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A Comparative Morphological Observations On The Preen (Uropygial) Glands Of Geese, Ducks And Young Pigeons

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ABSTRACT

The uropygial gland in birds; is an organ located on the back near the base of the tail. It is more important for aquatic birds, but why it is so important for other birds? and what is the nature of its secretion?

Twenty male domestic geese (*Anser anser domesticus*)of one year old , twenty male Muscovy ducks *(Black Magpie)*of one year old and twenty five male young pigeons (*Columba livia domestica*) of 6 weeks old were used through this study.

The results indicated that in ducks and geese the gland secretes glycolipids , but only oily secretion. in young pigeons. According to mode of secretion ,the glands of all 3 species were of holocrine mode of secretion in young pigeons there was a central lumen leading to one excretory duct opening on a small papilla for each of the two lobes which are not divergent. In ducks and geese, the two lobes were diverged , each having one collecting sinus leading to one excretory duct for each lobe opening on a small papilla in ducks but it was broader in geese. The capsule of the gland was thicker in geese and ducks but the least in young pigeons .

The cells of the secretory tubules are arranged in 4 zones for the three species. The secretory cells had more characteristic cells in geese than in ducks. The mast cells were more evinced in ducks and geese but were fewer in young pigeons. The average glandular weight was in geese 8.50 +0.22 gm for 3 Kg body weight , lesser in ducks, 7.00 +0.20 gm for 3 Kg body weight but the least in young pigeons (0.27+ 0.02gm) for 350 gm body weight.

The tissues stainability for lipids by oil red O was at the same degree in the three studied species .

INTRODUCTION

Preen gland, also called Uropygial, or Oil Gland, in birds, located on the back near the base of the tail. Paired or in two united halves, it is found in most birds.

Most birds preen by rubbing their bill and head over the preen gland pore and then rubbing the accumulated oil over the feathers of the body and wings and the skin of the legs and feet. The oil of each part of the gland is secreted through the surface of the skin through a grease nipple -like nub*(1)*.

It has been speculated that, at least some species, the oil contains a substance that is a precursor of vitamin D. This precursor substance is thought to be converted to vitamin D by the action of sunlight and then absorbed through the skin. Many ornithologists mentioned that the function of the preen gland differs among various species of birds *(1)*.

Preen oil may protect birds against plumage-degrading organisms, such as bacteria and fun *(2)* .

The aim of this work was to determine to what extent the preen gland is important for some avian species more than the others and to be the first step for more investigation concerning the influence of ages and sexes.

MATERIAL AND METHODS

Twenty male domestic geese, (*Anser anser domesticus*) one year old , twenty male Muscovy ducks *(Black Magpie*) one year old and twenty five male young pigeons (*Columba livia domestica*) of 6 weeks old were used through this study. The weights of birds, and uropygial glands were recorded and the ratio between weight of the gland and body weight were statistically estimated and evaluated . The actual positions of the glands were recorded and photographed grossly in their situ.

The birds were collected during January till March (2013) .

The glands were dissected and removed, cut both longitudinally and crossly for each gland involving the one lobe; longitudinally and its counter one; crossly . fixed immediately in suitable fixatives after weighing, and processed till 5-7 micrometer thick sections were prepared and stained with different stains including H & E, Crossmon's trichrome, Weigert's elastic-van Gieson st., Silver impregnation for reticular fibers, Alcian blue-PAS for neutral and acidic mucopolysaccharides, and toluidine blue PH 4.5 for mast cells .

Some frozen specimens were cut to obtain sections for lipids and staind with oil red O.

The methods were quoted from *(3, 4)*.

The dimensional results were expressed as mean ± SE.

RESULTS

Macroscopically

The uropygial gland of ducks : Had two diverging lobes and small papilla; caudally before the end of the tail. At the summit of the papilla, two small openings of the excretory ducts are seen (Fig.1). The angle of divergence between the two lobes was up to 60.

The average gland weight was 7.00± 0.20 gm, for duck (body weight of 3.00±0.200 kg) and the gland weight/ body weight ratio reached to 0. 21.

The glands were embedded in a lot of adipose tissue and covered superficially with the skin while below the glands were attached to the iliococcygeal muscle that covering the ilium and the coccygeal vertebrae.

The glandular lobes were compact, having no central cavity except at the most caudal part of the gland where a collecting sinus from which two separate excretory ducts were derived to open on the small papilla.The latter was bounded by tuft of feathers.

The uropygial gland of geese: Had two larger diverging lobes and broader papilla than that of ducks; caudally before the end of the tail. At the summit of the papilla are present two larger openings than those of the ducks; one for each lobe for each of the excretory ducts (Fig. 2). The angle of divergence between the two lobe reached up to 50, lesser than that of ducks. Tuft of feathers were bounding the papilla.

The average gland weight was 8.50 ±0.22 gm, for the average goose body weight of 3.00±0.200 kg and the gland weight/body weight ratio reached to 0. 23.

The uropygial gland of young pigeons Had two smaller non-diverging lobes and small single papilla; caudally before the end of the tail. The summit of the papilla presents two smaller openings than those of the ducks and geese; one for each lobe excretory duct (Fig.3). At the papilla, small and short feathers were present .

The average gland weight was 0.27± 0.02gm for the average pigeon squab body weight of 350±0.25 gm and the gland weight/body weight ratio reached to 0.007.

The two glandular lobes are not completely compact, but cavities of the secretory units were extending to the peripheral region of the lobe could be detected.

Microscopically

In ducks: The capsule thickness reached to an average of 412.2± 12 micrometer, attached directly to the ilio-coccygeal muscle below(Fig4) and adjacent to the secretory tubules internally. It is interwoven of numerous collagenic fibers (in green) (Fig.4), and numerous reticular fibers (Fig.5), with few elastic fibers and contained externally many blood vessels and nerve fascicles. Moreover, the reticular fibers were extended alongside the secretory tubules (Fig.5), where the collagenic fibers were the least between the tubules except in the central region of the lobar core where they became more condensed (Fig.6).

The parenchyma of the gland was constructed of longitudinal simple branched tubules that were slightly expanded distally towards the capsule ,and extended towards the papilla caudally.

The tubules had narrow lumens and thick walls. Gradually the tubules widen towards the final collecting sinus before ending by 2 excretory ducts that open on the papilla. Before ending to the collecting sinus ,up to 4 tubules might unite together (Fig.7).

The lining epithelium of the tubules begins thicker towards their blind ends , formed of basal flat or cuboidal germinative epithelial cells with basophilic cytoplasm, followed by several layers of polyhedral cells with vacuolated cytoplasm as storage cells, followed by secretory cells and fourth zone of smaller darkly stained nuclei, where the cells of the latter zone were burst down leaving degenerated nuclei and oily secretion (Fig.8).

Most of the secretory contents were stained intensely with oil red O, indicating their lipid nature (Fig.9). Moreover, the capsular fibroblasts revealed stainability for cytoplasmic lipids (Fig.9) as also in the fibroblasts of the trabeculae between the secretory tubules. Little and few secretory contentes revealed alcianophilia as acidic mucoplysaccharides were seen in some tubular lumens (Fig.10). Those alcianophilic products were absent towards the central collecting sinus .

Between the tubules some mast cells could be observed with a characterstic metachromatic cytoplasm with toluidine blue (Fig.11).

Gradually, the tubules widen luminally with thinner lining epithelial layers engorged with the secretory products towards the collecting sinus (Fig.12). An irregular smaller connecting sinuses were present before the larger one central collecting sinuse having slightly thicker lining epithelium(Fig.13) than that of the main collecting sinus could be demarcated.

The most caudal region of each lobe contained the wide irregularly lumened collecting sinus , having the thinnest epithelial lining of stratified epithelium (Fig.14), from this sinus one excretory duct for each lobe was extended to open on the small papilla separately and both were lined with stratified columnar epithelium except at their opening on the papilla where the epithelium becomes stratified squamous epithelium.

In geese: The capsule was slightly thinner than that of ducks, with an average thickness reached to 300 ± 10.2 μm. It is constructed of an inner denser and outer looser C.T., containing many blood vessels and nerve fascicles with few small Pacinian corpuscles. In addition, the fibroblasts of the capsule were liable to coalesce cytoplasmic lipids that were staind red by oil red O (Fig 15).

The stroma of the geese gland did not much vary from that of ducks, including the distribution of mast cells.

The secretory tubules through their extension parallel to the longitudinal axis of the lobes were interdigitated (Fig. 16), and difficult to reveal lumens peripherally (Fig.17).

The lining epithelium of the secretory tubules had specific patterns other than those of ducks. It begins by one layer of cuboidal or slightly flat cells of slightly basophilic cytoplasm and vesicular nuclei and well-

distinct nucleoli, followed by several layers of large irregular or elongated cells having acidophilic cytoplasm as storage cells and become more overladen by vacuolated cytoplasm towards the lumens as secretory . Hence, Very distinct vacuolated cytoplasm was demarcated . Near the lumens the cells were destructed or desquamated(fourth zone) emptying their lipid contents in the lumens (Figs. 15 & 18).

Although few alcianophilic secretions could be seen in some tubules (Fig.19), passing towards the collecting sinus, those secretions were increased and filled many of the wider tubules (Fig.20).

It is well-seen that not all the tubules at the same level , having the same width of their lumens (Fig.21), at the same thickness of their lining epithelium . Towards the collecting sinus, it was the same picture as was in ducks.

From the collecting sinus were derived two large excretory ducts ,one for each lobe that began by a lining epithelium of stratified columnar and contained a lot of detached and destructed cells with oily secretory contents (Figs.22 and 23). Each duct ended separately on a wider opening than that of ducks that opend on the summit of the broad papilla. The latter ducts were lined with thin stratified squamous epithelium before their opening externally on the skin through the papilla.

In young pigeons

The gland had the thinnest fibrous capsule in comparison to both ducks and geese, reaching an average of 163± 6 µm. The two lobes had secretory units arranged side by side and formed large folds . the folds left a central wide lumen through the center of each lobe, so the cavity reached till the capsular basally situated tubular glandular ends (Fig. 24). The capsule is attached deeply to the ilio-coccygeal muscle , and formed mainly of dense reticular and collagenic fibers (Fig.25), where the fibers extended deeply between the secretory units of branched alveolar entities. The elastic fibers were thin and wrapped the secretory units.

The secretory units were abutting side by side (Fig.26), so having a unit lumen that is emptied to the common central cavity that continued caudally towards the largest excretory ducts which open separately on a small papilla (Fig.27). The presence of fat globules through the secretory cells did not vary from those in ducks and geese and gave the same degree of oil red O stainability as those observed in ducks and geese.

The epithelium for each unit begins by basal or germinative layer of flat cells of basophilic cytoplasm, followed by several layers of polyhedral cells that had central or eccentric small heterochromatic nuclei (Fig. 28). Towards the lumens of the secretory units, the cells were destructed and involved in the secretory products.

The secretory products appeared to be mainly oily or of lipids ,while the mucoplysaccharides were difficult to be seen (Fig.29) in pigeon squabs in comparison to those of ducks and geese.

The main central lumen for each lobe was lined with thin stratified epithelium (Fig.30). , and leading to the largest excretory ducts (Fig.27) that open on the papilla by a separate two openings ; one for each lobe.

Mast cells through the young pigeon glandular tissue were very few in comparison to those of ducks and geese ,distributed in between the secretory units.

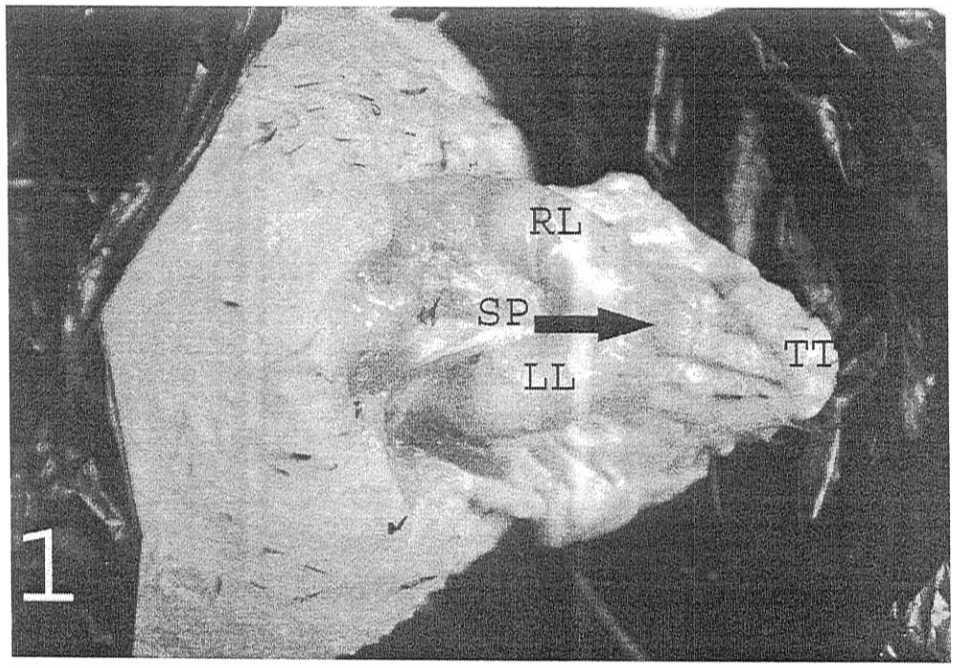

Fig. 1: Topographical anatomy for duck uropygial gland revealing RL: right lobe. LL : left lobe , sp: small papilla and TT: Tail tip.

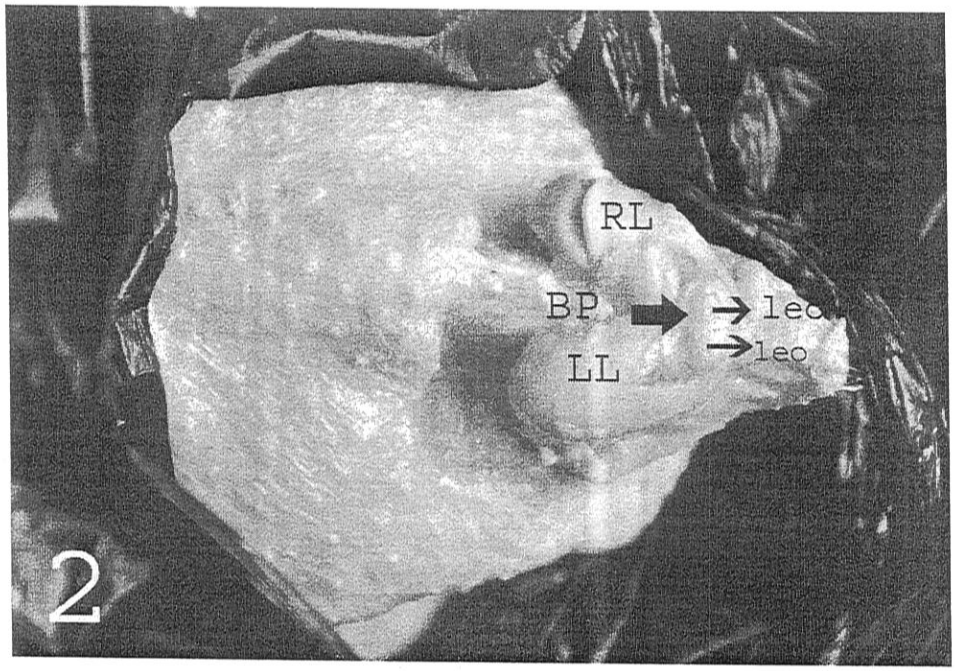

Fig. 2: Topographical anatomy for goose uropygial gland revealing RL: right lobe. LL : left lobe, BP: broad papilla , reo: right excretory opening and leo: left excretory opening.

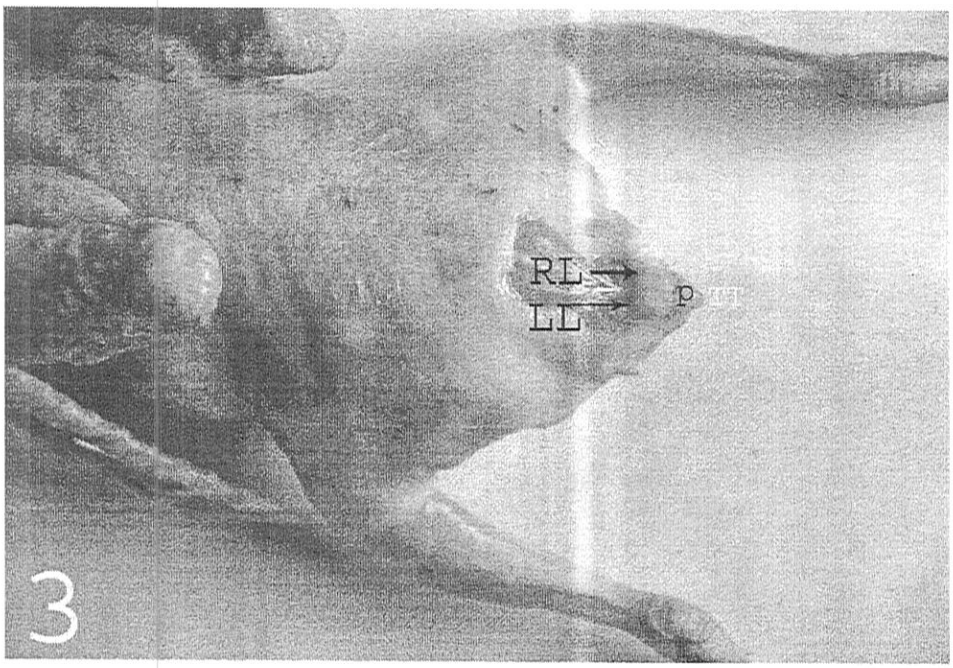

Fig.3 : Topographical anatomy for young pigeon uropygial gland re- vealing RL: right lobe, LL : left lobe and P : very small papilla.

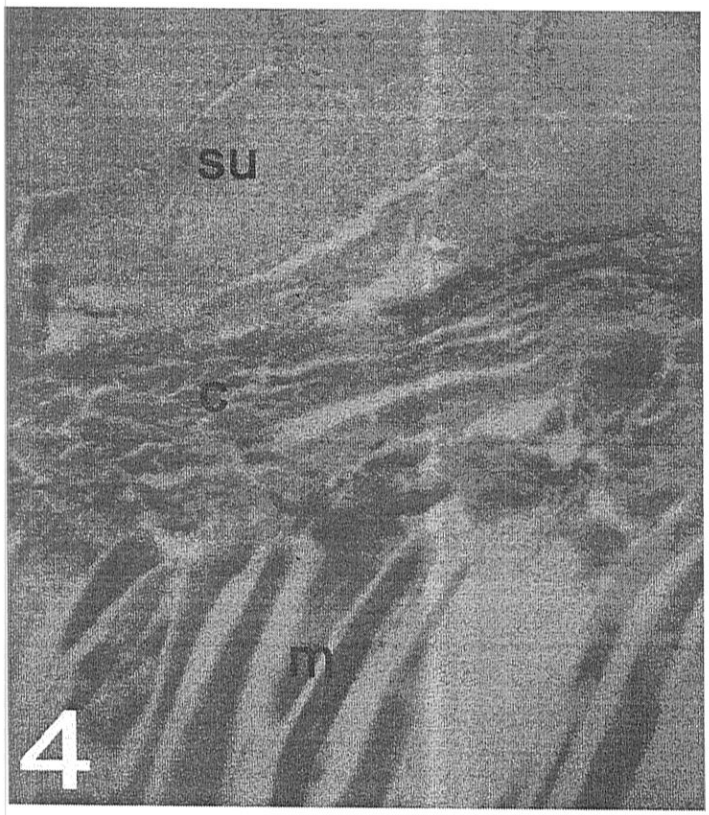

Fig. 4: Photomicrograph for duck uropygial gland revealing iliococcygeal muscle (m), capsule (c) in green, peripheral secretory unit (su). Crossmon's trichrome, X 100.

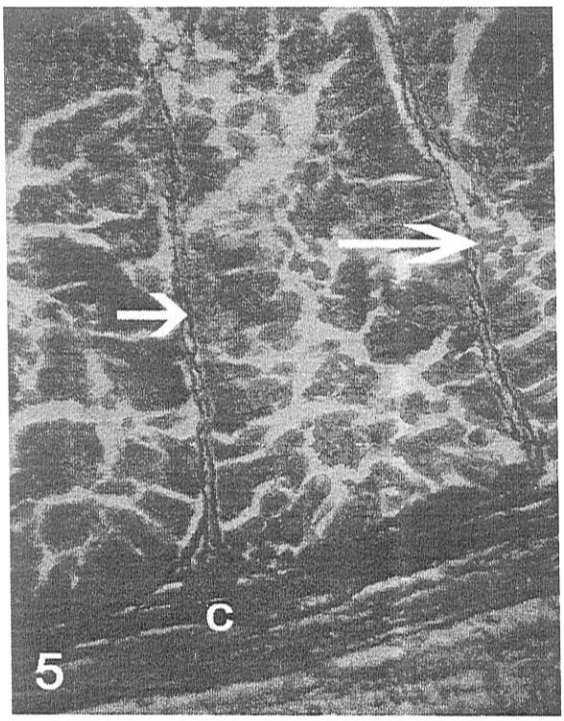

Fig.5 : Photomicrograph for duck uropygial gland revealing reticular fibers (in black) of capsule (c) and extending inbetween the secretory tubules (arrows) . Silver impregnation, X 100.

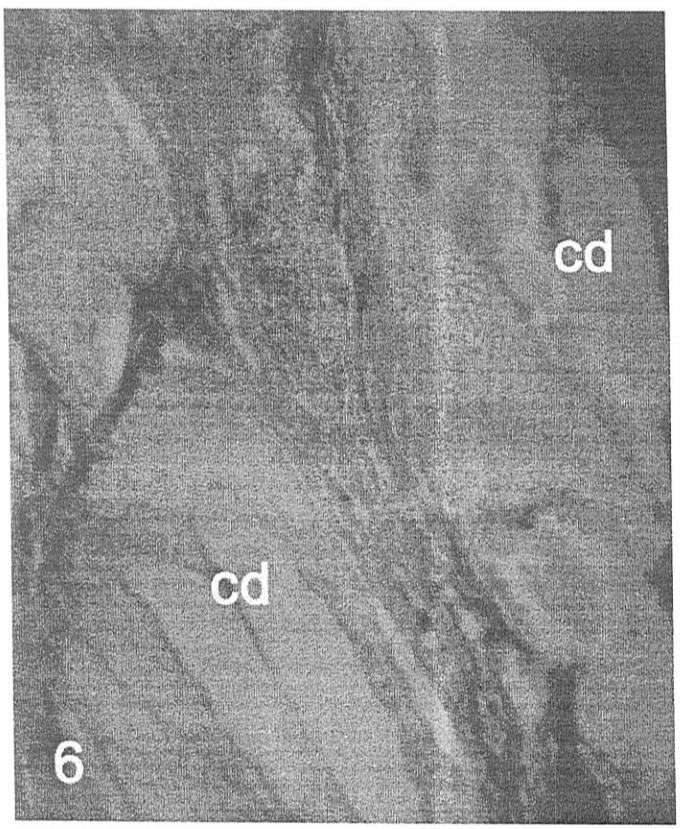

Fig. 6: Photomicrograph for duck uropygial gland revealing condensed collagenic fibers (in green) in the lobar core (arrows) between the wider collecting ducts (cd). Crossmon's trichrome, X100.

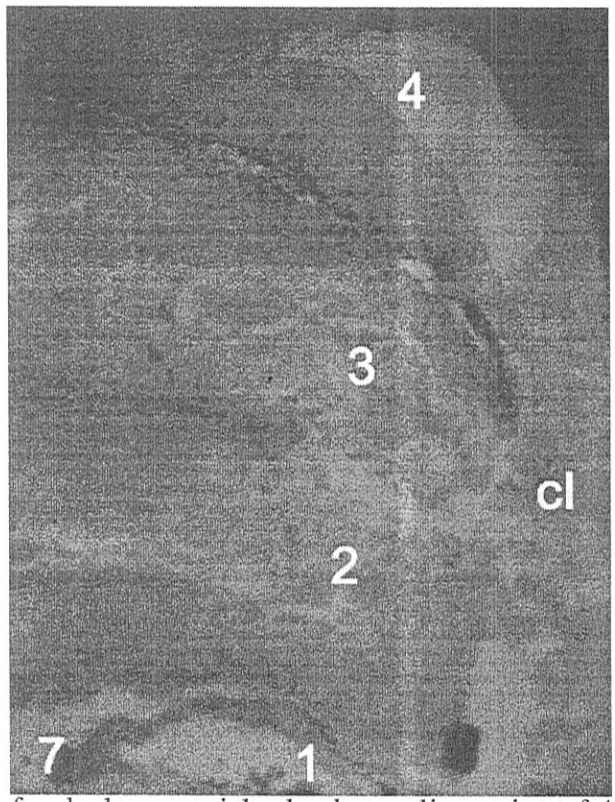

Fig.7 : Photomicrograph for duck uropygial gland revealing union of 4 secretory tubules (1-4) befor the central collecting sinus. H & E,X100

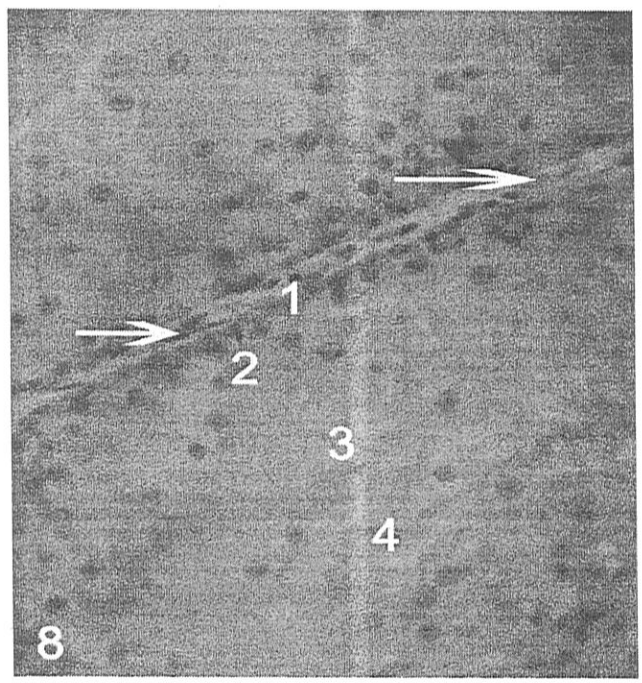

Fig. 8: Photomicrograph for duck uropygial gland revealing four zones of epithelial cells (1-4) that lining the secretory units , intertubular connective tissue trabeculae (arrows). H & E, X 400.

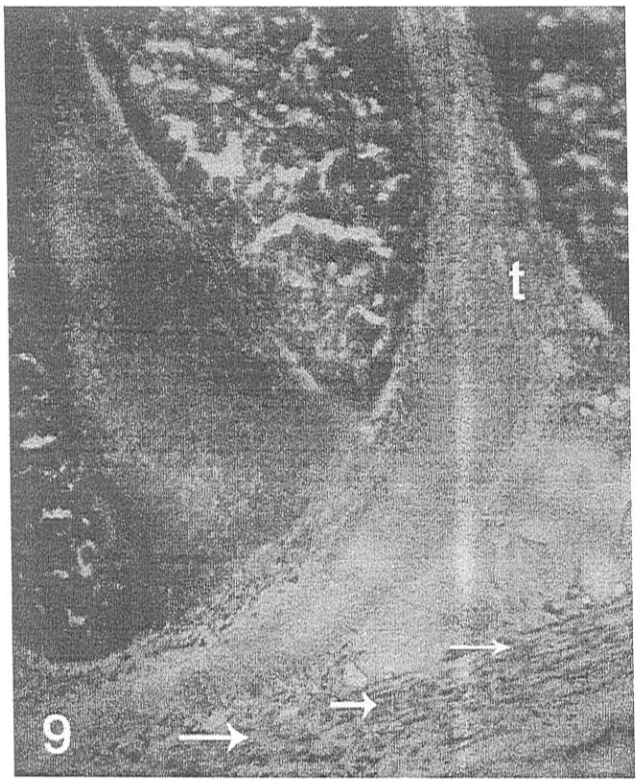

Fig.9. Photomicrograph for duck uropygial gland revealing lipid or oil contents of the secretory cells (in red) , even the fibrobasts cytoplasm of the capsule (arrows) and trabeculae (t) between the secretory units. Oil red O, X 100.

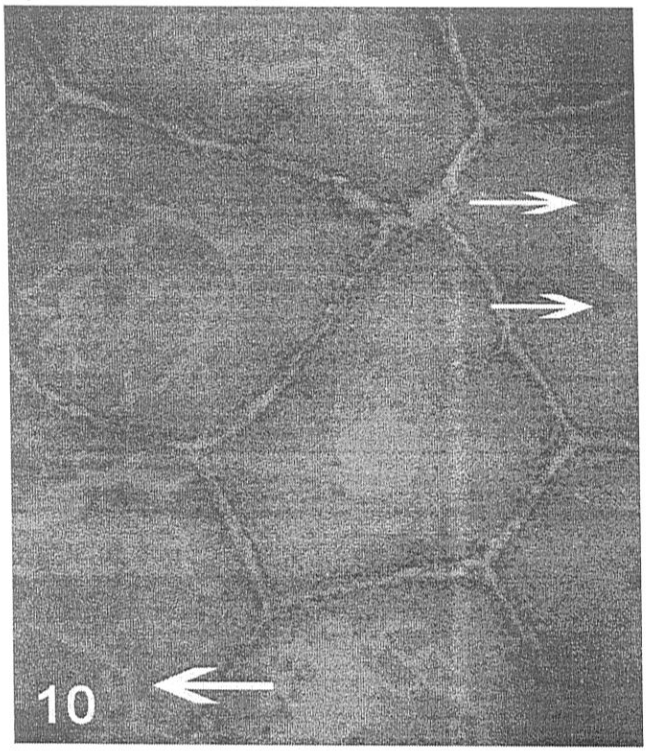

Fig.10. Photomicrograph for duck uropygial gland revealing little and few alcianophilic secretory contents (arrows) in some tubules. Alcian blue, X100.

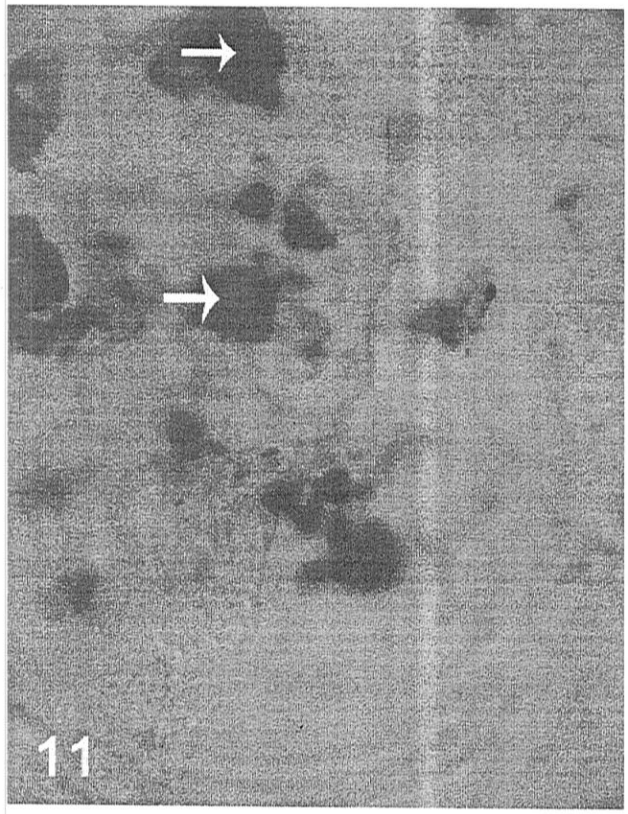

Fig.11: Photomicrograph for duck uropygial gland revealing few mast cells (in violet) ; (arrows) between the secretory tubules. Toluidine blue, X 400.

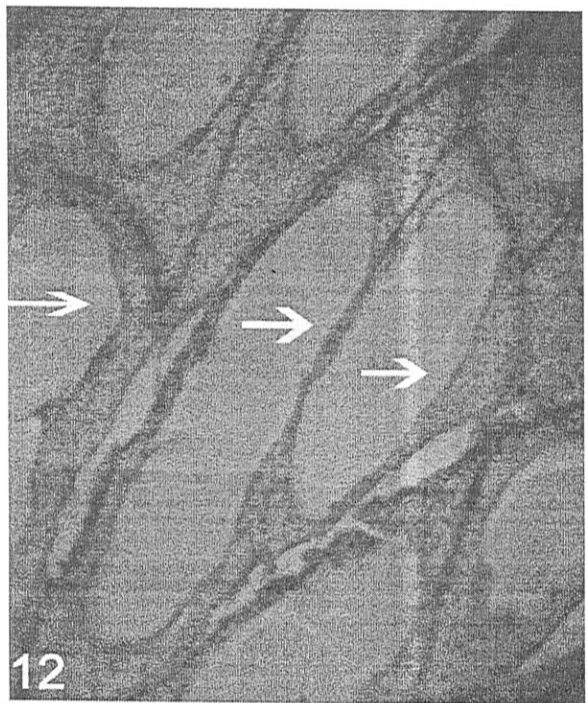

Fig. 12: Photomicrograph for duck uropygial gland revealing intermediate regions of the tubules with wider lumens engorged with secretory contents (arrows) in their way towards the central collecting sinus. H & E, X 100.

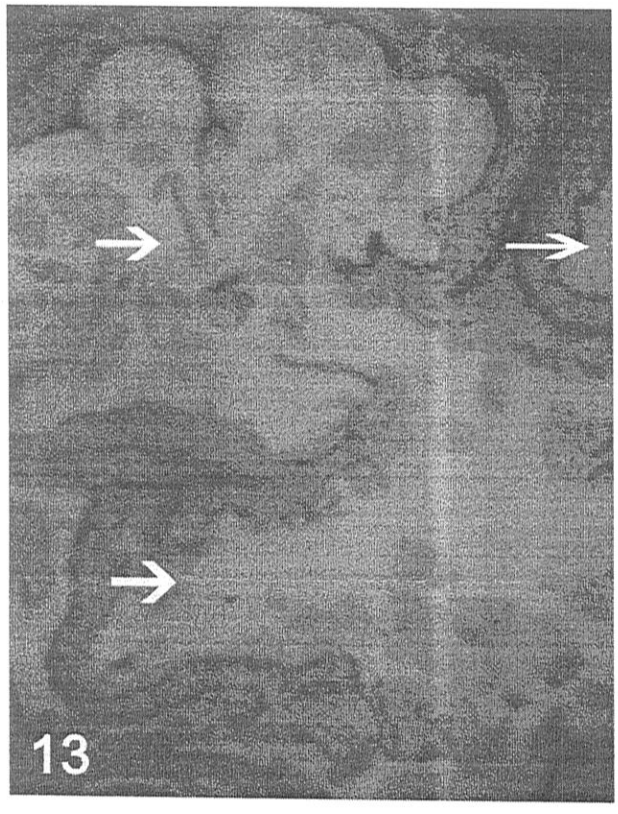

Fig. 13: Photomicrograph for duck uropygial gland revealing smaller connecting siuses (arrows) were present before the largest collecting sinus. H & E, X100.

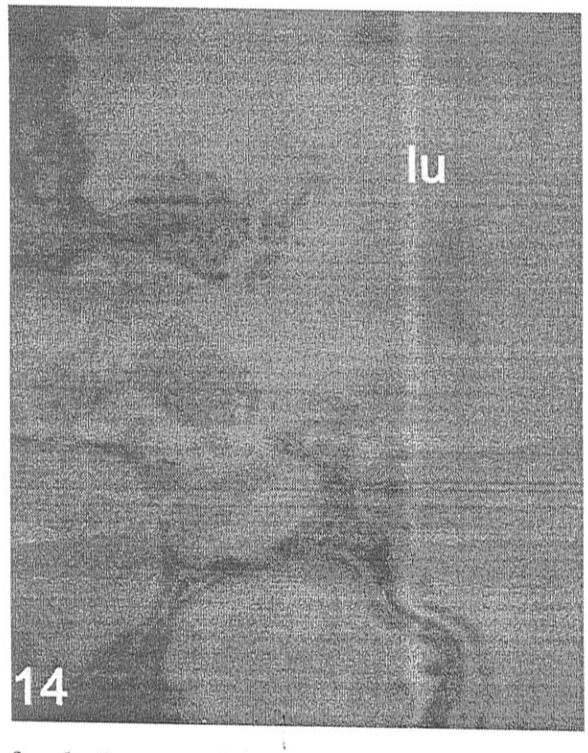

Fig.14: Photomicrograph for duck uropygial gland revealing the largest central collecting sinus with its stratified epithelium and wide lumen (Lu). H & E, X100.

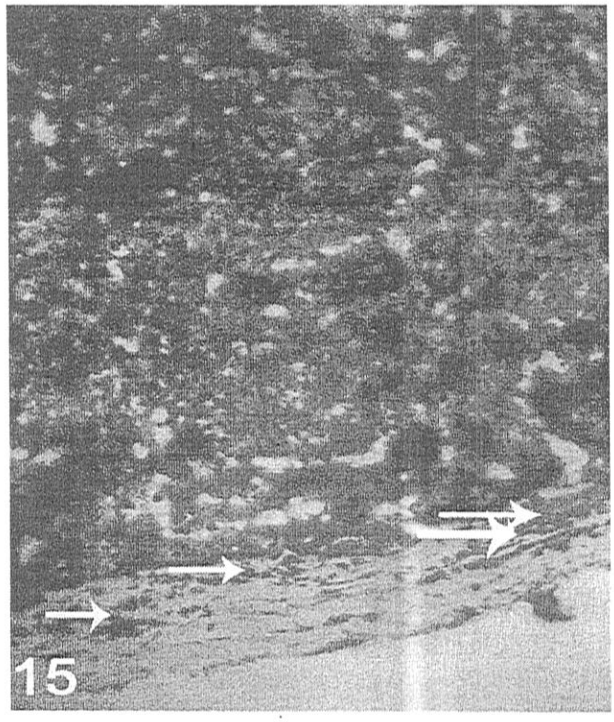

Fig. 15: Photomicrograph for goose uropygial gland revealing lipid contents of the glandular cells (in red) and also in the fibroblasts (arrows) of the capsule. Oil red O, X 100.

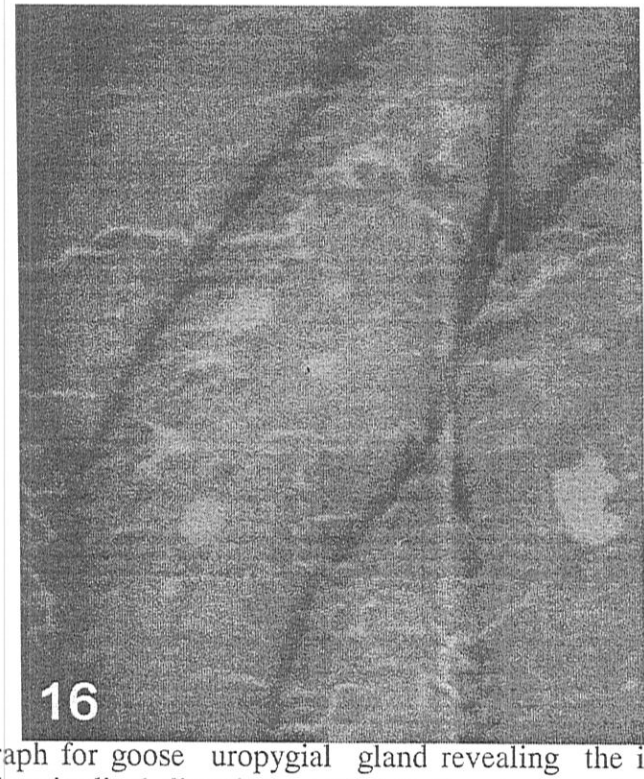

Fig. 16: Photomicrograph for goose uropygial gland revealing the interdigitating secretory tubules , in a longitudinal direction parallel to the gland surface. Weigert's elastic-Van Gieson's st., X 100.

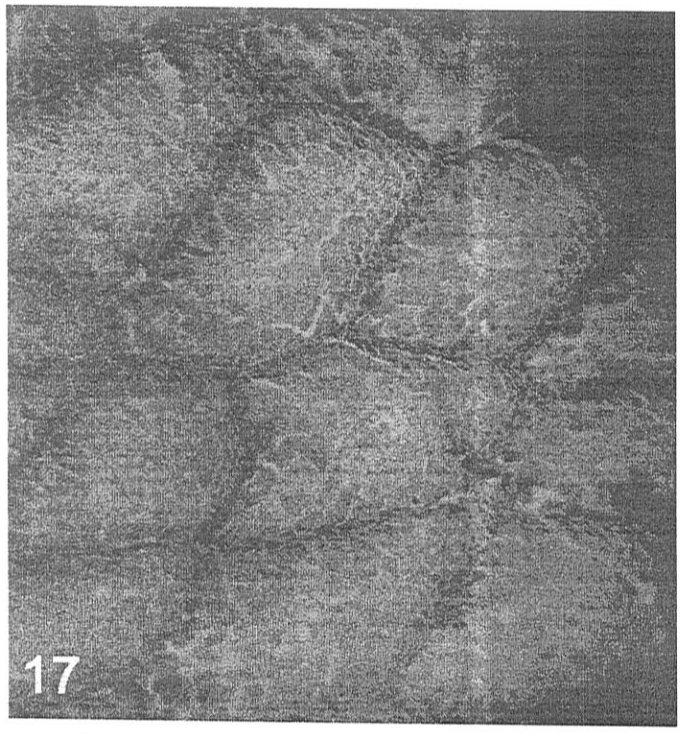

Fig.17: Photomicrograph for goose uropygial gland revealing the peripheral parts of the tubules in cross section, having narrow lumens or those lumens were obscured due to their tangential sectioning . H & E, X 100.

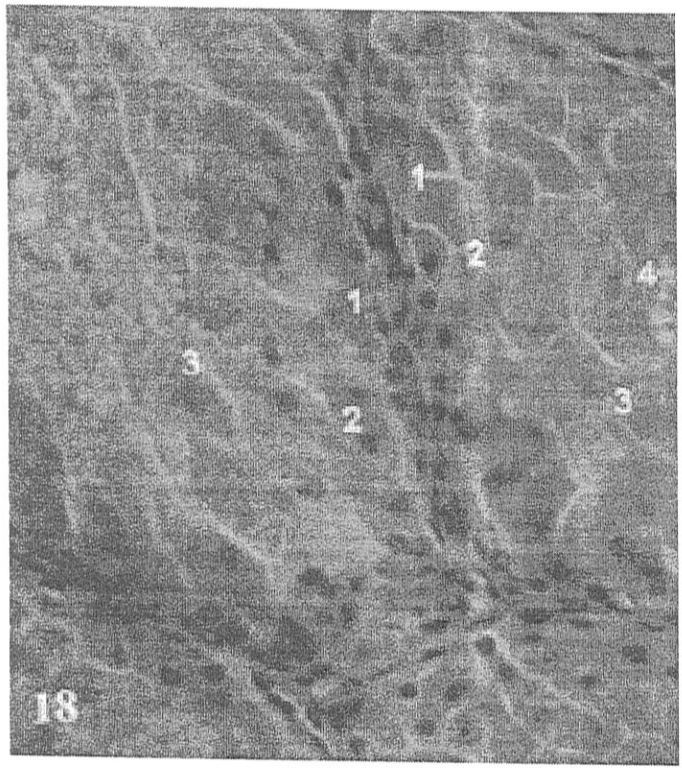

Fig. 18: Photomicrograph for goose uropygial gland revealing four secretory cellular zones (1 – 4) , intertubular conn. Tissue trabeculae (arrows). H & E, X 400.

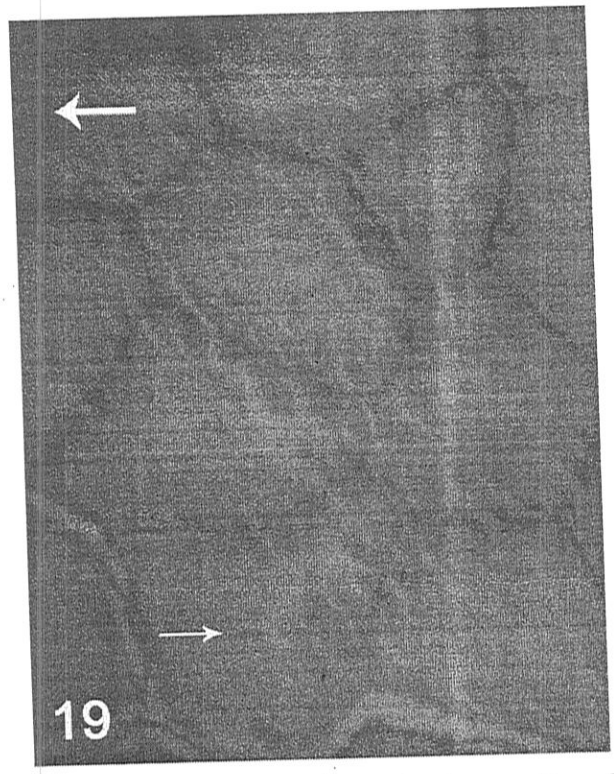

Fig.19: Photomicrograph for goose uropygial gland revealing few and little alcianophilic contents (arrows) of the secretory tubules. Alcian blue, X 100.

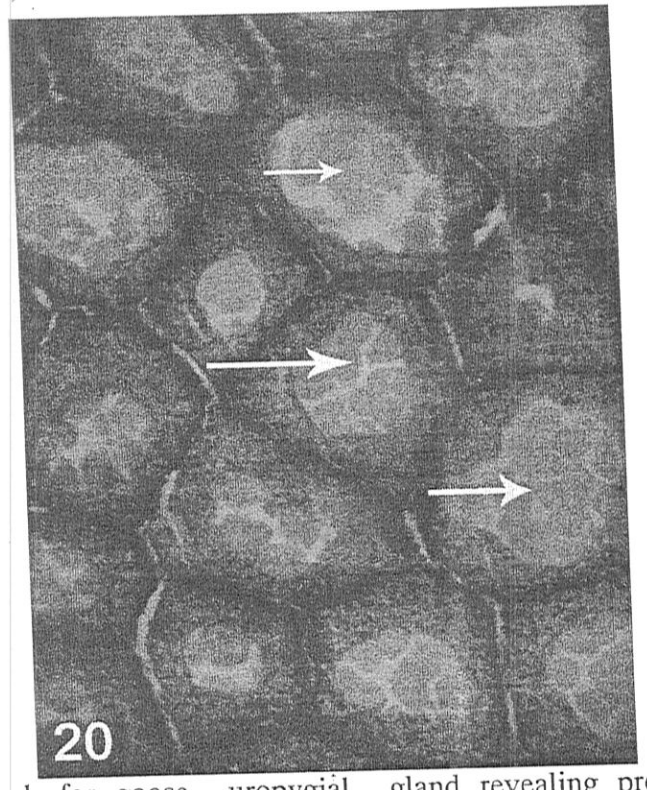

Fig.20:Photomicrograph for goose uropygial gland revealing profuse secretory contents (arrows) of the tubules filling the inner wider portions of the secretory tubules. H & E, X 100.

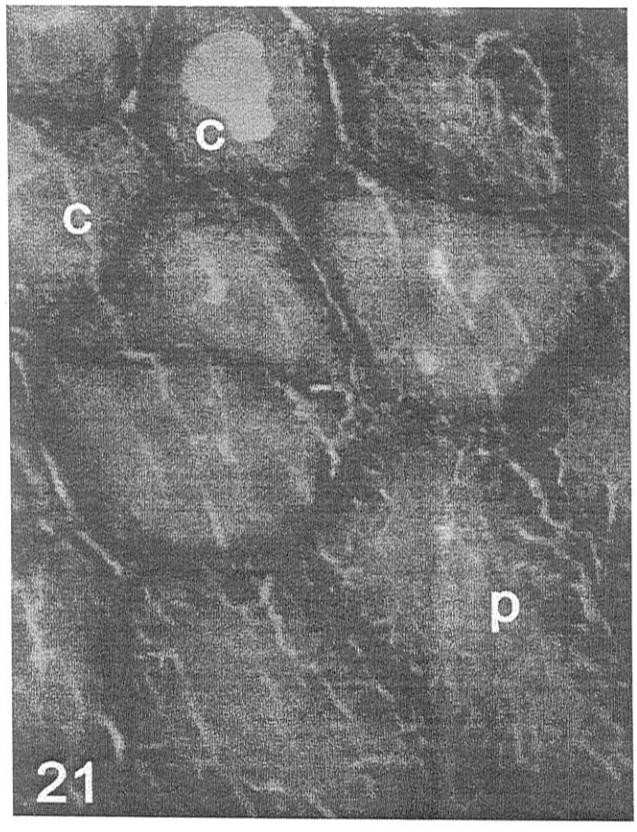

Fig.21: Photomicrograph for goose uropygial gland revealing zone between narrower secretory (P) and wider central portions of the tubules (c) with variable thickness of the lining epithelium. H & E, X 100.

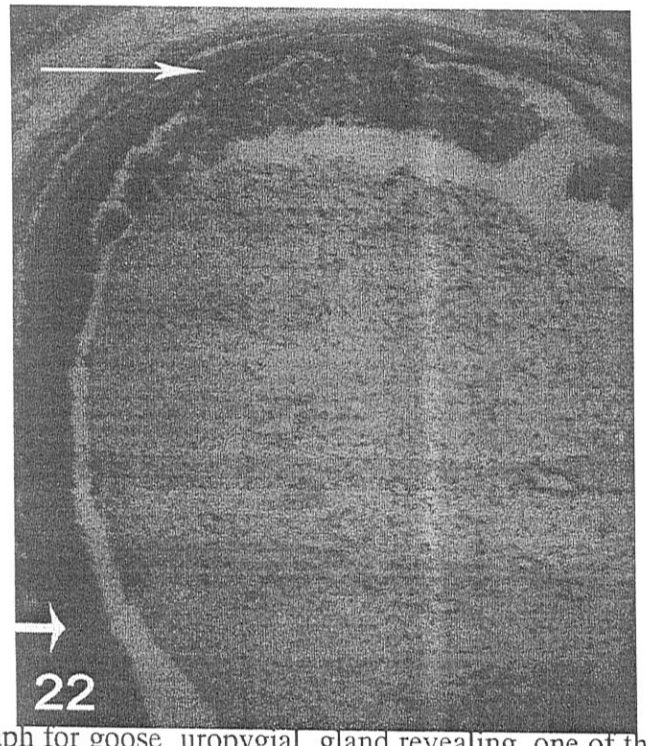

Fig.22: Photomicrograph for goose uropygial gland revealing one of the two excretory duct for the gland (arrow) extending from the collecting sinus towards the papilla. H & E, X100.

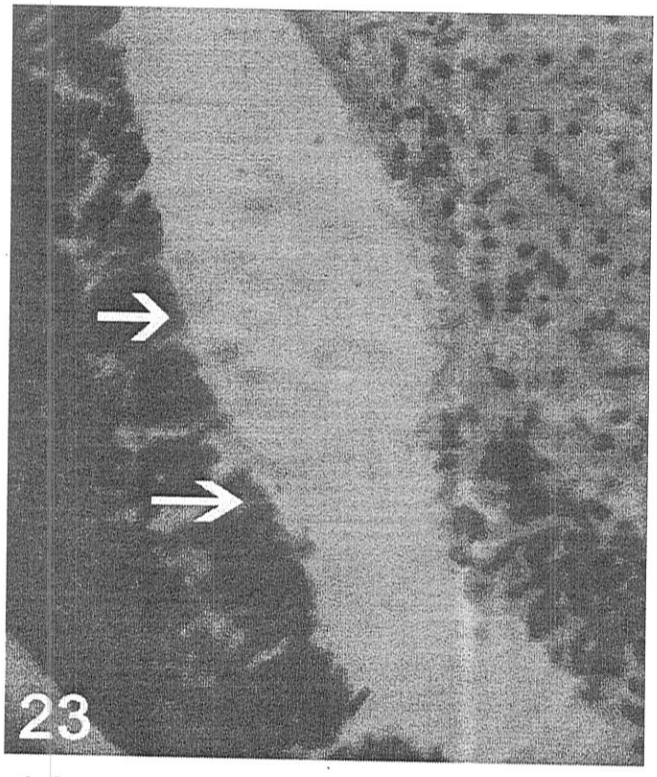

Fig. 23: Photomicrograph for goose uropygial gland revealing Higher magnification for Fig. 22 to reveal the stratified columnar epithelium .(arrows) linning the large excretory duct. H & E, X400.

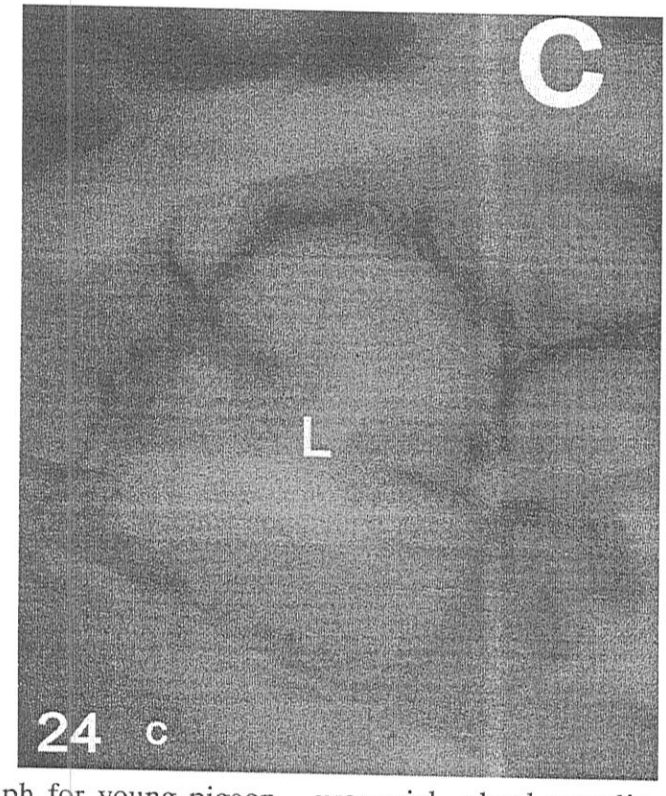

Fig.24:Photomicrograph for young pigeon uropygial gland revealing the wide lumened (L) secretory units that reached near the capsule (c) ,central lumen of the lobe (C). H & E , X 100.

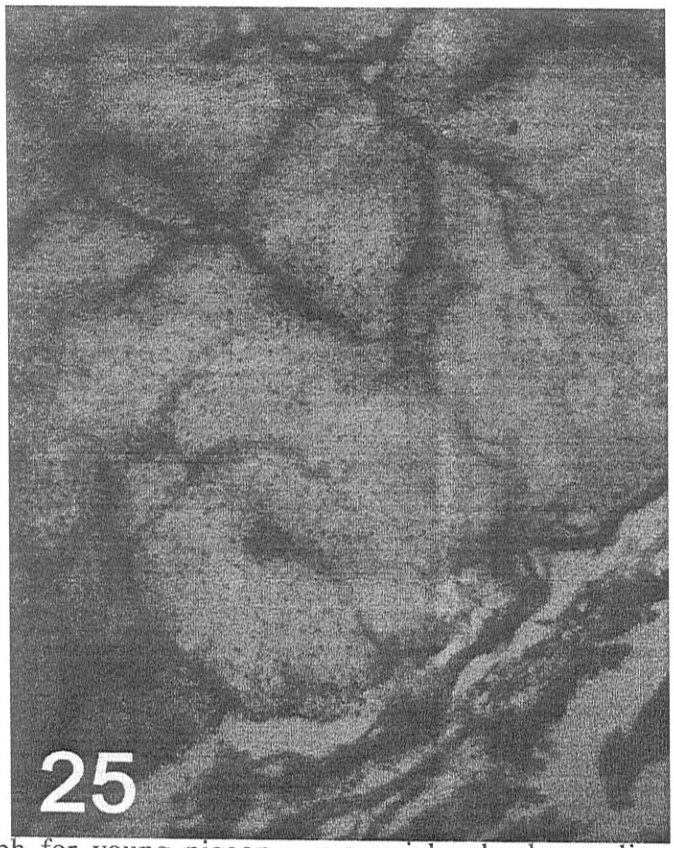

Fig.25:Photomicrograph for young pigeon uropygial gland revealing capsule of the gland having collagenic fibers (in green) , but few between the secretory units. Crossmon's trichrome st., X 100.

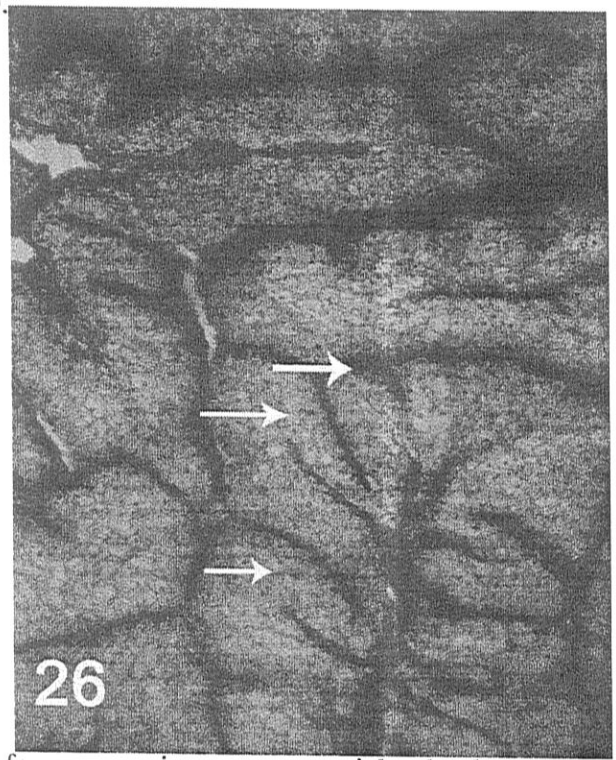

Fig. 26: Photomicrograph for young pigeon uropygial gland revealing the scretory units are abutting side by side (arrows) through the folded epithelium of the main lumen of the lobe . Crossmon's trichrome, X 100.

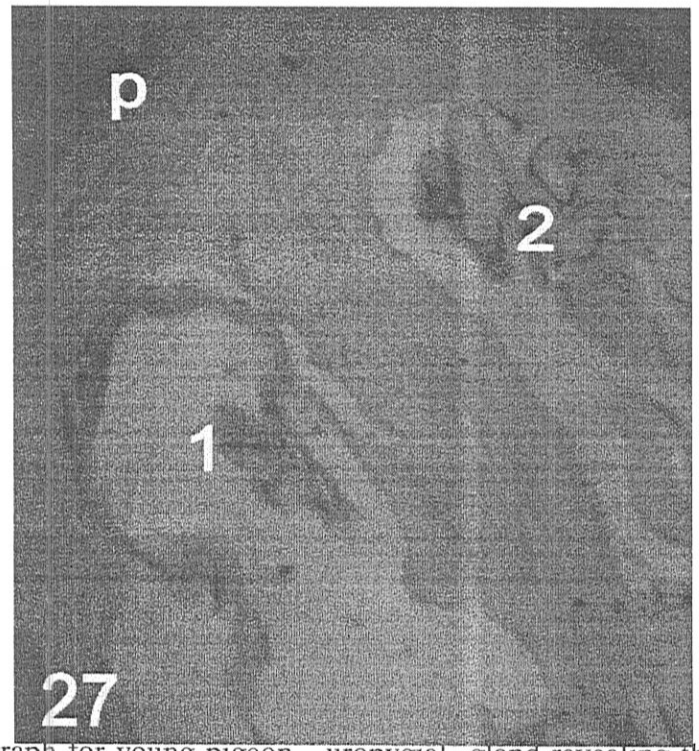

Fig.27: Photomicrograph for young pigeon uropygial gland revealing the tip of small papilla (p) containing two separate excretory ducts (1 & 2) . H & E , X 100.

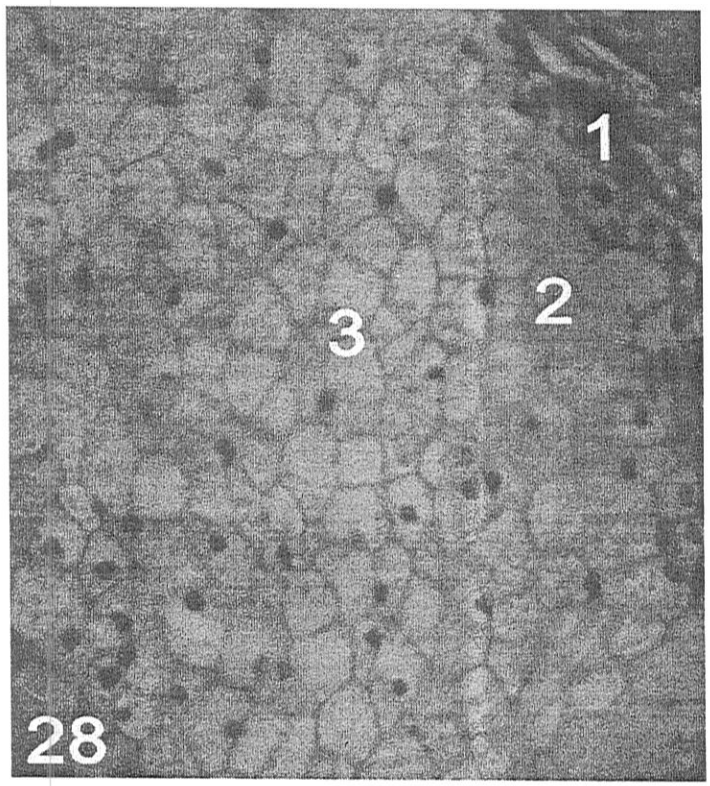

Fig.28: Photomicrograph for young pigeon uropygial gland revealing zones of the secretory cells (1 – 3), where the fourth zone cells are oscured due to tangential section does not reach to the lumen. H & E , X 100.

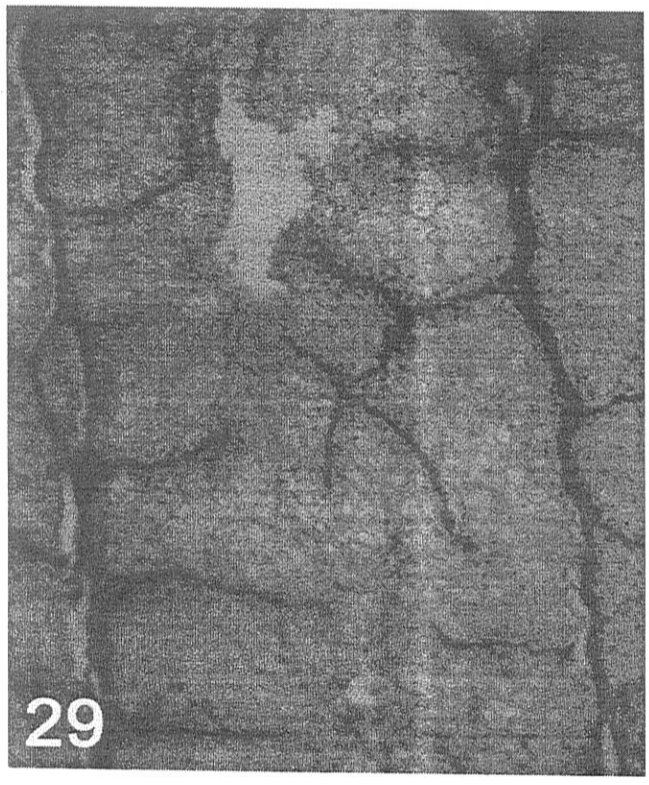

Fig. 29: Photomicrograph for young pigeon uropygial gland revealing no alcianophilic luminal secretions, where the gland is purely lipid or oil secretory. Alcian blue, X 100.

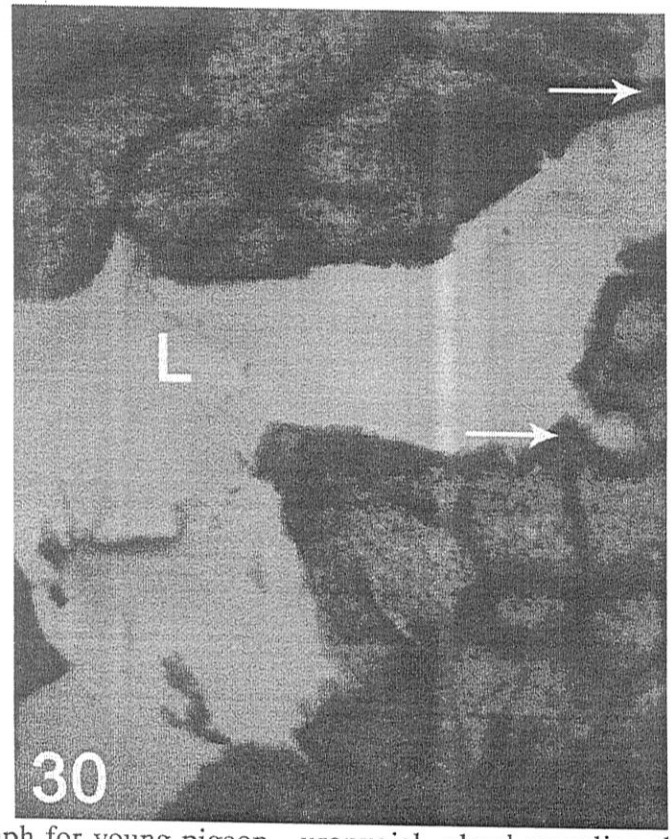

Fig.30: Photomicrograph for young pigeon uropygial gland revealing the main central lumen (L) of one lobe lined with stratified epithelium (ep). Crossmon's trichrome, X 100.

DISCUSSION

The position of the glands is found dorsal to the iliococcygeal vertebrae, based on the ilio-coccygeal muscle as has been described previously *(5)*.

Regarding the angles between the two lobes of preen gland in ducks (50), but in goose was 60, those angles were collectively mentioned as to be 60-70 *(6)*.

According to the current results, the 2 lobes had 2 separate excretory ducts for the studied 3 species In moorhen, who found that each of lobes has a single duct *(7,8)*.

While in geese the uropygial papillae was broad and held two openings for their 2 excretory ducts, in moorhen *(8)* found the papillae is long and thin, while in turkey , the base of papillae was wide on the uropygial wike *(9,10)*.

Due to the larger glands in both geese and ducks in comparison to those of young pigeons , it is a likely condition for both swimming species ,needing for the more oily secretion to prevent their feathers from absorbing water. This condition is not needed for pigeons. Hence, more investigation is needed to study the glands of pigeon in different ages till its involution . It was demarcated that the glands were absent in some few handeled pigeons during this study. The absence of the glands in some bird species including: *kiwis, rheas, cassowaries, emu, ostriches, mesites, bustards, pigeons and doves, woodpeckers, frogmouths, and Amazon parrots* were mentioned *(11)*. The uropygial secretion is unlikely to play a major role in modifying plumage UV reflectance *(11)*. However, the uropygial secretion may have been selected to interfere as little as possible with visual signaling through plumage reflectance *(12)*.

The evolution of size of the uropygial gland: mutualistic feather mites and uropygial secretion reduce bacterial loads of eggshells and hatching failures of European birds *(13)*.

The gland of the 3 studied species were surrounded by a connective tissue capsule apparently devoid of muscle fibers, the glands parenchyma composed of secretory tubules, cases that were detected in Columba livia *(14)* and in moorhen *(8)* and pigeon *(15)*.

As for the pacinian corpuscles that could be observed in goose preen gland capsule , this is a novo finding was not mentioned by the available literature. Although, it was investigated that pacinian corpuscles were found in the capsule of duck preen glands, but denied their presence in goose preen gland capsules *(16)*. Those proprioreceptors are important to monitor the extent of secretory content of the gland and their pressure on the glandular capsule and its adjacent connective tissue.

Although the capsules of goose and duck preen glands showed lipids capsular fibroblasts storing lipids , a condition which could not be detected in Moorhen *(8)*.

According to this work, the epithelium of secretory units is formed of four zones ; germinative, storage cells, secretory and luminal degenerated cell zone, similar results were described *(17)* in indeginous geese and in Moorhen ducks *(8)* , four zones were recorded *(18)*. The tubular epithelium is classified into 3 zones as were in native ducks of Iraq *(19)*. The epithelium lining the tubules was determined to be composed of 4 different types of epithelial cells from the base to the lumen *(20,21)*.

Regarding the description of the young pigeons secretory units of the uropygial gland , that showed large polyhedral intermediate cells overlain with lipids, so it was the same picture in rock dove *columba livia* (columbidae-columbiformes) *(22)*.

According to the present work, both duck and goose preen glands revealed some or few acidic mucopolysaccharide secretions , indicating glycolipid secretory products. On the other hands, the young pigeon glands did not show any carbohydrate secretion, but its

products were purely oily. In Pekin immature and mature ducks, *(23)* recorded alcianophilic secretions as those recorded in this work in both ducks and geese.

From this work, it is apparent that the uropygial glands of the three studied species are holocrine glands according to mode of secretion,thence, while some researchers have described the uropygial gland of the quail as a simple tubular gland with a holocrine mode of secretion, some other researchers have described the uropygial gland as a gland composed of a multitude of tubules lined by stratified epithelium, which are arranged radially around the central duct of each lobe *(24)*. Also, the central duct of each lobe in young pigeons, simulating the findings of the latter authors in quail *(16)*.

Although the glands of both ducks and geese contained simple branched tubular secretory units, in white stork, found the secretory units as simple tubular glands *(21)*.

Inspite of the well-demarcated reticular fibers in both ducks and geese more than in young pigeons, those fibers were denied by *(21)* in white stork.

The stroma of young pigeons contained very few elastic fibers between the secretory glandular units, a condition found in pigeons *(25)*. In this regard, it was substituted by a lot of reticular fibers.

Respecting the presence of mast cells in between the secretory tubules of ducks and geese according to the current work, none of the available literature have searched or detected those cells in these species. Hence, the attention was devoted to detect these cells for their importance in immunity and protection of the body. The importance of mast cells for host defense against several pathogens has now been well established *(26)*. The location of mast cells, which are found closely associated with blood vessels, allows them to have a crucial sentinel role in host defence. The mast cell has a unique 'armamentarium' of receptor systems and mediators for responding to pathogen-associated signals. *(27,28)* evidenced that mast cells are responsible for regulation cerebral vasodilation and may mediate vasodilation during migraine headaches. *(29)* said that mast cells are best known as multifunctional entities that may confer a benefit on immune system. like in mammals, mast cells in nonmammalian vertebrates contain a wide range of bioactive compounds including histamine, heparin, neuropeptides, and neutral proteases.. mast cells have a widespread distribution in some organs, the highest concentration occurring in different tissues in the different taxa. currently, researchers are grappling with the nature of scientific support to substantiate the functional importance of mast cells in nonmammalian vertebrates.

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الملخص العربى

مشاهدات مورفولوجية مقارنة للغدة الزلمكية فى البط والاوز وصغار الحمام

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ان الغدة الزلمكية فى الطيور موجودة اعلى نهاية الذيل تحت الجلد مباشرة وهى مهمة للطيور الماثية فهل الطيور الاخرى فى احتياج لها'.. وماهى طبيعة افرازها؟ وطريقة الافراز؟

تم فى هذا البحث استخدام عشرين من ذكور البط فى عمر عام (متوسط وزن الغدة ٧±٠٢٠ جراما) وعشرين من ذكور الاوز فى عمر عام (متوسط وزن الغدة ٨,٥ ± ٢٠. جراما)وذلك لوزن الجسم فى الحالتين ٣ كيلوجرامات. وعدد خمسة وعشرين من ذكور صغار الحمام (متوسط وزن الغدة ٢٧. ± ٢.و)وذلك لوزن الجسم ٣٥٠ جراما.

وبعد دراسة الغدد عيانيا تم تحضير قطاعات برافينية و مجمدة وصبغها بالصبغات المختلفة وقد اوضحت النتائج مايلى:

كانت محفظة الغدة اكثر سمكا فى البط والاوز عنه فى الحمام.

كانت خلايا الانيبيبات المفرزة منتظمة فى اربعة مراحل افرازية متتالية: الجرثومية والافرازية والمخزنة والميتة. وكانت الخلايا المفرزة فى الاوز ذات طبيعة مورفولوجية خاصة عنها فى البط.

ان افراز الغدد فى البط والاوز كان دهنيا مع بعض الكربوهيدرات. بينما فى الحمام فكان دهنيا خالصا.

طبقا لطريقة الافراز فقد كان من النوع المستهلك الذى يتم فية استهلاك وموت الخلايا وخروجها مع الافراز وذلك فى الثلاثة انواع من الطيور.

كان افراز الخلايا من الحويصلات المفرزة الى فراغ وسطى فى كل فص ومنه الى قناة اخراجية لكل فص يفتح على الحلمة الصغير منفصلا عن الاخرى وذلك فى صغار الحمام. والذى كان الفصان فيها متلاصقين بدون زاوية تباعد بينهما.

كان فصا الغدد فى الاوز والبط منفرجين بزاويتى تباعد بينهما اكبر فى البط عنه فى الاوز وكانت الانيبيبات المفرزة تجمع افرازها فى انيبيبات مجمعة ثم متصلة مؤدية الى جيوب مركزية اكبرها تخرج منه قناة اخراجية واحدة لكل فص والتى تفتح منفصلة على حلمة عريضة فى الاوز او حلمة اصغر فى البط.

قابلية الخلايا للصبغ بالزيت الاحمر اوو (لصبغ الدهون) كانت شديدة فى الانواع الثلاثة.

تم تسجيل النتائج الاخرى ومناقشتها.