

IDENTIFICATION OF A CESTODE FROM  
*Chaunia micropallias* (Cuvier, 1831) AND ITS  
POTENTIAL AS BIOINDICATOR FOR AQUATIC  
HEAVY METAL POLLUTION

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Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfillment of the requirement for the degree of Master of Science

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**March 2012**

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At present, parasites are attracting increasing interest from parasite ecologists as potential indicators of environmental quality because of the variety of ways in which they respond to anthropogenic pollution. However, until recently, little was known about the accumulation of toxins within parasites. Certain parasites, particularly intestinal acanthocephalans and cestodes of fish, can accumulate heavy metals at concentrations that are orders of magnitude higher than those in the host tissues or the environment. Furthermore, a little of helminth parasites have so far been recorded in Malayan freshwater fishes. In a study by Fernando and Furtado (1964), they found one species in *Channa striatus* and two species in *Channa micropeltes*. Therefore, the aim of this study was to identify the species of cestodes from *Channa micropeltes* (Cuvier, 1831) and to evaluate the metal accumulation ability of the cestodes compared to their host as a possible sentinel in monitoring increasing heavy metal pollution in lacustrine environment. By the way, the potential suitability of cestodes as a sentinel organism for metal pollution under natural environment conditions was determined.

A total of thirty snakehead fishes *Channa micropeltes* (Cuvier, 1831) were collected at Sungai Chomo, Tasik Kenyir, Malaysia. Muscle, liver, intestine and kidney tissues were removed from each fish and the intestine was opened to reveal cestodes. The cestode was identified on the basis of their morphological characteristics. In order to assess the concentration of heavy metal in the environment that accumulated both in fish and cestode, samples of water at surface layer and sediment were also collected. The sediment at the bottom of the lake was taken by using Ekman-Grab at three different stations around Chomo river at Kenyir lake. All samples of fish tissues, cestodes and sediment were kept frozen at  $-20^{\circ}\text{C}$  until metal analysis. Then they were digested and the concentrations of Manganese (Mn), Zinc (Zn), Copper (Cu), Cadmium (Cd) and Lead (Pb) were analyzed by using an inductively-couple plasma mass spectrometry (ICP-MS) equipment.

For identification of cestode from *Channa micropeltes* at Tasik Kenyir, after staining, drawing by using Camera Lucida, measurement by using advanced microscope and using Scanning Electron Microscope (SEM), it was showed that cestode was *Senga parva* (Fernando and Fertado, 1964). It differed from other species of genus *Senga*, parasitizing fish genus *Channa*, by the size strobila, scolex, apical disc, hooks, number of hooks, testes and some other characteristics.

For heavy metal detection, the result indicated that the worms have potential as bioindicators, because in three (Pb, Zn and Mn) out of the five elements measured, cestodes have accumulated the highest metal concentrations ( $p < 0.05$ ), and accumulated Cu and Cd as the second highest concentration ( $p < 0.05$ ) when compared to host tissues. Therefore, the present study thus indicated that the *Senga*

*parva* accumulated metals and might have potential as a bioindicator of heavy metal pollution.

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk ijazah Sarjana Sains

**PENGECAMAN CACING PITA DARI IKAN *Channa micropeltes* (Cuvier, 1831) DAN POTENSINYA SEBAGAI BIOPENUNJUK PENCEMARAN LOGAM BERAT AKUATIK**

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Pada masa ini, parasit dapat menarik minat yang kian bertambah daripada para pengkaji ekologi parasit sebagai penunjuk yang berpotensi terhadap kualiti alam sekitar oleh sebab kepelbagaian cara bagaimana mereka bertindak balas terhadap pencemaran antropogenik. Walau bagaimanapun, sehingga sekarang, tidak banyak yang diketahui tentang pengumpulan toksin dalam parasit. Sesetengah parasit, terutamanya acanthocephalans dalam usus dan cestodes dalam ikan, boleh mengumpul logam berat pada kepekatan mengikut magnitud yang lebih tinggi daripada yang berada dalam tisu perumah atau alam sekitar. Tambahan pula, hanya sedikit cacing parasit yang setakat ini telah direkodkan dalam ikan air tawar Malaysia. Dalam satu kajian oleh Fernando dan Furtado (1964), mereka menemui satu spesis dalam *Channa striatus* dan dua spesis dalam *Channa micropeltes*. Oleh itu, matlamat kajian ini adalah untuk mengenal pasti spesis cestodes dari *Channa micropeltes* (Cuvier, 1831) dan menilai kemampuan mengumpul logam pada cestodes berbanding perumah sebagai sentinel yang berkemungkinan dapat memantau peningkatan pencemaran logam berat dalam persekitaran danau.

Sebenarnya, potensi kesesuaian cestodes sebagai organisma sentinel untuk pencemaran logam dalam keadaan alam semula jadi telah ditentukan.

Sebanyak tiga puluh (30) ekor ikan Toman, *Channa micropeltes* (Cuvier, 1831), telah dikumpulkan di Sungai Chomo, Tasik Kenyir, Malaysia. Tisu otot, hati, usus dan buah pinggang telah dikeluarkan dari setiap ikan dan usus telah dibuka untuk mendedahkan cestodes. Cestoda telah dikenal pasti atas dasar ciri-ciri morfologi mereka. Dalam usaha untuk menilai kepekatan logam berat dalam persekitaran yang terkumpul dalam ikan dan cestode, sampel air pada lapisan permukaan dan sedimen turut dikumpulkan. Sedimen di bahagian bawah tasik telah diambil dengan menggunakan Ekman-Grab di tiga stesen yang berbeza di seluruh Sungai Chomo di Tasik Kenyir. Semua sampel tisu ikan, cestodes dan sedimen telah disimpan beku pada  $-20^{\circ}\text{C}$  untuk analisis logam. Kemudian mereka telah dihadam dan kepekatan Mangan (Mn), Zink (Zn), Kuprum (Cu), Kadmium (Cd) dan Plumbum (Pb) telah dianalisis dengan menggunakan peralatan inductively-couple plasma mass spectrometry (ICP-MS).

Untuk pengecaman cestoda daripada *Channa micropeltes* di Tasik Kenyir, selepas pewarnaan, lukisan dengan menggunakan Kamera Lucida, pengukuran dengan menggunakan advanced microscope dan menggunakan Mikroskop Imbasan Elektron (SEM), ia menunjukkan bahawa cestoda *Senga parva* (Fernando dan Furtado, 1964). Ia berbeza dari spesis lain daripada genus *Senga*, menjangkiti ikan genus *Channa*, oleh saiz strobila, scolek, cakera apikal, cangkuk, bilangan cangkuk, testis dan beberapa ciri-ciri yang lain.



Untuk pengesanan logam berat, keputusan juga menunjukkan bahawa cacing mempunyai potensi sebagai petunjuk biologi, kerana dalam tiga (Pb, Zn dan Mn) daripada lima elemen yang diukur, cestodes telah mengumpul kepekatan logam yang tertinggi ( $p < 0.05$ ), dan terkumpul Cu dan cd sebagai kepekatan kedua tertinggi ( $p < 0.05$ ) berbanding tisu perumah. Oleh itu, kajian ini menunjukkan bahawa *Senga parva* dapat mengumpul logam dan mungkin berpotensi sebagai petunjuk biologi kepada pencemaran logam berat.