitrophic Aquaculture System

A Tuwo, I Yasir, J Tresnati, Mutmainnah, R Aprianto, A Yanti, A D Bestari and M Nakajima

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012013

The stability of mangrove ecosystems for edu-tourism based on macrozoobenthos ecological indicators in the educational fish ponds of Hasanuddin University

A Saru, M Lanuru, S Mashoreng, Y Jubhari and M Ilham

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012014

Species diversity of wrasses caught by fishermen in the Spermonde Islands, South Sulawesi, Indonesia

I Yasir, J Tresnati, A Yanti, P Y Rahmani, R Aprianto and A Tuwo

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012015

Long-Term Monitoring of Parrotfish Species Composition in the Catch of Fishermen from the Spermonde Islands, South Sulawesi, Indonesia

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012016

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J Tresnati, I Yasir, A Yanti, R Aprianto, P Y Rahmani and A Tuwo

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012017

Cultivated seaweed carbon sequestration capacity

S Mashoreng, Y A La Nafie and R Isyrini

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012018

Morphological and genetic analysis of *Gracilaria* sp. cultured in ponds and coastal waters

N I S Arbit, S B A Omar, E Soekendarsi, I Yasir, J Tresnati, Mutmainnah and A Tuwo

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012019

Comparative study on the growth, carotenoid, fibre and mineral content of the seaweed *Caulerpa lentillifera* cultivated indoors and in the sea

R Syamsuddin, H Y Azis, Badraeni and Rustam

[+ Open abstract](#) [View article](#) [PDF](#)

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012020

Enrichment of commercial feed for striped snakehead fry (*Channa striata*) with golden snail (*Pomacea* sp.) flour

S Ndobe, S F Mangitung, R Bardi, Madinawati, D T Tobigo and A M Moore

[+ Open abstract](#) [View article](#) [PDF](#)

OPEN ACCESS

012021

Analysis of coral reef benthic cover changes around Kapoposang Island, Pangkep Regency, South Sulawesi using multi-temporal remote sensing imagery

A Faizal, A F Raazy and A Rasyid

[+ Open abstract](#) [View article](#) [PDF](#)

OPEN ACCESS

012022

Perspectives on seagrass ecosystem services from a coastal community

R Ambo-Rappe, Y A. La Nafie, A A Marimba, L C. Cullen-Unsworth and R K. Unsworth

[+ Open abstract](#) [View article](#) [PDF](#)

OPEN ACCESS

012023

Design Viability of Purse Seiners Operating in Bone Regency, South Sulawesi, Indonesia

S A Farhum, M Zainuddin, A F P Nelwan, A A Pangera and R D Risa

[+ Open abstract](#) [View article](#) [PDF](#)

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012024

Nursery Performance of Sandfish *Holothuria scabra* Juveniles in Tidal Earthen Pond Using Different Types of Cage

M Firdaus and L F Indriana

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OPEN ACCESS

012025

Livelihood Features of Seaweed Farming Households: A Case study from Bungin Permai Village, South Konawe, South East (SE) Sulawesi, Indonesia

M Rahim, L O M Aslan, Ruslaini, S A A Taridala, N I Wianti, A Nikoyan, Budiyanto and H Hafid

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-
- OPEN ACCESS** 012026
Use of Common Lantana (*Lantana camara* Linn) Extract to Prevent Ice-ice Disease and Trigger Growth Rate of the Seaweed *Kappaphycus alvarezii*
R S Patadjai, I Nur and S Kamri
[+](#) Open abstract [View article](#) [PDF](#)
-
- OPEN ACCESS** 012027
Structural relationship among steroids from Sulawesi Tenggara's sponge *Clathria* sp. and their radical scavenger activity
I Sahidin, Baru Sadarun, La Ode M. Aslan, Wahyuni, M. Hajrul Malaka and Adryan Fristiohady
[+](#) Open abstract [View article](#) [PDF](#)
-
- OPEN ACCESS** 012028
Coral Disease Prevalence on Scleractinian Corals at Prigi Bay, Trenggalek, East Java
Rosdianto and O M Luthfi
[+](#) Open abstract [View article](#) [PDF](#)
-
- OPEN ACCESS** 012029
The effect of *Melastoma malabathricum* leaf extract on growth and spawning of blue swimming crab (*Portunus pelagicus*)
N Alam, Y Fujaya, Haryati, D K Sari, M Achmad, M Rusdi and N Farizah
[+](#) Open abstract [View article](#) [PDF](#)
-
- OPEN ACCESS** 012030
Chemical composition and antibacterial activity of honey collected from East Nusa Tenggara, Indonesia on pathogenic bacteria in aquaculture
Y Salosso
[+](#) Open abstract [View article](#) [PDF](#)
-
- OPEN ACCESS** 012031
Habitat characteristics and distribution of flyingfish in Fak-Fak and surrounding waters
P Boli, I Luhulima, F Simatauw, S Leatemia, S Tabay, D Parenden and A S Ananta
[+](#) Open abstract [View article](#) [PDF](#)
-
- OPEN ACCESS** 012032
Antioxidant, antibacterial and antifungal activity of edible coating chitosan-galactose complex
Rieny Sulistijowati, Rahim Husain, Muhammad Cakra Datau and Kusbidinandri
[+](#) Open abstract [View article](#) [PDF](#)
-
- OPEN ACCESS** 012033
The Effect of Dosage Combination and Feeding Frequency on Growth and Survival Rate of Vannamei Shrimp Juveniles in Ponds
Z Zainuddin, S Aslamyah, K Nur and Hadijah
[+](#) Open abstract [View article](#) [PDF](#)
-
- OPEN ACCESS** 012034
Diversity of attached marine life in different types of artificial timber reefs
J F Alam, T Yamamoto, T Umino, S Nakahara and K Hiraoka
[+](#) Open abstract [View article](#) [PDF](#)
-
- OPEN ACCESS** 012035
Osteological study of Titan Trigger fish, *Balistoides viridescens* (Bloch and Schneider, 1801) (Balistidae: Tetraodontiformes) from the Spermonde Archipelago Waters
M Afrisal, Nurjirana, Irmawati and A I Burhanuddin
[+](#) Open abstract [View article](#) [PDF](#)
-

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012037

The effect of initial weight of seedlings grafted from tissue-cultured and local strain seedlings on growth and carrageenan content of the Red Seaweed (*Kappaphycus alvarezii*) using a grafting method

A L Embi, L O M Aslan, W Iba, A B Patadjai and E Sulistiani

[+ Open abstract](#) [View article](#) [PDF](#)

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012038

Comparing skipjack tuna catch and oceanographic conditions at FAD locations in the Gulf of Bone and Makassar Strait

R Hidayat, M Zainuddin, A Mallawa, M A Mustapha and A R S Putri

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012039

Evisceration rate of sandfish *Holothuria scabra* during transportation

A Tuwo, I Yasir, J Tresnati, R Aprianto, A Yanti, A D Bestari, Syafiuddin and M Nakajima

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012040

Biological aspects of Indian scad (*Decapterus russelli* Ruppell, 1830) in south site of Madura Strait Waters, East Java

G Bintoro, T D Lelono, Rudianto and N D Utami

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012041

The introduced Banggai cardinal fish (*Pterapogon kauderni*) population in Ambon Island, Indonesia

K Wibowo, U Y Arbi and I B Vimono

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012042

Water bird habitat suitability analysis in an urban coastal wetland (case study: Lantebung mangrove ecotourism area)

A Purify, N Nurdin, R I Maulani and M Lanuru

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012043

Grafting of *Kappaphycus alvarezii* seedlings using different seedling sources in Sasara Coastal Waters, Buton Utara, Southeast (SE) Sulawesi, Indonesia

Armin, L O M Aslan, A B Patadjai, W Iba, Yusnaeni and W H. Muskita

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OPEN ACCESS

012044

The Effect of Different Oblique Incision Length in Slide-Slipped Grafting using Tissue Cultured and Local Seedlings on the Growth of Seaweed (*Kappaphycus alvarezii*) in Sasara Coastal Waters, Kulisusu Bay, Buton Utara, SE Sulawesi, Indonesia

R Hasriah, L O M. Aslan, W Iba, A B Patadjai, Ruslaimi, M Balubi and E Sulistiani

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012045

The Fishing Ground of Large Pelagic Fish during the Southeast Monsoon in Indonesian Fisheries Management Area-713

Safuruddin, B Aswar, M Rijal Ashar, R Hidayat, Y K Dewi, M. T Umar, S. A Farhum, A Mallawa and M Zainuddin

[+ Open abstract](#) [View article](#) [PDF](#)

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012046

Biodiversity of lobster larvae (*Panulirus* spp.) from the Indonesian Eastern Indian Ocean



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The effect of differences in feed protein raw materials on the glycogen content, metamorphosis rate of mangrove crab larvae (*Scylla olivacea*) and feed price

Haryati, Y Fujaya and E Saade

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The association of economically important fish with mangroves in Maumere Bay, Indonesia

A Vincentius, M N Nessa, J Jompa, A Saru, M Hatta and N Rukminasari

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OPEN ACCESS 012049

Evaluating Ecotourism Development in Bontang: Water Quality, Compatibility, and Carrying Capacity

Aspiany, Sutrisno Anggoro, Frida Purwanti and Bambang Indratno Gunawan

[+ Open abstract](#) [View article](#) [PDF](#)

OPEN ACCESS 012050

Preliminary study: human trampling effects on seagrass density

N Nurdin, Y La Nafie, M T Umar, M Jamal and A Moore

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OPEN ACCESS 012051

Macroscopic characteristics of the gonad maturity stages of dusky parrotfish *Scarus niger*

A Yanti, I Yasir, P Y Rahmani, R Aprianto, A Tuwo and J Tresnati

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Exploring Biodiversity and Monitoring Genetic Resources of Aquatic Plants in Manado, North Sulawesi, Indonesia

M F I Nugraha, R Koneri, A Julzarika, Reflinur, W Enggarini, R Yunita, M A Radjamuddin and H Novita

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Sri Suro Adhawati and Achmar Mallawa

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Histopathological changes in the intestine of *Channa micropeltes* infected with the cestode *Senga rostellariae*

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Histopathological changes in the intestine of *Channa micropeltes* infected with the cestode *Senga rostellariae*

Marina Hassan¹, Muhammad Syafiq Izzuddin Abdul Hadi², Mohd Fazrul HisamAbd Aziz², Wahidah Wahab¹, Farizan Abdullah¹, Shuhaimi Deraman¹, Kismiyati³ and Mohd Ihwan Zakariah¹

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Abstract. *Channa micropeltes* or *toman* is a native freshwater fish species and not commercially species in Malaysia. The fish become one of the anglers' attractions to Kenyir Lake, especially for recreational fishing purpose. However, parasitic diseases are one of the most common problems for this fish population. Studies on parasites of *C. micropeltes* is essential to our knowledge for the maintenance of natural resources. So, the objectives of this study were to identify the cestode and observe the histopathological changes on gastrointestinal tract of infected *C. micropeltes*. About 15 *C. micropeltes* were caught by using fishing rod. The fish were pithing, dissected and gastrointestinal tract was removed, then placed on petri dish. The stomach and intestine were fixed in 10% buffered formalin and proceed for preparing histology slides by using standard method for histology. Then, the tissues were stained by using hematoxylin and eosin (H & E) stain. The tissue changes were described. The cestodes were collected, fixed in 70% ethanol, stained with aceto-carmin and prepared the permanent slide. The cestodes morphology were observed under microscope for identification. In this study, only *Senga rostellariae* was identified. The histopathological changes showed the intestine with severe villus damage with destruction of villi epithelium and necrosis. Some areas with cross section of cestode showed increase of goblet cells and generated necrosis. Based on this study, *S. rostellariae* was a dominant species, and its activities caused severe damage to the fish intestine. The conditions can cause death to the fish due to hemorrhage and malabsorption of nutrient.

1. Introduction

Channa micropeltes are native to the fresh waters of Southeast Asia, Malaysia, Thailand, Indo China, Myanmar, and India [1]. The fish are inhabiting all parts of Malaysia and usually, they prefer lakes, reservoirs, canals, rivers and most of it commonly deep, standing or slow-flowing water [2]. It is a common species found in Kenyir Lake. The *C. micropeltes* is a daytime predator, feeding on fishes, frogs, and birds. They are very aggressive and even attacking humans. The aggressiveness and strong swimmers attracted anglers seek for recreational fishing purpose.



In Kenyir Lake, *C. micropeltes* commonly are infected with ectoparasites such as *Argulus* sp and Monogenea (Unpublished data). Shaharom (2012) [3] reported the cestode infection in the intestine of *C. micropeltes*. However, adult cestode is common parasites in digestive tract of fishes [4]. The parasitic infections are sometimes very fatal and cause high mortalities when their life cycles are well supported by intermediate hosts [5]. The serious mechanical injuries occurred with high numbers of cestodes and inflammatory reactions may occur in association with mature worm and plerocercoid larvae [4]. The depth of penetration of some species various and depended on fish hosts [6]. This study is important because, in wild, the rate of infection and effect of the cestode are unknown. Thus, this study aimed to identify the species of cestode and describe the severity of pathological changes of intestine caused by the cestode infection.

2. Materials and methods

2.1. Fish sample

Fish samples of *Channa micropeltes* (n=10) were collected from Lake Kenyir, Terengganu and their weights (g) and lengths (cm) were measured using a measuring board. Next, pitching method was applied by cutting the fish's spinal cord to make it paralyzed. After that, the fish was cut open using scissors up from the anus to the bottom of the jaw and the gastrointestinal tract was taken out and placed on petri dish. Gastrointestinal was divided into 3 part; stomach, proximal intestine, and mid intestine. Each end portion was fastened using a thread and was injected by 3 ml syringe with needle that contained 10% buffered formalin solution. Fixed sample in urine bottle contained 10% buffered formalin solution for histology. Sample of cestode was collected and fix in 70% ethanol.

2.2. Identification of cestode

Cestodes were fixed in AFA solution; alcohol, formalin, and acetic acid. It then being stained with aceto-carmin and put on the slide, covered with a coverslip to prepare the permanent slide [7]. The structure/illustrations of the Cestodes were drew by using Lucida camera which fitted on Olympus Microscopes under 4X magnification.

2.3. Histopathological studies

The infected tissue of *C. micropeltes* was taken out and fixed in 10% buffered formalin solution. Then it being dehydrated, clarified with xylene and processed for preparation of paraffin wax blocks [7]. Next, the tissue was cut at 4 - 5µm thickness rotary microtome and was put on slides. The tissue was stained with hematoxylin and eosin (H & E) for histopathological analysis and being observed under a light microscope. Lastly, the photo of the tissue was captured and being described if any damage caused by Cestode on *C. micropeltes* gastrointestinal tract presented.

3. Results and discussion

3.1. Result

3.1.1. Identification of cestode. The morphology of the present cestode consist structure of scolex, hook and bothria at the head (Figure 1) and mature proglottid structure consist testes and ovary (Figure 2). All proglottids are much broader than long. Immature proglottids have no trace of any reproductive organs. Mature proglottids are medium in size with almost straight lateral margin, quadrangular in shape and slightly broader and longer. Mature proglottids have developing ovary, testes, and vitelline follicles and arranged in a cluster.

The ovary is medium size, distinctly bilobed, transversely situated in the posterior region. Ovarian lobes are irregular margin, big size, and lobulated. Isthmus is connecting the two ovarian lobes, slightly curved, transversely placed and near the posterior margin. Testes are medium in size, round in shape, crowded together and some overlapping on each other. The vitellaria are follicular.

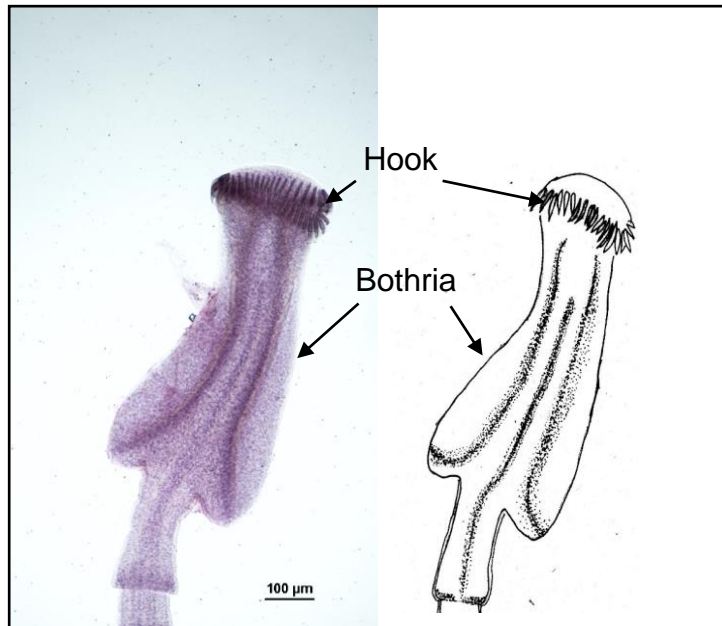


Figure 1. *Senga rostellariae*. Head region. (A) The head region stained with aceto-carmin (B) drawing by camera lucida.

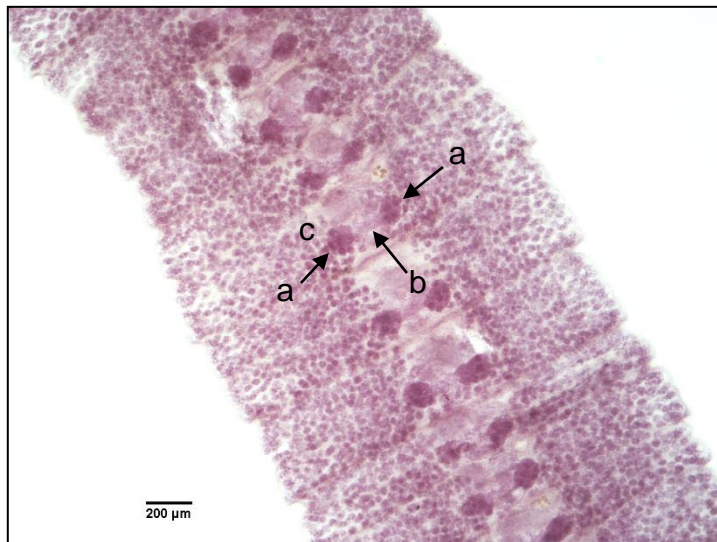


Figure 2. *Senga rostellariae* showed mature proglottid. (a) Ovary (b) Isthmus (c) testes. 100× total magnification Scale bar 200 μm.

3.1.2. Histopathological studies

The cestode was found lying in the lumen of the intestine. The intestinal layer pale and filled with mucus in the lumen. The lumen of intestine full with the body of cestode and most of the head embedded in the intestinal wall (figure 3).



Figure 3. Cestode in the lumen of the intestine.

The pathological effect exhibited ruptured serosa layer, inflammatory infiltration at the infected area, shortened and irregular shaped of villous. However, in the heavy infestation with the cestodes showed the breakage, hemorrhage, and separation of villous processes with large space (figure 4). There were also highly distribution of goblet cells in the villous (Figure 5). The epithelial necrosis was noticed (figure 4).

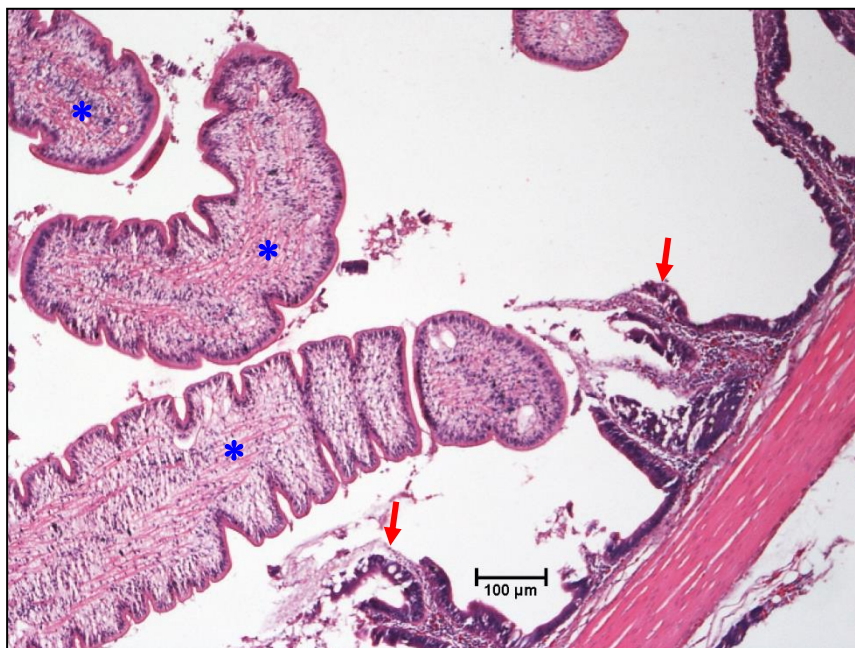


Figure 4. Cross-section of cestode (*) and destruction of villi and necrosis (arrow) (H & E; x10

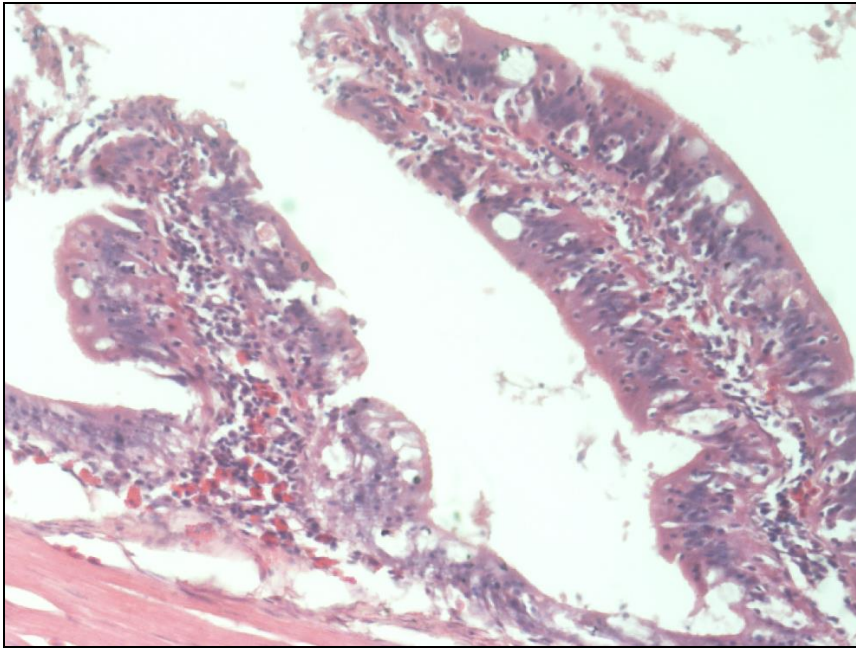


Figure 5. The infected intestine showed highly distribution of goblet cells, infiltration of inflammatory cells, and hemorrhage. (H & E; x40)

3.2. Discussion

The internal and external organ of the *S. rostellariae* was described to compare other *Senga* spp. which is important for identification. However, the *Senga* spp found in *C. micropeltes* in this present study were different from species *S. parva* and *S. filiformis* [8]. Based on the morphological descriptions, the present cestode is *Senga rostellariae* [9].

The type of scolex is covered with numerous hooks and has related to severe damages of the intestinal wall. The hemorrhage occurred when the scolex reached and damaged to the blood vessel. In the case of helminths infection, Haque and Siddiqi (1978) [10] reported that the surface desquamation of mucosal epithelium, infiltration of eosinophils and plasma cells.

The severe infection was evidenced by the total eruption of villi from the mucous membrane which resulted to a major disruption of the structural organization of the intestine which might have a profound influence on the nutrition and digestion process of the fish. The degree of pathogenicity and damages were depended on the intensity of infection [11,12]. The *S. rostellariae* blocking the intestinal lumen and disrupt the overall absorption efficiency of the intestine which affects fish's growth by restricting its food intake.

4. Conclusion

The cestode found in *C. micropeltes* was only *S. rostellariae*. The severity of tissue changes or damages were related to the intensity of cestode infection. The severe damage to the intestine of fish showed that *S. rostellariae* is pathogenic. The damages might cause the fish has digestive disturbance and lead to physiological problems.

References

- [1] Ambak M A, Mansor M A, Z. M and Mazlan A G 2012 *Fishes of Malaysia* (Malaysia: Universiti Malaysia Terengganu)
- [2] Courtenay W R and Williams J D 2004 *Snakeheads (Pisces, Channidae): a biological synopsis and risk assessment* vol 1251 (US Geological Survey)
- [3] Shaharom F 2012 *Fish Parasite of Lake Kenyir* (Peninsular Malaysia: Universiti Malaysia Terengganu)

- [4] Gaikwad P R, Sonune M B and Nagmote S R 2016 Histopathological Effects of the Cestode parasites on fishes from the Amravati region of Vidarbha (MS) India *Int. J. Life Sci.* **4** 602–5
- [5] Shakir H A, Khan A M and Abid M 2006 The prevalence of cestode infection in a freshwater catfish, *Sperata sarwari* *Punjab Univ. J. Zool* **21** 41–7
- [6] Taraschewski H 1989 *Acanthocephalus anguillae* in intra-and extraintestinal positions in experimentally infected juveniles of goldfish and carp and in sticklebacks *J. Parasitol.* 108–18
- [7] Kaur P 2014 Histo-pathological effect of *Senga* species (Cestode: Pseudophyllidea) in intestine of Piscian hosts. *World J. Pharm. Pharm. Sci.* **3** 1506–13
- [8] Fernando C H and Furtado J I 1964 Helminth parasites of some Malayan fresh-water fishes. *Bull. Natl. Museum, State Singapore.*
- [9] Dhole J S, Sonune B V, Reddy Y R and Chavan R J 2011 Two Pseudophyllidean Tapeworms from fresh water fish *Mastacembelus armatus* of maharashtra state (India) with revised key to species of genus *Senga* *Acta Parasitol. Glob.* **2** 25–33
- [10] Haque M and Siddiqe A H 1978 Histopathology of pig and man *Indian J. Parasitol.* **2** 97–8
- [11] Benarjee G, Reddy B L, Prasad K S K, Srikanth K, Swamy M, Ramu G and Ramulu K N 2007 Dynamics of parasite population and its histopathological and histophysiological effects in the stomach of a freshwater fish *J. Indian Fish. Assoc.* **34** 47–58
- [12] Reddy B L and Benarjee G 2014 Mode of attachment and Pathogenicity of *Lytocestus indicus* in fresh water Murrels *Int J Curr Microb. Appl Sci* **3** 507–11