UNIVERSITI PUTRA MALAYSIA

GENETIC AND MORPHOMETRIC VARIATION OF MARINE PRAWNS, *Penaeus monodon* Fabricius AND *Fenneropenaeus merguiensis* De Man IN MALAYSIAN WATERS

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MASTER OF SCIENCE
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By

DANIA AZIZ

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirement for the Degree of Master of Science

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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Chairman: Prof. Siti Shapor Siraj, PhD

Faculty: Agriculture

Marine prawns are divided into two common genera of *Penaeus* and *Fenneropenaeus*. *Fenneropenaeus merguiensis* is locally known as banana prawn while *Penaeus monodon* is tiger prawn. These prawns are widely distributed and are extensively cultured in the tropical and subtropical waters. Information on the genetic structure and diversity of natural populations for both the species is still limited eventhough it has long been exploited. Thus, the present study is to genetically characterize the wild and cultured populations by using morphological and microsatellite markers.

A total of 16 populations were randomly selected representing 12 from Peninsular Malaysia and 4 from East Malaysia. Nineteen characters were measured using the conventional morphometric method and were analyzed according to the ratios of abdominal length and total length to reduce the

allometric effects. The T-test analysis showed that the two species are statistically different from each other in the majority of the morphological traits.

A total number of alleles per locus ranged from 3 to 9 with the allele size ranging from 100 to 300 base pairs. Overall F_{ST} value was high (73.4%), with great differentiation among the populations of both the species. F_{IT} and F_{IS} values were low but highly significant ($P<0.05$), suggesting a slight deficiency of heterozygosity. Chi-square (χ^2) and likelihood ratio (G^2) tests showed significant deviation ($p<0.05$) from Hardy-Weinberg equilibrium except for two loci.

Considerable genetic distances were observed among all the populations with values ranging from 0.0103 to 0.6296. The genetic structure among the prawns within each region implies that mixing of individuals might have occurred, UPGMA dendrogram showed two major clusters, representing the two species. The wild and the cultured populations were also grouped separately. The genetic relationship between both the species was close, probably because the prawns are marine-estuarine species. There are no specific barrier to prevent migrations and genetic flow thus, there is still some form of interaction via migration and mating between the populations despite their geographical distance.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Master Sains

MORFOMETRIK DAN VARIASI GENETIK UDANG MARIN, *Penaeus monodon* Fabricius DAN *Fenneropenaeus merguiensis* De Man DI PERAIRAN MALAYSIA

Oleh

DANIA AZIZ

September 2011

Pengerusi: Prof. Siti Shapor Siraj, PhD

Fakulti: Pertanian

Udang marin terbahagi kepada dua genus yang biasa dijumpai iaitu *Penaeus* dan *Fenneropenaeus*. *Fenneropenaeus merguiensis* dikenali dengan nama tempatan sebagai udang putih manakala *Penaeus monodon* dikenali sebagai udang harimau. Udang ini tersebar secara meluas dan dikultur secara ekstensif di perairan tropik dan subtropik. Maklumat mengenai struktur dan kepelbagaian genetik populasi udang liar ini masih terhad dan tidak mencukupi, walaupun ia merupakan spesies yang telah lama dieksploitasi. Oleh itu tujuan kajian ini adalah untuk menghuraikan variasi morfologi dan genetik di kalangan populasi udang di perairan Malaysia.

Sejumlah 16 populasi dipilih secara rawak mewakili 12 populasi daripada Semenanjung Malaysia dan 4 populasi dari Malaysia Timur. Sembilan belas

ciri diukur menggunakan kaedah morfometrik konvensional dan dianalisisa mengikut nisbah panjang abdomen dan panjang keseluruhan untuk mengurangkan kesan alometrik. Analisis T-test menunjukkan perbezaan yang ketara dari segi statistik untuk kedua-dua spesies bagi majoriti ciri morfologi setiap individu.

Sejumlah bilangan alel per lokus berjulat daripada 3 hingga 9 dengan julat saiz alel daripada 100 hingga 300 pasangan bes. Nilai F_{ST} menunjukkan perbezaan yang tinggi (73.4%) di kalangan populasi kedua-dua spesies. Nilai F_{IT} dan F_{IS} adalah rendah tetapi signifikan ($P<0.05$), ini menunjukkan berlakunya pengurangan heterozigositi. Nilai (χ^2) chi-square dan nisbah 'likelihood' (G^2) menunjukkan penyimpangan signifikan daripada Hukum Hardy-Weinberg kecuali dua lokus.

Jarak genetik tercerap di kalangan semua populasi mempunyai nilai yang berjulat daripada 0.0103 hingga 0.6296. Struktur genetik udang ini dalam setiap kawasan mencerminkan bahawa berlakunya pencampuran individu. Dendrogram UPGMA menunjukkan dua kumpulan utama, yang mengkelaskan kedua-dua spesies udang. Populasi alami dan kultur juga tergulung secara berasingan. Hubungan genetik di antara kedua-dua spesies udang adalah dekat, ini mungkin disebabkan oleh kedua-dua udang ini merupakan spesies marin-muara sungai. Tiada penghalang khusus bagi menghindar migrasi dan aliran genetik justeru, berlaku interaksi melalui migrasi dan kacukan di kalangan populasi walaupun berjauhan secara geografi.

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I certify that a Thesis Examination Committee has met on 9th September 2011 to conduct the final examination of Dania Aziz on her thesis entitled "Genetic Variation of Marine Prawns, *Penaeus monodon* Fabricius and *Fenneropenaeus merguiensis* De Man in Malaysian Waters" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

Members of the Thesis Examination Committee were as follows:

Che Roos Saad, PhD
Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Chairman)

Faridah Qamaruz Zaman, PhD
Associate Professor
Faculty of Science
Universiti Putra Malaysia
(Internal Examiner)

Maheran Abdul Aziz, PhD
Associate Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Internal Examiner)

Siti Azizah Mohd. Nor, PhD
Professor
Pusat Pengajian Sains Kajihayat
Universiti Sains Malaysia
Malaysia
(External Examiner)

SEOW HENG FONG, PhD
Professor and Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 20 December 2011

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfillment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

Siti Shapor Siraj, PhD
Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Chairman)

Siti Khalijah Daud, PhD
Associate Professor
Faculty of Science
Universiti Putra Malaysia
(Member)

Jothi Malar Panandam, PhD
Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Member)

_____
BUJANG BIN KIM HUAT, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

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DANIA AZIZ

Date: 9th September 2011

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