UNIVERSITI PUTRA MALAYSIA

FORMATION OF SECRETORY GRANULES AND MODE OF SECRETION IN THE SALIVARY GLANDS OF SWIFTLET- AN ULTRASTRUCTURAL STUDY

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CERTIFICATION

I hereby certify that I have read this project paper entitled "Formation of Secretory Granules and Mode of Secretion in the Salivary Glands of Swiflets - An Ultrastructural Study", by Ainul Riza Binti Abu Seman and in my opinion it is satisfactory in term of the scope, quality, and presentation as partial fulfilment of the requirement for the course VPD 4999- Final Year Project.

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DEDICATIONS

This project paper is dedicated to Allah S.W.T., who had created me and made all things possible throughout this project,

To my family:

My father, Abu Seman B. Umar

My mother, Ruzaimah Bt. Rahmat

My brother, Mohd. Jamuri B. Abu Seman

My friends

And to all my teachers who have committed themselves towards the noble cause of education. Thank you for your continuous support and care.

May this be your inspiration and motivation for your future endeavours

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LIST OF ABBREBIATIONS

%	Percent
nm	Nanometer
µm	Micrometer
°C	Degree Celsius
Å	Angstrom
EBN	Edible bird nest
ER	Endoplasmic Reticulum
L	Lumen
M	Molar
MV	Microvilli
N	Nucleus
rER	Rough Endoplasmic Reticulum
RNA	Ribonucleic acid
SG	Secretory granule
TEM	Transmission electron microscope

ABSTRAK

Abstrak kertas projek yang dikemukakan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada keperluan kursus VPD 4999- Projek Ilmiah Tahun Akhir

PEMBENTUKAN TITISAN REMBESAN DAN MOD REMBESAN DALAM KELENJAR LIUR BURUNG WALIT- KAJIAN ULTRASTRUKTUR

Oleh

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2016

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Dua spesies burung walit - *Aerodramus fuciphagus* dan *Aerodramus maximus* merupakan spesies spesies burung yang membina sarang daripada rembesan kelenjar liur. Pada musim pembiakan, terutamanya semasa membuat sarang, kelenjar liur jelas kelihatan membesar dan membengkak untuk menghasilkan rembesan air liur yang banyak yang akan mengeras menjadi sarang yang juga merupakan sarang burung boleh dimakan.

Sarang burung walit telah dilaporkan mengandungi banyak khasiat dan diperkaya dengan ciri-ciri keimunan dan antivirus terhadap penyakit. Kajian ini meneliti di peringkat ultrastruktur dengan tumpuan diberikan kepada pembentukan granul rembesan dan kaedah rembesan kelenjar liur *A. fuciphagus*. Kajian ini juga bertujuan untuk memberi bukti dari segi struktur untuk menjelaskan kemungkinan sumber keimunan dan antivirus pada sarang burung sesuai dimakan.

Untuk kajian ini, sampel kelenjar liur telah diteliti di bawah mikroskop elektron transmisi (TEM). Pembentukan granul rembesan kelenjar liur berasal daripada penghujung retikulum endoplasma kasar yang terasing dan yang bercantum antara satu sama lain. Seterusnya, granul rembesan ini dibawa kebahagian sitoplasma apikal dimana ianya juga bergabung antara satu sama lain untuk membentuk granul rembesan yang lebih besar.

Isi kandungan granul rembesan dibebaskan kedalam lumen asinus kelenjar melalui ruptur membran granul yang menkelaskan kaedah rembesan kelenjar liur burung walit sebagai rembesan merokrin. Pada peringkat ultrastruktur, bukti struktur menunjukan bahawa ciri keimunan dan antivruspada sarang burung walit berkemungkinan disumbangkan oleh ribosom sitoplasma sel asinus.

Katakunci: *burung walit, ultrastruktur, pembentuka titisan rembesan, rembesan merokrin, ribosom*

ABSTRACT

Abstract of project paper presented to the Faculty of Veterinary Medicine in partial requirement for the course VPD 4999 – Final Year Project

FORMATION OF SECRETORY GRANULES AND MODE OF SECRETION IN THE SALIVARY GLAND OF SWIFTLETS – AN ULTRASTRUCTURAL STUDY

By

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2016

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Two swiftlets species, the *Aerodramus fuciphagus* and *Aerodramus maximus* are the only avian species which are known to build their nest from the secretion of their salivary glands. During the breeding season especially during nesting the salivary gland was markedly enlarged and hypertrophied to produce the salivary secretion which hardened to become the nest which is the edible bird nest (EBN).

EBN has been reported to be highly nutritious and fortified with immuno-competent and antiviral properties. The present study examined this unique gland at the ultrastructural level focusing on the formation of secretory granules and mode of secretion in the salivary gland of *A. fuciphagus*. The study was also intended to provide some plausible explanation on the origin or source of the immuno-competent and antiviral properties of the EBN.

For the above study, samples of swiftlet salivary glands were processed and examined under the transmission electron microscope. Formation of the secretory granules appeared to originate from coalescence of pinched off dilated ends of the rough endoplasmic reticulum. These were carried to the apical cytoplasm where they again coalesced to form larger secretory granules.

The content of the secretory granule appeared to be released into the lumen of acinus by rupture of the apical cell membrane which classify the mode of secretion in the salivary gland of the swiftlet as the merocrine type. Ultrastructural evidences indicated that the immuno-competent and antiviral properties of the EBN could be contributed by cytoplasmic ribosomes of the acinar cell.

Keywords: *swiftlet, ultrastructure, secretory granules formation, merocrine secretion, ribosomes.*

1.0 INTRODUCTION

Edible bird nests (EBN) made from hardened saliva of cave nesting swiftlets have long been a sought-after delicacy amongst the Chinese population and are among the most expensive animal products consumed by humans (Thorburn, 2015). According to Lau and Melville (1994) bird nest trade is of considerable antiquity as far back as the T'ang Dynasty.

There are more than 24 species of insectivorous, eco-locating swiftlets distributed around the world and only a few produce nests that are deemed "edible" (Koon, 2000). The majority of EBN traded worldwide comes from two heavily exploited species, the White nest swiftlet - *Aerodramus fuciphagus* - and the Black nest swiftlet - *Aerodramus maximus*- (Babji, 2011). White nest swiftlets are normally resident birds on islands, however lately they have been found to be distributed on mainland in large numbers (Tan, 2001).

The five common species of swiftlets found in Malaysia and Borneo Island are *Hydrochus gigas, Collocalia esculent* (White Belly Swifts), *Crypsiurus balasiensis* (Asian Palm Swift), *Aerodramus maximus* and *Aerodramus fuciphagus* (Ibrahim *et al*., 2009). The EBN is built entirely from salivary secretion (Mardiastuti and Soehartono, 1996; Ibrahim *et al*., 2009; Iswanto, 2002) and highly sought after for both cuisine and medicine. It is an exotic item for delicacies and used as medications to improve physical strength (Oktorina *et al*, 2005). Norhayati *et al*. (2010) states that the EBN is highly nutritious and reported to possess immuno-competent and antiviral properties.

With current research on swiftlet being directed on the commercial importance of EBN very limited research however have been focused on the various body systems of the swiftlet. Thus, there is a need to understand the anatomy, physiology and nutrition of this avian species if the swiftlet industry is to be fully develop in Malaysia. In the same perspective and in view of the uniqueness of the salivary gland in the swiftet which produce the highly sought-after EBN there is a need to undertake a study on the formation and secretion of the secretory granules in the swiftlet salivary gland.

1.1 OBJECTIVE

To study the formation of secretory granules and mode of secretion in swiftlet salivary glands. It is also to provide plausible explanations on the origin of the immuno-competent and anti-viral properties in the EBN.

1.2 JUSTIFICATION

A study on the formation of secretory granules and mode of secretion in the salivary gland involved the cytoplasmic organelles of the acinar cells. Cytoplasmic organelles could only be seen under electron microscope which necessitate that this study to be carried out at the ultrastructural level.

1.3 HYPOTHESIS

The substance produced by the salivary glands in the swiftlet to build its nest which is highly nutritive and fortified with immuno-competent and antiviral properties involve a production mechanism which is different from that in conventional gland.

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