PHYLOGENETIC ANALYSIS OF *Gasteracantha, Thelacantha* AND *Macracantha* SPINY ORB-WEAVERS (ARANEAE; ARANEIDAE) IN PENINSULAR MALAYSIA

By

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ABSTRACT

PHYLOGENETIC ANALYSIS OF *Gasteracantha*, *Thelacantha* AND *Macracantha* SPINY ORB-WEAVERS (ARANEAE; ARANEIDAE) IN PENINSULAR MALAYSIA

Ooi Chia Ler

Spiny orb-weavers are a group of poorly studied spiders that possess a rigid abdominal exoskeleton often paired with protruding spines. In this study, seven species of female spiny orb-weavers from the genera *Gateracantha*, *Thelacantha* and *Macracantha* were collected. The morphological and molecular data of these spiders were examined and analyzed for species identification and taxonomic grouping. The morphological features examined included coloration, abdominal spine arrangement, leg and eye dimensions, the ratio of abdominal spine lengths, sternal features and external structure of epigyne. It was established that the abdominal spine arrangement, abdominal spine lengths, sternal features and external structure of epigyne can be used to reliably differentiate female individuals of each species. Morphological identification has proved challenging due to the rigid abdomen of spiny spiders which is difficult to chemically digest or surgically remove. This was exacerbated by the lack of male specimens. Therefore, the molecular approach was adopted to supplement the morphological data. Concatenated

mitochondrial 16S and COI markers were amplified, sequenced and analyzed for molecular identification and phylogenetic reconstruction of these spiny spiders. The molecular identification of each species agreed with morphological results. However, the few deposited GenBank sequences may limit the potential of molecular identification at this time. In terms of phylogeny, three trees of similar topology were generated based on the COI, 16S and concatenated COI + 16S datasets where *Gasteracantha*, *Macracantha* and *Thelacantha* were each inferred to be monophyletic. However, it was observed that *Gasteracantha crucigera* and *Gasteracantha hasselti* appeared to have shared a common ancestry with *Macracantha arcuata* with supports (ML> 99; BI=1.00). These species recorded a genetic difference at least 9.51% to *Macracantha* as compared to the other species of *Gastracantha*. Additionally, haplotype analyses have revealed the possibility and extent of gene flow within several species of spiny orb-weavers in Peninsular Malaysia.

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Last but not least, I especially thank for my mom, dad and brothers who provided unconditional love and care. I would not have made it this far without them.

DECLARATION

I hereby declare that the project is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UTAR or other institutions.

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APPROVAL SHEET

This project report entitled "**PHYLOGENETIC ANALYSIS OF *Gasteracantha*, *Thelacantha* AND *Macracantha* SPINY ORB-WEAVERS (ARANEAE; ARANEIDAE) IN PENINSULAR MALAYSIA**" was prepared by OOI CHIA LER and submitted as partial fulfilment of the requirements for the degree of Bachelor of Science (Hons) Agricultural Science at Universiti Tunku Abdul Rahman.

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PERMISSION SHEET

It is hereby certified that **OOI CHIA LER** (ID No: **15ADB00117**) has completed this final year project/ dissertation/ thesis* entitled "PHYLOGENETIC ANALYSIS OF *Gasteracantha*, *Thelacantha* AND *Macracantha* SPINY ORB-WEAVERS (ARANEAE; ARANEIDAE) IN PENINSULAR MALAYSIA" under the supervision of Dr. Tan Ji (Supervisor) from the Department of Agricultural and Food Science, Faculty of Science.

I hereby give permission to the University to upload the softcopy of my thesis in PDF format into the UTAR Institutional Repository, which may be made accessible to the UTAR community and public.

Yours truly,

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(OOI CHIA LER)

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LIST OF ABBREVIATIONS

AL	Abdominal Length
ALE	Anterior Lateral Eye
AME	Anterior Median Eye
AW	Abdominal Width
bp	Base Pairs
BI	Bayesian Inference
BLASTN	Basic Local Alignment Search Tool for Nucleotide
COI	Cytochrome Oxidase I
CL	Cephalothorax Length
CW	Cephalothorax Width
dH_2O	Distilled Water
DNA	Deoxyribonucleic Acid
dNTP	Deoxyribonucleotide Triphosphate
kb	Kilobase
KM/km	Kilometre
mA	milliampere
ml	Microlitre
mm	Millimetre
ML	Maximum Likelihood

MSA	Multiple Sequence Alignment
MY	Malaysia
NCBI	National Center for Biotechnology Information
PCR	Polymerase Chain Reaction
PLE	Posterior Lateral Eye
PME	Posterior Median Eye
rpm	Revolutions per Minute
RNA	Ribonucleic Acid
spp.	Species
TAE	Tris-acetate-ethylenediaminetetraacetic acid
TL	Total Length
µL	Microliter