

SYSTEMATIC AND PHYLOGENETIC OF
SEA CATFISHES (SILURIFORMES:
ARIIDAE) IN PENINSULAR MALAYSIA

SITI WAZNAH BINTI ABDURAHMAN

DOCTOR OF PHILOSOPHY
UNIVERSITI MALAYSIA TERENGGANU

2015

SITI WAZNAH BINTI ABDURAHMAN

DOCTOR OF PHILOSOPHY

2015

SYSTEMATIC AND PHYLOGENETIC OF SEA
CATFISHES (SILURIFORMES: ARIIDAE) IN
PENINSULAR MALAYSIA

SITI WAZNAH BINTI ABDURAHMAN

Thesis Submitted in Fulfilment of the Requirement
for the Degree of Doctor of Philosophy in the
School of Fisheries and Aquaculture Sciences
Universiti Malaysia Terengganu

February 2015

Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu
in fulfilment of the requirement for the degree of Doctor of Philosophy

**SYSTEMATIC AND PHYLOGENETIC OF SEA CATFISHES
(SILURIFORMES: ARIIDAE) IN PENINSULAR MALAYSIA**

SITI WAZNAH BINTI ABDURAHMAN

March 2015

**Main Supervisor : Prof. Emeritus Mohd Azmi bin Ambak,
Ph.D.**

**Co-supervisor :Shahreza bin Md. Sheriff, Ph.D.
Prof. Ahmed Jalal Khan Chowdhury, Ph.D.
Seah Ying Giat, Ph.D.**

School :Fisheries and Aquaculture Sciences

A taxonomic study was carried out on ariid (Siluriformes: Ariidae) in order to determine their status in Peninsular Malaysian waters, with the commentaries on their phylogenetic relationships. A clear diagnostic characters, species descriptions, and a 'key to species' were also established. A total of 15 species of ariid in 10 genera were identified and documented with new records of *Arius leptotacanthus* and *Hemiaris sona* throughout this study. In fact, it is estimated that 25 species of ariid in 11 genera were presence in Malaysian waters according to the present study and previous records.

Molecular approach using partial cytochrome *b* gene was applied for the construction of the ariid phylogenetic tree. The results were analysed based

on 10 genera found throughout this study, namely *Arius*, *Batrachocephalus*, *Cryptarius*, *Hemiarius*, *Hexanematichthys*, *Ketengus*, *Nemapteryx*, *Netuma*, *Osteogeneiosus*, and *Plicofollis*. The *Plicofollis* and *Netuma* species were observed to be a monophyletic group with their own synapomorphic characters, whereas, *Arius* species was considered as a non-monophyletic group. *Batrachocephalus*, *Ketengus* and *Osteogeneiosus* species were considered as monospecies by having their own autapomorphic characters. Overall, the phylogenetic relationships determined using the molecular marker is congruent with the morphological characters examined throughout this study.

A detail species level investigation on morphological variations and molecular characterizations were determined for *Arius*, *Netuma*, and *Plicofollis* species, which shared very similar morphological features. The multivariate discriminant function analysis using truss network measurements for all three genera produced clear separations of the species in their respective groups. Specific measurements of body depth, body length, and caudal region were identified as the useful characters to accurately distinguish the species within each genus. In addition, the molecular characterization examined for *Arius*, *Netuma* and *Plicofollis* species produced three separate phylogenetic trees with clear clustering of the species in their respective groups. The present study reveals that both morphological and molecular approaches used could provide additional information on the different aspects of taxonomic information for the species studied.

Generally, the present study provides a clear clarification on ariid taxonomy in Peninsular Malaysian waters. The results obtained in this study could contribute significantly on the revision of ariid taxonomy in Malaysia and South-east Asian countries as well.

Abstrak tesis yang dikemukakan kepada Senat Universiti Malaysia Terengganu sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

SISTEMATIK DAN FILOGENETIK IKANDURI (SILURIFORMES: ARIIDAE) DI SEMENANJUNG MALAYSIA

SITI WAZNAH BINTI ABDURAHMAN

Mac 2015

Penyelia Utama : Prof. Emeritus Mohd Azmi bin Ambak, Ph.D.

**Penyelia Bersama: Shahreza bin Md. Sheriff, Ph.D.
Prof. Ahmed Jalal Khan Chowdhury, Ph.D.
Seah Ying Giat, Ph.D.**

Pusat Pengajian : Sains Perikanan dan Akuakultur

Satu kajian taksonomi telah dijalankan ke atas ikan duri untuk menentukan statusnya di perairan Semenanjung Malaysia, dengan ulasan-ulasan mengenai hubungan filogenetik mereka. Ciri-ciri diagnostik yang jelas, penerangan mengenai spesies-spesies, dan kunci kepada spesies juga telah dihasilkan. Sebanyak 15 spesies ikan ariid dalam 10 genus telah dikenalpasti dan didokumentasikan sepanjang kajian ini, dengan dua spesies yang pertama kali dijumpai, iaitu *Arius leptotacanthus* dan *Hemiarisussona*. Menurut kajian ini dan rekod-rekod dari kajian-kajian yang dijalankan sebelum ini, dianggarkan bahawa secara keseluruhannya terdapat 25 spesies ikan duri dalam 11 genus di perairan Malaysia.

Pendekatan molekuler telah dilaksanakan dengan menggunakan sepa gen *cytochrome b* untuk pembinaan pokok filogenetik ikan duri. Keputusan yang dihasilkan adalah berdasarkan 10 genus ikan duri yang dijumpai sepanjang kajian ini iaitu *Arius*, *Batrachocephalus*, *Cryptarius*, *Hemiaris*, *Hexanematichthys*, *Ketengus*, *Nemapteryx*, *Netuma*, *Osteogeneiosus*, dan *Plicofollis*. Spesies *Plicofollis* dan *Netuma* merupakan kumpulan monofiletik, manakala, spesies *Arius* adalah kumpulan bukan monofiletik. Spesies *Batrachocephalus*, *Ketengus* dan *Osteogeneiosus* adalah monospesies, di mana spesies-spesies ini mempunyai ciri-ciri *autapomorph* mereka tersendiri. Secara keseluruhannya, hubungan filogenetik yang dikaji dengan menggunakan pendekatan molekuler bersesuaian dengan ciri-ciri morfologi yang dianalisis sepanjang kajian ini.

Pencirian morfologi dan molekul telah dijalankan ke atas spesies-spesies *Arius*, *Netuma*, dan *Plicofollis*, di mana kumpulan ikan ini kebiasaannya mempunyai ciri-ciri morfologi yang sama. Analisis diskriminasi menggunakan ukuran-ukuran *truss network* bagi ketiga-tiga genus telah menghasilkan pemisahan yang jelas bagi kesemua spesies didalam kumpulan masing-masing. Ukuran-ukuran khas pada ketinggian badan, panjang badan, dan sekitar bahagian ekor, telah dikenal pasti sebagai ciri-ciri berguna yang dapat membezakan spesies-spesies dalam setiap genus tersebut dengan lebih tepat. Di samping itu, pencirian molekul yang dianalisis untuk spesies-spesies *Arius*, *Netuma* dan *Plicofollis* telah menghasilkan tiga pokok filogenetik berlainan yang mengelompokkan setiap spesies dalam kumpulan masing-masing. Kajian ini

menunjukkan bahawa kedua-dua kaedah morfologi dan molekul dapat menyumbangkan maklumat tambahan taksonomi tentang spesies-spesies yang telah dikaji.

Secara keseluruhannya, kajian ini memberikan penerangan yang jelas mengenai taksonomi ikan duri di perairan Semenanjung Malaysia. Keputusan yang diperolehi dalam kajian ini boleh memberikan sumbang yang penting kepada taksonomi ikan duri di Malaysia dan juga negara-negara Asia Tenggara.