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DIVERSITY, BIOLOGICAL AND ECOLOGICAL ASPECTS OF MARINE BAITWORMS, WITH AN EMPHASIS ON A POLYCHAETE *Marphysa moribidii* (IDRIS, HUTCHINGS, ARSHAD 2014) FROM MORIB MANGROVE AREA, MALAYSIA

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By

IZWANDY BIN IDRIS

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

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DEDICATIONS

To my wife, Wan Iryani Wan Ismail, who has been standing by my side throughout my postgraduate studies and since being together for the past 12 years. Not to forget our daughters, Nurul Iffah and Nurul Izzah Natheema for them to endure the lack of quality time during my study period

To my parents and siblings, especially my mother whom I want to make her proud of her son's achievement

To my mother in law who have made her daughter a very supportive wife

and finally

To all who believe in me

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirements for the degree of Doctor of Philosophy

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The commercial value of marine baitworms from Class Polychaeta in Malaysia is not fully explored. It was previously researched by selected, local and foreign researchers. Hence, the objectives of the present study are to identify taxonomically polychaete species used as baitworms in Peninsular Malaysia, and to examine the biology and ecology of the dominant species.

The study was performed in two phases; the first phase was to systematically identify polychaete species used as baitworms in Peninsular Malaysia. The second phase focused on the biology and ecology of a dominant species from June 2011 to December 2012 at the Morib mangrove area in Selangor, Peninsular Malaysia. Random transect quadrats across three designated tidal flat areas were used to collect samples.

A total of seven polychaete species were identified in this study, namely *Marphysa moribidii* sp. nov., *M.* cf. *sanguinea*, *Halla okudai*, *Diopatra claparedii*, *Namalycastis rhodochorde*, *N.* cf. *abiuma* and *Perinereis* cf. *nuntia*. *Marphysa moribidii* sp. nov. was named and described in this study while *M.* cf. *sanguinea*, *N.* cf. *abiuma* and *P.* cf. *nuntia* had close similarities with the existing species. All species are new records in Malaysia with the exception of *D. claparedii* and *N. rhodochorde* which were previously reported in Kedah and Sabah respectively. *Marphysa moribidii* sp. nov. is the dominant baitworm species collected by the bait diggers and have a wide distribution across the west coast of Peninsular Malaysia.

The population of *M. moribidii* sp. nov. in Morib mangroves, was mostly confined in the upper tidal flat (UTF) area, particularly within the patchy microhabitat, which was identified as polychaete niche (PN). The microhabitat was characterised by having a high percentage of total organic matter, water content, silt and very fine sand. It was also located around the stilt roots of *Rhizophora apiculata*, providing protection from potential predators. Allometry analyses indicate that the growth of the species followed an allometric pattern. The maximum life span (t_{max}) was two years with growth constant (K) of 1.5 year^{-1}. The Bhattacharya and NORMSEP analyses concluded that there were two major spawning events occurred in 2012, although the von Bertalanffy Growth Function (VBGF) was only able to detect one spawning event.

The male and female ratio was close to 1:1. The gametogenesis processes were asynchronous in both sexes. Fecundity data revealed that there were two spawning seasons occurred during the study period.

Marphysa moribidii sp. nov. exhibited subsurface deposit feeding with high percentage of organic matter found in its intestinal contents. It also practices selective feeding by consuming a higher percentage of very fine sand compared to other sediments size classes. This sediments size class was chosen by *M. moribidii* sp. nov. for its high surface volume ratio which allowed more surfaces for organic coatings.

In summary, several aspects covering the systematics, biology and ecology of marine baitworms, in particular, *M. moribidii* sp. nov. in Peninsular Malaysia, have been documented in this study. Results obtained indicated that the biology and ecology of *M. moribidii* sp. nov. in Morib mangrove were interrelated. Moreover, the biological characteristics of *M. moribidii* sp. nov. meet all the criteria for commercial baitworm species. Nevertheless, more studies are needed to grasp a better understanding of the species, to allow correct resource management and to carefully consider the possibility of rearing the species in an artificial environment.

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

KEPELBAGAIAN SERTA ASPEK BIOLOGI DAN EKOLOGI UMPUN-UMPUN UMPAN MARIN, DENGAN TUMPUAN KEPADA 'POLYCHAETE' *Marphysa moribidii* (IDRIS, HUTCHINGS, ARSHAD 2014) DARI KAWASAN PAYA BAKAU MORIB, MALAYSIA

Oleh

IZWANDY BIN IDRIS

Disember 2014

Pengerusi: Professor Aziz Arshad, PhD

Fakulti: Pertanian

Nilai komersil umpun-umpun umpan marin dari Kelas 'Polychaeta' di Malaysia masih tidak dikaji dengan lengkap. Ini kerana kajian awal ke atas 'polychaete' dijalankan secara selektif oleh penyelidik tempatan dan luar negara. Matlamat kajian ini adalah untuk mengenalpasti melalui taksonomi spesis 'polychaete' yang digunakan sebagai umpun-umpun umpan marin di Semenanjung Malaysia dan memahami biologi dan ekologi spesies umpun-umpun umpan marin yang utama.

Kajian dijalankan melalui dua fasa; fasa pertama untuk mengenalpasti spesies 'polychaete' yang digunakan sebagai umpun-umpun umpan marin di Semenanjung Malaysia. Fasa kedua pula melibatkan kajian ke atas biologi dan ekologi satu spesies dominan di kawasan bakau Morib bermula dari Jun 2011 sehingga Disember 2012. Sampel dikutip menggunakan keadah kuadrat transek rawak merentasi tiga kawasan dataran pasang surut yang ditetapkan terlebih awal.

Tujuh spesies 'polychaete' dikenalpasti melalui kajian ini iaitu *Marphysa moribidii* sp. nov., *M.* cf. *sanguinea*, *Halla okudai*, *Diopatra claparedii*, *Namalycastis rhodochorde*, *N.* cf. *abiuma* dan *Perinereis* cf. *nuntia*. *Marphysa moribidii* sp. nov. adalah spesies yang baru diberi nama dan dicirikan melalui kajian ini. *Marphysa* cf. *sanguinea*, *N.* cf. *abiuma* dan *P.* cf. *nuntia* pula mempunyai persamaan dengan

spesies yang telah dikenalpasti. Selain daripada *D. claparedii* dan *N. rhodochorde* yang masing-masing telah direkodkan di Kedah dan Sabah, spesies 'polychaete' yang dijumpai dalam kajian ini direkodkan buat pertama kali di Malaysia. *Marphysa moribidii* sp. nov. merupakan spesies dominan yang diambil oleh pencari umpun-umpun umpan marin dan mempunyai taburan terluas di persisiran pantai barat Semenanjung Malaysia.

Populasi *M. moribidii* sp. nov. di kawasan bakau Morib kebanyakannya bertumpu di kawasan 'upper tidal flat' (UTF), khususnya di habitat mikro yang dikenali sebagai 'polychaete niche' (PN). Mikro habitat ini mempunyai ciri seperti peratusan kandungan bahan organik, air, selut serta pasir sangat halus yang tinggi. Ia juga berada di dalam kawasan akar jangkang *Rhizophora apiculata*, dipercayai memberikan perlindungan kepada *M. moribidii*. Analisis alometri menunjukkan bahawa corak pertumbuhan *M. moribidii* sp. nov. adalah alometrik. Jangka hayat maksimum *M. moribidii* sp. nov. di kawasan bakau Morib (t_{max}) ialah dua tahun dengan kadar pertumbuhan (K) sebanyak 1.5 tahun^{-1}. Analisis 'Bhattacharya' dan 'NORMSEP' menunjukkan terdapat dua musim peneluran utama berlaku dalam setahun. Walaupun begitu, 'Fungsi Pertumbuhan von Bertalanffy' (VBGF) hanya dapat mengesan satu musim peneluran sahaja.

Nisbah di antara jantan dan betina menghampiri 1:1. Proses gametogenesis berlaku secara tidak berturutan di dalam kedua-dua jantina. Analisis data fekunditi mendapati terdapat dua musim peneluran berlaku sepanjang tempoh kajian dijalankan.

Marphysa moribidii sp. nov. mengamalkan pemakanan deposit bawah permukaan berdasarkan kepada kadar peratusan bahan organik yang tinggi dijumpai di dalam kandungan saluran pemakanannya. Spesies ini turut mengamalkan pemakanan memilih berdasarkan dengan peratusan kandungan pasir sangat halus yang lebih tinggi berbanding dengan sedimen kelas lain di dalam saluran pemakanan. Sedimen kelas ini mempunyai nisbah permukaan dan isipadu yang tinggi berbanding dengan sedimen kelas lain bagi pelekatan selaput organik.

Kesimpulannya, beberapa aspek meliputi taksonomi, biologi dan ekologi umpun-umpun umpan marin terutamanya *M. moribidii* sp. nov. di Semenanjung Malaysia telah berjaya direkodkan di dalam kajian ini. Keputusan yang diperolehi menunjukkan biologi dan ekologi *M. moribidii* sp. nov. di kawasan bakau Morib adalah saling berkaitan. Selain itu, ciri biologi *M. moribidii* sp. nov. menepati semua kriteria yang perlu sebagai spesies yang mempunyai nilai komersil. Walau bagaimanapun, kajian lanjutan perlu dilakukan untuk memahami spesies ini dengan lebih mendalam bagi membolehkan pengurusan sumber yang tepat dan kemungkinan untuk penternakan di persekitaran buatan.