P-ISSN: 2304-3075; E-ISSN: 2305-4360
International Journal of Veterinary Science
www.ijvets.com; editor@ijvets.com

Research Article

Macro and Microanatomical Study on the Uropygial Gland of the Mule Duck

Reda Mohamed[1,2]

[1]Department of Basic Veterinary Sciences, School of Veterinary Medicine, Faculty of Medical Sciences, The University of the West Indies, St. Augustine, Trinidad and Tobago; [2]Anatomy and Embryology Department, Faculty of Veterinary Medicine, Beni-Suef University, Beni-Suef 62511, Egypt
***Corresponding author:** kkidareda@gmail.com

Article History: Received: December 25, 2018 Revised: March 05, 2019 Accepted: March 16, 2019

ABSTRACT

The study on the gross and histological aspects of the uropygial gland of Mule duck was conducted on ten adult Mule ducks. The uropygial gland was a yellowish-creamy sebaceous gland located under the skin dorsal to the last caudal vertebra. It composed of two pear-shaped elongated lobes and papilla surrounded by downy feather. It was enclosed in a dense irregular connective capsule containing collagen and reticular fibers but devoid from smooth muscle fibers. Each lobe had secretory tubules and one excretory duct. The secretory tubules were arranged into two zones; the central and the peripheral. The epithelium of the secretory tubules was arranged in three layers; the basal, intermediate and secretory cell layers. The secretion of the uropygial gland was made up of lipids and carbohydrates which contribute to the water-repellent properties of the feather coat and serve as protection against microorganism infection.

Key words: Uropygial gland, Duck, Anatomy, Histology

INTRODUCTION

The Mule duck a sterile hybrid cross between a Muscovy and a Pekin duck. It was classified as the second of the most economic bird after fowl (Nickel *et al.*, 1977). Duck meat is one of the popular sources of protein in Trinidad and other developing countries. Breeding of these ducks occurs either in a semi enclosed or a free-range system. Many studies were done on the morphology of the uropygial gland in goose (Shafiian and Mobini, 2014), Osprey (Harem *et al.*, 2010), Adelie and Gentoo penguins (Chiale *et al.*, 2014), White Stork (Kozlu *et al.*, 2011), Kiwi (Reynold *et al.*, 2017), Moorhen (Sawad, 2006), Chimango caracara (Chiale *et al.*, 2016), White Plymouth Rock chickens (Wagner and Brood, 1975) and rock dove Montalti *et al.*, 2001). Studies showed that the secretion of the uropygial gland acts as water-repellent for the feather (Salibian, and Montalti, 2009; Chiale *et al.*, 2016), protection against bacteria and fungi (Shawkey *et al.*, 2003; Salibian and Montalti, 2009; Harem *et al.*, 2010; Chiale *et al.*, 2017), thermal insulation and pheromone production (Salibian, and Montalti, 2009), Sex signals in Budgerigars (Zhang *et al.*, 2010) as well as prostaglandin and growth hormone production (Jawad, 2017). The current study aimed to investigate the gross and histological characteristics of the uropygial gland of the adult Mule duck.

MATERIALS AND METHODS

This study has been conducted with the ducks according to the international ethical standard, by giving minimum pains to the bird. A total of ten adult apparently healthy Mule ducks irrespective of sex weighing 2-4 Kg were used in the study. They were collected from local farms in Trinidad and they were slaughtered by cutting the blood vessels of the neck. The topographic position of the uropygial gland was observed and photographed. The uropygial gland was carefully removed by manual extraction of the feathers around the gland and then making superficial incisions in the skin around the gland. The gross anatomical structures of the gland including the location colour and shape were studied and gross photographs were taken using a digital camera. Samples from the glands were taken and left in a 10% neutral buffered formalin for 24 hours to fix. After fixation the samples were dehydrated using ethanol, followed by clearing in xylene and then impregnated with soft paraffin and left to harden to obtain paraffin blocks. The blocks were then cut serially by rotary microtome into 5-7 µm thick sections and then mounted on dry, clean glass slides. The slides were stained with Harris haematoxyline and eosin (H &E) stain for general histology and Alcian blue (Ab) stain for glycogen as outlined by Drury and Wallington (1980) and then examined under a light

Cite This Article as: Mohamed R, 2019. Macro and microanatomical study on the uropygial gland of the mule duck. Inter J Vet Sci, 8(2): 96-100. www.ijvets.com

microscope. Nomina Anatomia Avium that was proposed by Baumel *et al.* (1993) was used for nomenclature of the structure of the gland.

RESULTS

Gross observations

The uropygial gland of the Mule duck was a well-developed, bilobed, creamy-yellowish V- shaped gland located on the dorsal aspect of the caudal vertebrae and directed forward and outward. The pear shaped lobes of the gland were separated cranially with connective tissue inbetween and they were connected caudally by the common papilla. Each lobe has a central cavity and an excretory duct. The two excretory ducts were joined together in the common papilla. The common papilla was short, broad, quadrilateral, compressed dorsoventrally and surrounded by skin and a tuft of downy feathers. The gland was related to the lateral coccygeus and levator coccygeus muscles ventrally and to the coccygeus muscle ventrolaterally.

Microscopic observations

The uropygial gland of the Mule duck was a simple, branched, tubular and holocrine gland. It consisted of stroma and parenchyma. The stroma was a dense irregular connective tissue capsule made up of collagen, elastic and reticular fibers devoid from smooth muscle fibers surrounded the gland. Thin septulae extended from the capsule inward between the lobes of the gland which contained the closely packed secretory tubules forming the interlobular septum. The inter connective tissue was made up of collagen, reticular and elastic fibers, and was more was numerus towards the central zone than the peripheral one. The parenchyma of the gland consisted of secretory tubules which were lined by stratified epithelium and ducts. The secretory tubules were divided into two zones regarding their location, width of lumen and height of the epithelium; the peripheral and central zones. The peripheral zone was situated close to the capsule and characterized by taller epithelium and very narrows to wide lumen, whereas the central zone was situated close to the primary cavity and characterized by very thin epithelium and a very wide lumen.

The epithelial cells of the secretory tubules had three layers; the germinal, intermediate and secretory layers. The germinal layer consisted of flattened cells with a dark nucleus and basophilic cytoplasm. The intermediate layer consisted of polyhedral cells with eosinophilic granular cytoplasm and centrally located nuclei. The secretory layer consisted of polyhedral cells with secretory granules. The cytoplasm of this layer was pale staining and vacuolated and filled by the gland secretion. The nuclei of the cells of this layer were peripherally situated. The cells of the secretory layer towards the lumen with pyknotic nuclei were degenerated cells. There were no myoepithelial cells around the secretory tubules as the gland secretion was secreted by the mechanical squeezing with the duck beak in which the secretory products were transferred from the secretory parenchyma into the lumen of each follicle, and then passed, via a minute duct of the follicle to be stored in the secondary sinus and then passed to the primary sinus to be expelled when stimulated by the bill (Fig. 2).

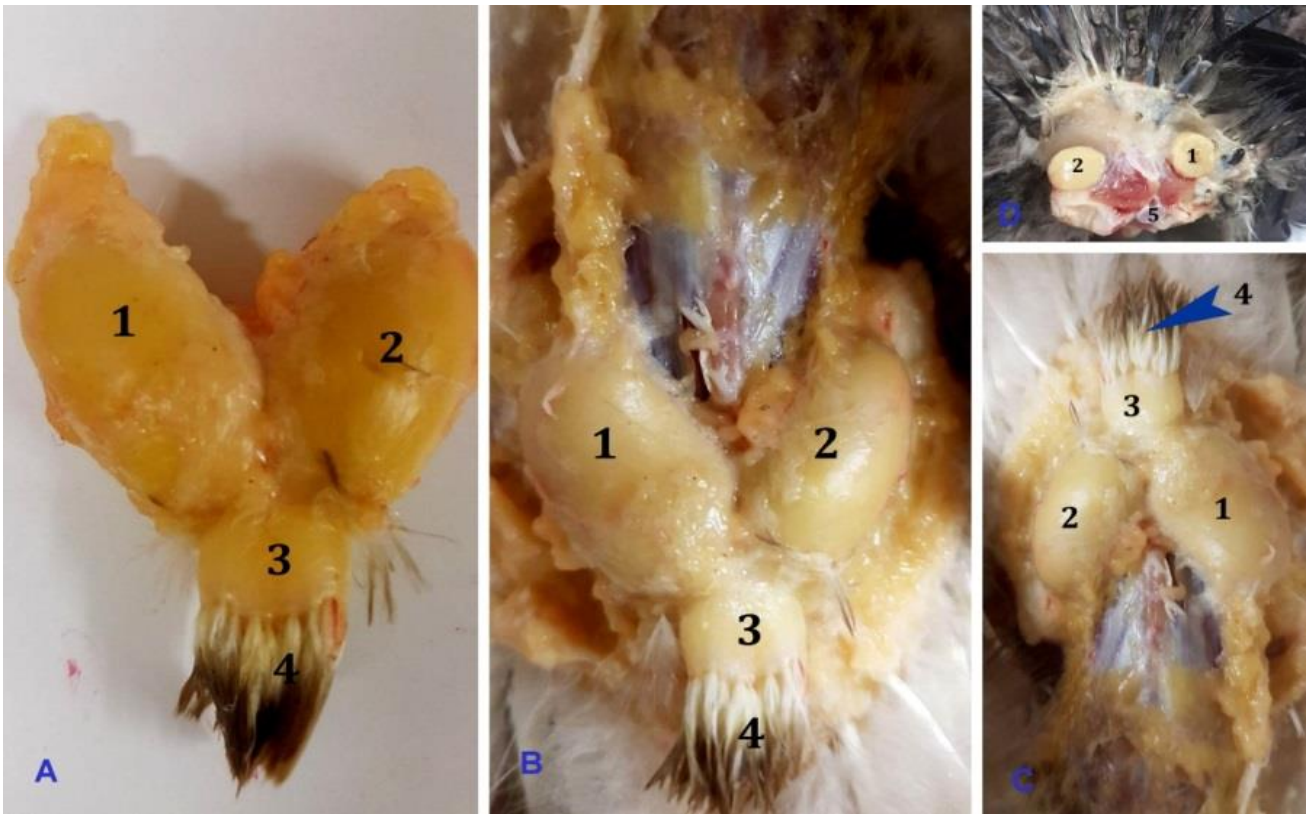

Fig. 1: Photographs showing the in situ position of the uropygial (B, C & D) and after its separation from the body (A) of the Mule duck. 1- Right lobe; 2- Left lobes; 3- Papilla; 4- A downy feather tuft; 5- Last caudal vertebra.

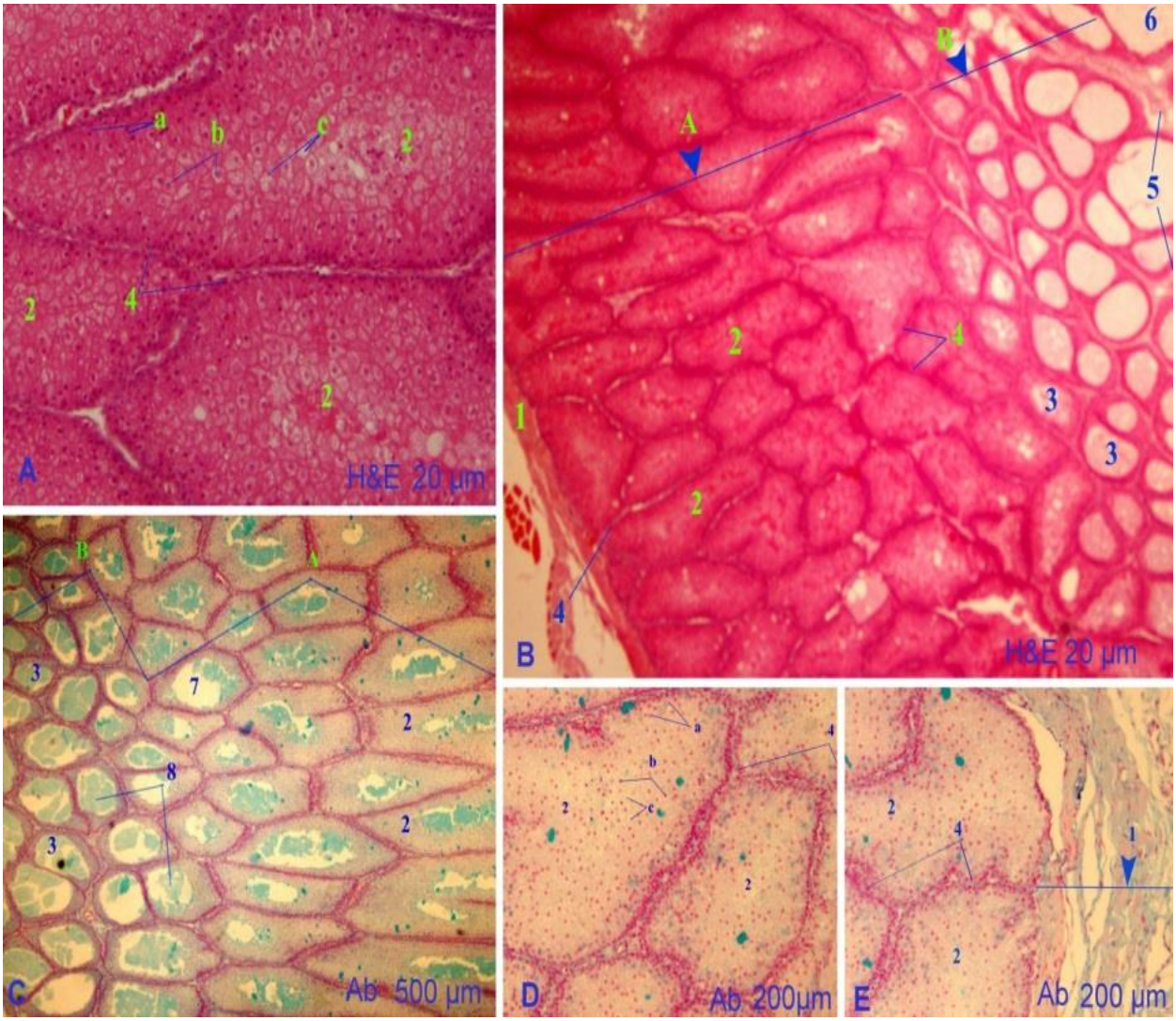

Fig. 2: Photographs showing the histology of the uropygial gland of the Mule duck (H& E A-B & Alcian blue C, D & E).
A- Peripheral zone; B- Central zone; 1- Capsule 2- Peripheral tubules; 3- Central tubules; 4- Interfollicular septae; 5- Terminal ducts 6- Chamber; 7- Lumen; 8- Secretion; a- Basal cells; b. Intermediate cells; c. Secretory cells.

DISCUSSION

The uropygial gland of the Mule ducks was a bilobed, compact, well developed, sebaceous organ situated dorsal to the last caudal vertebra under the skin; a similar observation was reported in birds (Jacob and Ziswiler 1982; Sawad, 2006; Harem *et al.*, 2010). However, Das *et al.* (1965) stated that the uropygial gland of the duck is not developed.

Each lobe of the gland has the secretory tissue which secretes the oil via the papilla which is the duct system of the gland. The papilla was situated above the tail in the form of a nipple-like appearance with two orifices; a similar result was mentioned in birds (Jacob and Ziswiler 1982; McLelland, 1985; Salibian, and Montalti, 2009; Chiale *et al.*, 2016). Moreover, the uropygial gland of the Mule duck is surrounded by a tuft of downy feathers which helps in moistening the bill by the oil secretion and subsequently throughout the plumage, similar result was recorded in birds (Jacob and Ziswiler 1982; McLelland, 1985; Stettenheim, 2000).

The observation in this study was similar to that of Rajathi *et al.* (2014) in duck that the uropygial gland is a simple branched tubular and holocrine type of gland. Morover, the observations in this study was similar to that of Rajathi *et al.* (2014) and Sunada *et al.* (2001) in duck, Chandrasekar *et al.* (1990) in Japanese quail, Kozlu *et al.* (2011) in White Stork and Shafiian and Mobini (2014) in goose, stating that the secretory acini of the uropygial gland composed of multiple, branched straight tubules which were organized into peripheral and central zones.

The observation in this study was similar to that of Jacob and Ziswiler (1982) in birds, Sawad (2006) in moorhen, Harem *et al.* (2010) in osprey, Shafiian and Mobini (2014) in goose and Chiale *et al.* (2016) in chimango caracara that the uropygial gland is surrounded by dense connective capsule which is made of elastic, reticular and collagenous fibers containing blood and nerve vessels as well as nerve fibers within its wall. On the other hand, the capsule has smooth muscle fibers in birds (Jacob and Ziswiler 1982) and in chimango caracara (Chiale *et al.*, 2016) and in goose (Shafiian and Mobini, 2014).

Connective tissue made of elastic, collagens and reticular fibers extends from the capsule of the lung capsule extends between the lobes of the gland forming

the interlobular septum; a similar result was observed in duck (Harem *et al.,* 2005), in goose (Shafiian and Mobini, 2014) and in birds (Jacob and Ziswiler, 1982).

The current investigation revealed that the secretory tubules were lined by stratified squamous epithelium which consisted of basal, intermediate and secretory cell layers; a similar result was reported by Rajathi *et al.* (2014), Sunada *et al.* (2001) and Harem *et al.,* 2005) in duck. However, the epithelial cells of the secretory tubules were formed of the germinative, intermediate, secretory and degenerative layer in White Plymouth Rock chickens (Wagner and Brood (1975), Moorhen (Sawad, 2006) and in rock dove (Montalti *et al.,* 2001), in White Stork (Kozlu *et al.,* 2011) and in goose (Shafiian and Mobini, 2014).

The secretory products were transformed from the secretory parenchyma into the lumen of each follicle, and then passed via a minute duct of the follicle to be stored in the secondary sinus and then passed to the primary sinus to be expelled when stimulated by the bill as mentioned in other birds (Bhattacharyya, 1972; Lucas and Stettenheim, 1972; Jacob and Ziswiler, 1982).

The adenomers epithelial cells typically were rich in lipids as mentioned by (Montalti *et al.,* 2005, Salibián and Montalti, 2009) in other birds, however these lipids are the major component of the uropygial secretion in chimango caracara (Chiale *et al.,* 2016). Morover, Alcian blue staining indicated that the gland secretion had mucin-type glycoprotein which forms viscous solutions which may act as protectants or lubricants on the surface of the body as mentioned by Montalti *et al.* (2001) in rock dove.

Conclusions

The gross anatomy and histological characteristics of the uropygial gland in Mule duck resemble those of other birds. The secretion of the uropygial gland contained carbohydrates and lipid which was initiated mechanically by the beak may be keep water proof and pliable feather qualities and protects the surface of the body of the Mule duck from the environment since the duck stay much time in water.

REFERENCES

Baumel JJ, SA King, JE Breasile, HE Evans and JCV Berge, 1993. Handbook of Avian Anatomy (Nomina Anatomica Avium). Publications of the Nuttall Ornithological Club, Cambridge.

Bhattacharyya SP, 1972. A comparative study on the histology and histochemistry of uropygial glands. Cellule, 69: 111-126.

Chandrasekar V, KN Sanjeev and PS Lalitha, 1990. Histology and histochemistry of the uropygial gland of the Japanese quail (Coturnix coturnix japonica). J Vet Anim Sci, 21: 77-82.

Chiale MC, E Patricia, Fernández, EJ Gimeno, C Barbeito and D Montalti, 2014. Morphology and histology of the uropygial gland in Antarctic birds: relationship with their contact with the aquatic environment. Australian J Zool, 62: 157-165.

Chiale MC, D Montalti, MA Flamini, P Fernández, E Gimeno and CG Barbeito, 2016. Histological and histochemical study of the uropygial gland of chimango caracara (Milvago chimango Vieillot, 1816). Biotech Histochem, 91: 30-37.

Chiale MC, D Montalti, MA Flamini, CG Barbeito, 2017. The uropygial gland of the Southern Caracara (Caracara plancus; Floconidae: Falconinae): histological and histochemical aspects. Acta Zoologica (Stockholm), 98: 245–251.

Das LN, DB Mishra and G Biswal. 1965. Comparative anatomy of the domestic duck (Anas bochas). Indian Vet J, 42: 320-326.

Drury RAB and T Wallington, 1980. Carleton's Histological technique 4th ed., Oxford University. Press. Oxford, New York, Toronto.

Harem MK, H Altunay, İŞ Harem and F Beyaz, 2005. Histomorphological and Histochemical Studies on Preen Gland of the wild and Domestic Duck. J Health Sci, 14: 20-30.

Harem IS, M Kocak-Harem, T Turan-Kozlu, Y Akaydin-Bozkurt, E Karadag-Sari and H Altunay, 2010. Histologic structure of the uropygial gland of the osprey (Pandion haliaetus). J Zool Wildlife Med, 41: 148-151.

Jacob J, V Ziswiler V, 1982. The uropygial gland.199-314 in Farner DS, JR King; KC Parkes, 1982. Avian biology: Volume VI. New York, America: Academic Press.

Jawad HAS, 2017. Uropygialectomy effects on chicken prostaglandin and growth hormone. J Morphol Anat, 1: 108.

Kozlu T, Y A Bozkurt and S Ates, 2011. A macroanatomical and histological study of the uropygial gland in white stork (Ciconia ciconia). Int J Morphol, 29: 723-726.

Lucas AM and PR Stettenheim, 1972. Avian anatomy: Integument. Agriculture Handbook 362, U.S. Department of Agriculture., Washington, D.C.

Nickel R, A Schumer and E Seiferle E, 1977. Anatomy of the domestic Birds. Verlag Paul Parey, Berlin and Hamburg.

Montalti D, A Quiroga, A Massone, JR Idiart and A Salibián, 2001. Histochemical and lectinhistochemical studies on the uropygial gland of rock dove Columba livia. Columbidae-Columbiformes). Braz J Morphol Sci, 18: 33-39.

Montalti D, AM Gutierrez, GR Reboredo and A Salibian, 2005. The chemical composition of the gland secretion of rock dove. Compar Biochem Physiol, 140: 275-279.

Rajathi S, N Ashok, Kumaravel A and Muthukrishnan S, 2014. Post hatch micrometrical development of the preen gland in the duck. Indian Vet J, 91: 51-35.

Reynolds S M, C Isabel, Alley MR and Cunningham SJ. 2017. Apteryx spp. (Kiwi) possess an uropygial gland: Anatomy and pathology. Eur J Anat, 21: 125-139.

Salibian A, D Montalti, 2009. Physiological and biochemical aspects of the avian uropygial gland. J Biol, 69: 437-446.

Shafiian AH and B Mobini, 2014. Histological and histochemical study on the uropygial gland of the goose (Anser anser). Bulgarian J Vet Med, 17: 1-8.

Shawkey MD, SR Pillai and GE Hill, 2003. Chemical welfare? Effects of uropygial oil on feather-degrading bacteria. J Avian Biol, 34: 345-349.

Sawad AA, 2006. Morphological and histological study of uropygial gland in moorhen (G. gallinule C. choropus). Int J Poult Sci, 5: 938-941.

Sunanda K, CS Rao, Y Nagamalleswari, LM Shanti, RP Jagapathi and G Purushottham, 2001. Gross and histological studies on the uropygial gland of the domestic duck (Anas boscas domesticus). Indian J Vet Anat, 13: 105.

Stettenheim PR, 2000. The integumentary morphology of modern birds – an overview. Amer Zool, 40: 461-477.

Wagner RC and Rl Brood, 1975. Cytological differentiation in the uropygial gland. J Morphol, 146: 395-414.

Zhang JX, We Wei, J Zhang and W Yang. 2010. Uropygial Gland-Secreted Alkanols Contribute to Olfactory Sex Signals in Budgerigars. Chem Senses, 35: 375-382.