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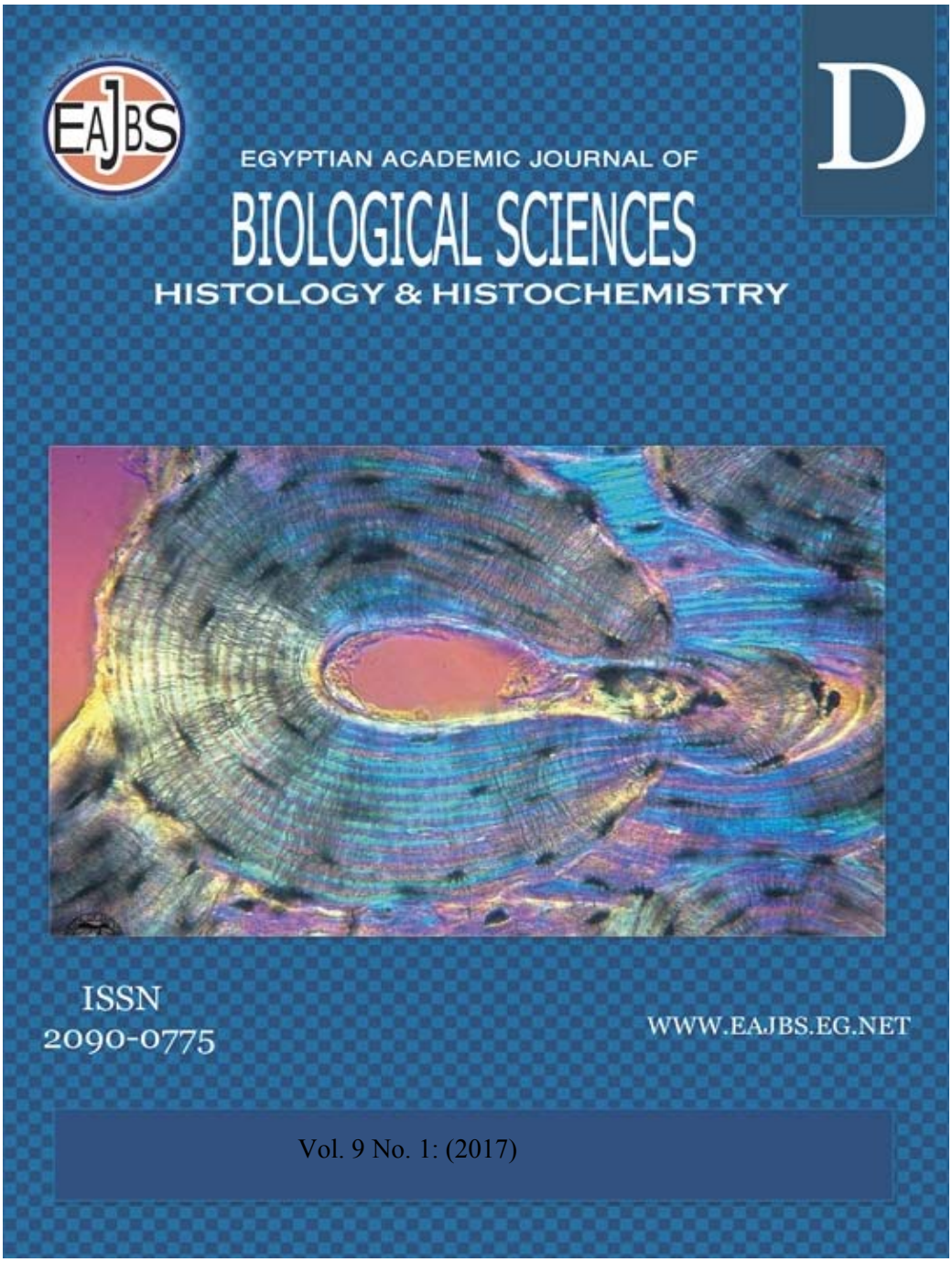

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Functional Anatomy of the Lips and Buccopharyngeal Cavity of Siluroid Fishes, *Clarias gariepinus* and *Bagrus bajad* Inhabiting Bahr Shebeen-Alkoom, Al-Menoufiya Governorate, Egypt.

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ABSTRACT

The present work aims to study the histological structures of the lips and buccopharyngeal cavity in both the omnivorous fish, Clarias gariepinus, and the carnivorous fish, Bagrus bajad. For this purpose, 20 specimens of the two species were collected from the River Nile at Bahr Shebeen Canal at Shebeen-Alkoom city, Al-Menoufiya governorate, Egypt. Results revealed that the lips of the two species are made up of the two layers; the epidermal and dermal. The epidermis composed of stratified mixed epithelium contained the undifferentiated epithelial cells, mucous cells, wandering cells and taste buds. The mucous cells are oval in shape and numerous in numbers with greater diversity in size and forms. The taste buds in the lips of C. gariepinus are greater in number than in Bagrus bajad. The dermis is formed of connective tissue rich in melanophores. The wall of the buccopharyngeal cavity of C.gariepinus and B. bajad were consists mainly of mucosa and submucosa and in some places of a third layer, the muscularis. Mucous cells are found within all parts of the epithelial mucosa with various shapes and sizes. Mucous-secreting cells, club cells and giant cells were highly abundant, forming the dominant feature in the epithelial layer. Such structures may be necessitated for lubrication of coarse food particles normally ingested.

INTRODUCTION

Siluriformes have the common name of Catfishes. They are known by this name because of the presence of barbels around their mouth, that look like the whiskers that surrounding the mouth of cats. The number of these barbels reaches to four pairs. It have a wonderfully diverse with over 3400 valid species comprising approximately 437 genera, 37 families and represent about 32% of all freshwater fishes, 10.8% of all fishes and 5.5% of all vertebrates (Jayaram, 2010 and Armbruster, 2011). Siluriformes have economically importance with high nutritive value and living both in marine and freshwater (Shehata, 1979; Jayaram, 2010 and Francis *et al.*, 2014).

Clarias gariepinus is one of the species belong to family Clariidae. The latter consist of fifteen genera, 12 endemic to Africa and two endemic to Asia, comprising a total of 93 species. This omnivorous fish has a widespread throughout tropical Africa and Asia (Shehata, 1979 and Nguyen & Janssen, 2002) due to fast growth rate, high stocking-density capacities, high consumer acceptability and high resistance to poor water quality and oxygen depletion (Shehata, 1979; Adewolu *et al.*, 2008; Akinwole & Faturoti, 2007 and Karami *et al.*, 2010). Because it is a prominent culture species (Adeyemo, 2008), the African Catfish has been used in many fundamental experimental researches (Sayed *et al.*, 2011).

Bagrus bajad is a benthic carnivorous feeder (bottom feeder) with high commercially importance (Malami & Magawata, 2010; Alhassan & Ansu-Darko, 2011 and El-Drawany & Elnagar, 2015) follow to the family Bagridae it was represented by thirty (30) genera and two hundred and ten (210) species. Bagridae commonly found throughout fresh- and brackish-water in Asia and Africa and only one genus, *Bagrus*, is endemic to Africa (Mo, 1991; Zaki *et al.,* 1994; Ferraris, 2007; Armbruster, 2011 and Ng & Kottelat, 2013).

The adaptations of the digestive organs of the fish to their normal diet are particularly evident in the form, size, structure, abundance and limitation of the microscopically elements such as dentition, mucous cells, taste buds, digestive glands and muscular coat in the esophagus, stomach, intestine and pyloric caeca. All of these features are subject to diverse and significant variations and much modification in accordance with the feeding habits (Dasgupta, 2000 and Khalaf-Allah, 2009).

Several studies are available on the histological structures of the alimentary canal of omnivorous fish, *Clarias gariepinus* (Shehata, 1979; Zaki *et al*., 1994; Gamal *et al.*, 2012; Aliyu and Solomon, 2012; Awaad *et al*., 2014 and Abou- Zaid, 2014) and carnivorous fish, *Bagrus bajad* (El-Naffar, 1967; Zaki, 1978; Khallaf & Alne-na-ei, 1987 and Mohamed & Awad Elseed, 2014). However, information on the description of morphological and histological adaptations of the lips and buccopharyngeal cavity of *C. gariepinus* and *B. bajad* according to food and feeding habits are very rare (Hussein, 2004).

Both the lips and buccopharyngeal cavity of the fish represents a specific variation of their morphology and histology which correlated with feeding habit, diet, body shape and also with the environmental conditions or eco-morphology (Shehata, 1982; Winemiller & Kelso-Winemiller, 1996; Bone & Moore, 2008 and Khalaf Allah, 2009). Therefore, the present study aimed to provide comparative description on the histological adaptations of the lips and buccopharyngeal cavity of *C. gariepinus* and *B. bajad* at Bahr Shebeen Canal, Al-Menoufiya governorate, Egypt according to its food and feeding habits to understanding the related functional mechanism of fish digestion and feeding strategy.

MATERIAL AND METHODS:

A total of 20 specimens; 10 of *Clarias gariepinus* and 10 of *Bagrus Bajad* formed the material for the present study. Fish specimens were collected by irregular visitors from different localities of Bahr Shebeen Canal at Shebeen-Alkoom city, Al-Menoufiya governorate, Egypt (Fig. 1); during the period from September, 2014 to May, 2015.

Trammel net was the main fishing method used to collect the fish (Latif, 1974). Wherever possible formed the material for the present study fish were examined fresh or preserved in 10% formalin solution for latter examination. In the laboratory, fish were taxonomically identified according to Boulenger (1907) and Sandon (1950). Total and standard lengths were measured to the nearest millimeters and recorded then the following studies were carried out.

For histological studies, small pieces (5 mm) of lips and buccopharyngeal cavity of *C. gariepinus* and *B. bajad* were removed from the dissected specimens and immediately fixed in alcoholic Bouin`s fluid for at least 48 hours, dehydrated in ascending concentrations of ethyl alcohol, cleared in xylene and embedded in paraplast wax (M.P.: 58°C). Transverse sections were cut at the thickness of 4-6 µm, stained with Harris`s haematoxylin and eosin

(Humason, 1979), microscopically examined, photographed and described.

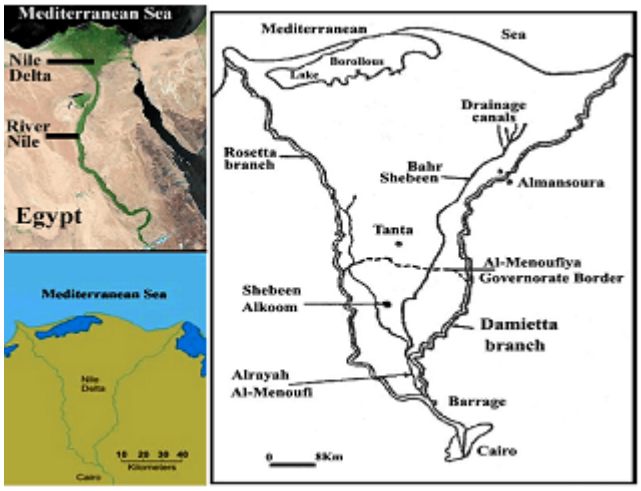

Fig. 1: Map of the Rive Nile showing the location of Bahr Shebeen Canal.

RESULTS

Lips:

Histologically, the lips in the two species are composed of two layers namely epidermis and dermis. In *C. gariepinus,* the lip is made up of stratified mixed epithelium in which different elements are found. These elements contained the undifferentiated epithelial cells, mucous cells, wandering cells and taste buds. The undifferentiated epithelial cells are arranged in several layers, the inner-most layers is the Malpighian layer, which is formed of elongated vertical cells resting on and fixed to the basement membrane with few processes. The majority of these cells pass more or less pointed apices directed outwards, with the large oval nuclei occupying the centers of the cells. Two or three layers of elongated polygonal cells, with oval nuclei, follow. The upper-most layers of the epidermis formed of cells with large oval nuclei (Plate 1A). The mucous cells are oval in shape and numerous in numbers with greater diversity in size and forms. They are much more concentrated in the upper layers than in the middle and lower ones of the epidermis. The type found near surface is rounded in shape. The crescent nuclei are housed in a cytoplasmic basal process (Plate 1C). Wandering cells (lymphocytes) are small-rounded-cells, with large nuclei. They are concentrated in the spaces between the Malpighian layer and the basement membrane (Plate 1E). Taste buds are numerous and much more concentrated on the papillae of the lips. Each taste bud consists of usual pear-shaped groups of numerous sensory cells supported by a number of small sustentacular cells and surrounded by a mantase of epithelial cells. The sensory cells have thread like processes extended into pit-like depressions on the outer layers of the stratified epithelium (Plate 1C).

The dermis is composed of ill-defined layer. The outer part is formed of dense wavy fibrous connective tissue rich in melanophores and running transversely with some vertical strands. The inner part is composed of loose connective tissue in the form of thick bands branching in all directions in the dermis. The lips of *C. gariepinus* are wavy in appearance at the base of which the thickness of epidermis increased (Plate 1A, C&E).

In *B. bajad*, however, the lip is comparatively thick and composed of stratified mixed epithelium in which the undifferentiated epithelial cells, mucous cells, wandering cells and taste buds are met with. Several layers are arranged and

represented the undifferentiated epithelial cells, the inner-most layers are resting on and fixed to the stratum compactum of the basement membrane. The majority of these cells pass more or less pointed apices, directed outwards, with the large oval nuclei occupying the centers of the cells. The inner-most layers followed by two or three layers of elongated polygonal cells with oval nuclei. The cells with large oval nuclei formed the upper-most layers of the epidermis (Plate 1B&D). The mucous cells are numerous with diversity in size and forms but the almost is oval in shape. They are much more concentrated in the upper layers than in the middle and lower ones (Plate 1D).Wandering cells are represented by small-rounded-cells with large nuclei. They are highly abundant in the spaces between the lower layers of the undifferentiated epithelial cells and the stratum compactum of the basement membrane (Plate 1F). Taste buds are few in number, pear in shape, and are located on the apices of elevated dermal papillae. Taste buds had two kinds of cells; the inner or sensory cells and the outer or nutritive cells while the latter type is characterized by having elongated nuclei; the former type is long and narrow with long protoplasmic processes towards the surface of the epithelium (Plate 1F).

The dermal layer composed of ill-defined layer. The outer part is formed of dense wavy fibrous connective tissue, poor in chromatophores and running transversely with some vertical strands. The inner part is composed of loose connective tissue (Plate 1B, D&F).

The buccopharyngeal cavity:

Results showed that, the buccal cavity of *C. gariepinus* and *B. bajad* extends from the lips to the first gill slits or to the anterior pharynx. The roof of the buccal cavity is slightly convex, while the floor is relatively elevated. The pharyngeal cavity of the two species studied can be divided into the anterior and posterior regions. The wall of the anterior region is laterally perforated by the gill clefts and is mainly concerned with the respiratory and gustatory functions. The posterior region, however, is mainly concerned with mastication.

Histologically, in *C. gariepinus*, the roof and the floor of the buccopharyngeal cavity consists mainly of mucosa and submucosa and in some places of a third layer, the muscularis. The epithelial folds are of irregular in shape, being broad flattened towards the lumen. The mucosa is formed of comparatively thick stratified epithelium resting on the basement membrane. The thickness of the submucosa is changes from one place of the buccal cavity to the other (Plate 2A). The stratified epithelial layer of the buccopharyngeal cavity composed of undifferentiated epithelial cells; mucous cells; club cells; taste buds and wandering cells (Plate 2A&C). Undifferentiated epithelial cells are presented almost everywhere around the taste buds and mucous cells as well as in the basal layer of the epithelium. The basic layer of the epidermis consists of one row of columnar epithelial cells. This layer is followed by two or three layers of polygonal cells followed by 3-5 layers. Between the latter layers and the basal layers, the club cells are crowded together. The columnar epithelial cells rested on a basement membrane which is composed of a thin fibrous layer attached to the stratum compactum which is in turn formed at wavy fibrous layer (Plate 2A&C).

Mucous secreting cells are found within all parts of the epithelial mucosa with various shapes and sizes. The mucous cells which lie near the surface of the epithelium are oval or spherical in shape with their long axis perpendicular to the surface, while in the middle, these cells are larger in size and take the flask shape (Plate 2A&C).

The club cells are confined to the deeper epithelial layers touching their rounded heads with the layers of

flattened epithelium. They are arranged in several layers with the youngest layer, close to the Malpighian layer, being oval in shape with different sizes. The cytoplasm of the club cells is homogeneous and stained faint red with the haematoxylin and eosin. However, some of the club cells are vacuolated with two or three oval nuclei in the central region (Plate 2A&C).

Few taste buds are found in the mucosa of the buccal cavity of *C. gariepinus* similar to those found in the lips. Two types of wandering cells are found in the mucosal layer of the buccopharyngeal cavity. The granular wandering cells are observed among the epithelial cells while some lymphocytes are found in the surrounding area of the basement membrane (Plate 2A&C).

The submucosa, which is richly supplied with blood vessels, is made up of loose connective tissue fibres parallel to each other along the extending basement membrane and become separated by the vertical strands of muscle fibres. The muscularis, if present, consists of very heavy and coarsely striated muscle fibers (Plate 2A&C).

The wall of the buccopharyngeal cavity of *B. bajad* is made up of two layers namely mucosa and submucosa; in some places of a third layer, the muscularis. The mucosa consists of stratified epithelium which resting on the stratum compactum of the basement membrane. The thickness of submucosa changes from one place to the other (Plate 2B&D).

Different epithelial cells were observed in the mucosal layer of the buccopharyngeal cavity. These cells are undifferentiated epithelial cells; mucous cells; club cells; giant cells; taste buds and wandering cells (Plate 2B&D).

The mucosa is made up of several layers of undifferentiated epithelial cells; the number of these layers varied between 5 and 7 layers. The undifferentiated epithelial cells varied in shape and size. The stratum compactum formed at the wavy homogeneous fibrous layer with varying thicknesses. The nuclei stained deeply blue with haematoxylin (Fig. 25). Posteriorly, the stratum germinativum becomes thicker and the mucosal folds are more abundant (Plate 2B&D).

The Mucous cells near the surface of the epithelium are more or less oval or spherical in shape and vary in size; their axis appears perpendicular to the surface. Some cells opened on the free surface of the mucosa where the secretion is poured out (Plate 2B&D). Posteriorly towards the esophagus, the mucous cells greatly increased in number, forming numerous mucous-secreting layers. Such cells tended to become concentrated along the sides of the mucosal folds (Plate 2B&D).

The club cells are arranged in several layers; the youngest layer, close to the stratum compactum, is different in shape and size. The cytoplasm of the club cells is homogeneous and stained red with the haematoxylin and eosin. Such club cells had oval nuclei in the central region (Fig. 25). Posteriorly, towards the esophagus, one or more layers of polygonal club cells are distributed among the stratified epithelial cells (Plate 2B&D).

The giant cells were observed below the mucous secreting layers, among the club cells, which acquired either an oval or spherical shapes. The size of each giant cell is about three or four times that of the mucous secreting cell. The compound nucleus is central with a definite nuclear wall. The latter cell had faint chromatin and one nucleolus (Plate 2B&D).

Taste buds particularly occurred in the anterior part of the buccopharyngeal cavity, in the pads and over the gills. The wandering cells are found in the mucosal layer of the buccopharyngeal cavity among the undifferentiated epithelial cells and the surrounding area of the stratum compactum of the basement

membrane. Posteriorly, however, the wandering cells are numerous and more crowded at the vicinity of the basement membrane (Plate 2B&D).

Beneath the mucosa, there is a well-developed stratum compactum. The thickness of submucosa is nearly similar to that of mucosal layer. Most of the fibers that form the stratum compactum run parallel to the free surface of mucosa. Some patches, however, run perpendicular to the latter surface and therefore form a strong support to the mucosal layer. The submucosa supplied with blood vessels in the fibrous connective tissue (Plate 2B & D). Posteriorly, submucosa is made up of collagenous connective tissue. Such structure, this tissue is characterized by the presence of dense bundles of longitudinal muscle fibers, stained deeply red with haematoxylin-eosin and dispersed in all directions. In some places however, it appears as a zigzag-shape tissue extending parallel to the basement membrane. The muscularis, if present, consists of very heavy and coarsely striated muscle fibers (Plate 2B & D).

The teeth in buccopharyngeal cavity of *C. gariepinus* and *B. bajad*:

The epithelium of the horny pad teeth is differentiated into; the basal zone which is composed of a single layer of the columnar cells resting on the basement membrane. The middle zone is is made up of various layers of polygonal cells. The superficial zone is also formed of several layers, the outermost of which is very irregular and is termed the stratum compactum. During the development of the teeth, the epithelium become thicker and extends down through the submucosal layer, forming the dental ridge. The enamel organ is composed of the cup-shaped dental ridge. The mesenchymal tissues fill the pulp of the cavity formed the dental papillae. The inner layer of the enamel is composed of columnar cells while the outer layer is formed of the cubic cells. The enamel cells secrete the dentine to the outside while the superficial mesenchymal cells of the dental papillae is formed of columnar cells; the odonoblasts responsible for the formation of the dentine remain in the central mesenchymatous cells of the pulp cavity even after the completion of development (Plate 2E & F).

DISCUSSION

The lip of *C.gariepinus* and *B. bajad* is made up of two layers; the epidermis and the dermis. The epidermis of lips is composed of stratified mixed epithelium, contained the undifferentiated epithelial cells, mucous cells, wandering cells and taste buds. The mucous cells are oval in shape and numerous in numbers with greater diversity in size and forms. Taste buds are numerous and much more found on the papillae of the lips. The outer layer is formed of dense wavy fibrous connective tissue richly supplied with melanophores and running transversely with some vertical strands. The inner part is composed of loose connective tissue in the form of thick bands branching in all directions in the dermis. Results are similar observation were detected by many authors including Shehata (1979 & 1997a); Albattal (2002) and Khalaf-Allah (2009).

Among the teleost fishes, the lips perform immense plasticity and structural adaptability for the exploitation of the diverse food items (Horn, 1998 and Dey *et al.*, 2015). The lips of the fishes could contribute in accurate localization, capture, deglutition and pre-digestive preparation of food by triggering the pick-up reflex in analogy with the barbels of some fishes (Northcutt, 2004).

In most vertebrates the sense of taste buds are used as a close range receptor for food item discrimination. Fish are unique among vertebrates in having taste buds widely distributed over the various regions (Tripathi & Mittal,

2010). The present study indicated that, the taste buds in the lips of *C. gariepinus* are greater in number than *in Bagrus bajad*. The distribution of TBs is reflection of the feeding behavior and the habitat in which the fish live can interpreted TBs on lips which is an active carnivorous fish having well developed eye. These results were agreed with (Pasha, 1964; Viña *et al*., 2013 and Abou- Zaid, 2014).

The level of taste system development in fish has previously been linked to the degree of benthic association of the fish, light level and water clearness of its habitat (Fishelson & Delarea, 2004; Franz-Odendaal & Hall, 2006; Bailey *et al*., 2007). Variations in number, nature and distribution of the taste buds in the fore gut appear to be related for changes in feeding habits. In the fish feeding by sight, taste buds have been reported to rare or absent; a few taste buds are present in those which feed by sight and taste; while in fish feeding by tasting abundant, taste buds are found (Shehata, 1997a; Albattal, 2002 and Khalaf-Allah, 2009).

At the light of these observations; omnivorous fish, *C. gariepinus* and carnivorous fish, *B. bajad* were bottom feeder. They feed by sight and taste buds. They can be distinguishing between the desirable and the undesirable food. The eyes and taste buds appear to play an important role in selection and orientation towards the food. Similar observations were observed by many authors notably Shehata (1994); De Bruin *et al.,* (1995); Argyris (2005); Oliveira *et al.,* (2007) and Khalaf-Allah, (2009). The abundance of taste buds in the fore gut of these fishes is rather to be correlated with the way in which the fish scores its food rather than with the nature of its diet. These results agree with the findings of Shehata (1982 & 1999); Agamy *et al.*, (1992); Kamel *et al.,* (1995) and Mai *et al.*, (2005).

In the present study, the buccopharyngeal cavity of *C. gariepinus* and *B. bajad* consists mainly of mucosa and submucosa and in some places of a third layer, the muscularis. Mucous cells are found within all parts of the epithelial mucosa with various shapes and sizes. Mucous-secreting cells, club cells and giant cells were highly abundant, forming the dominant feature in the epithelial layer. This may be necessitated for lubrication of coarse food particles normally ingested. The present study is quite similar to the same results detected in *C. gariepinus* (Shehata, 1979; Zaki *et al*., 1994; Gamal *et al*., 2012; Ikpegbu *et al*., 2012 & 2013) and in *B. bajad* (El-Naffar, 1967; Zaki, 1978, Khallaf & Alne-na-ei, 1987; Hussein, 2004 and Mohamed & Awad Elseed, 2014).

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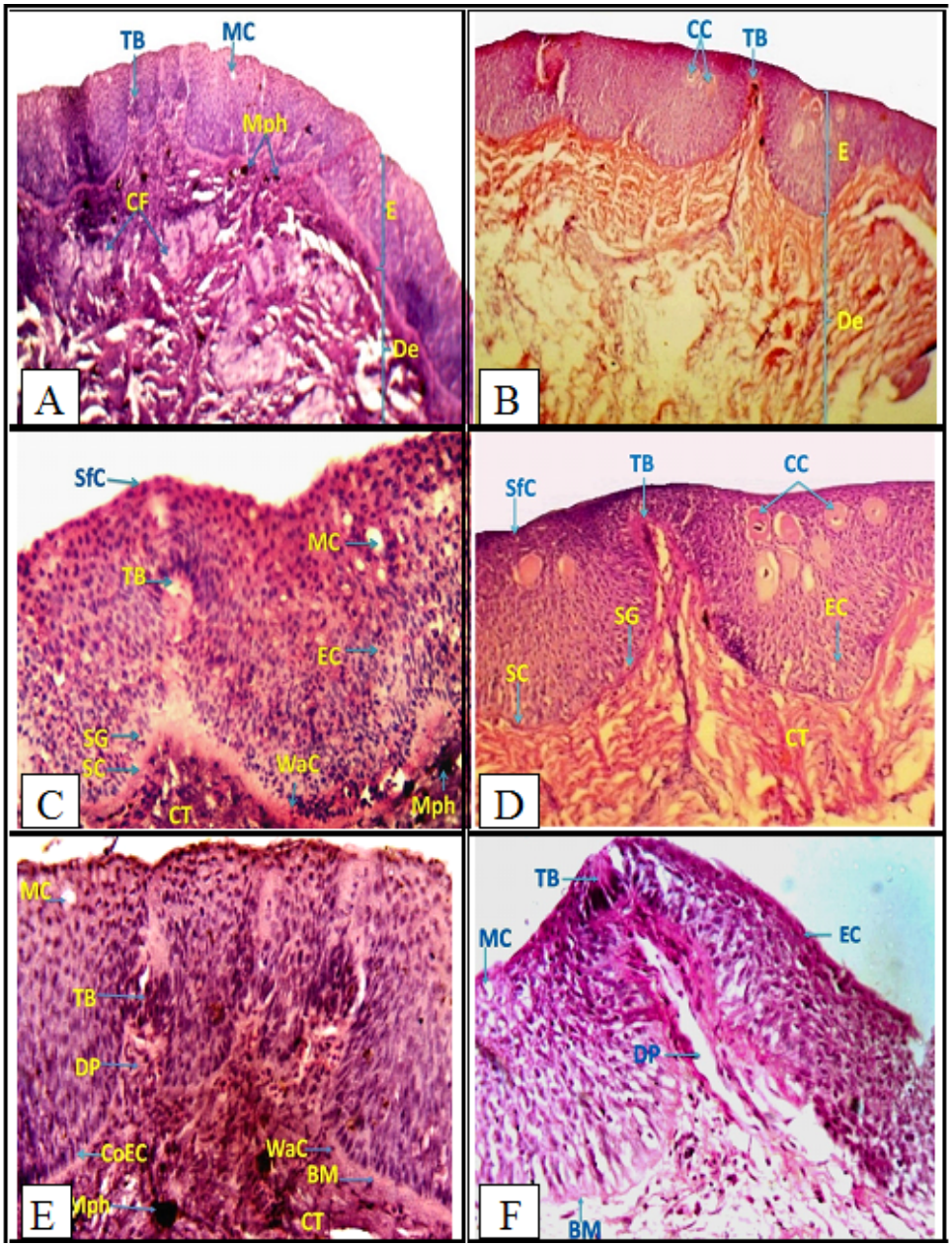
Plate I



A: A photomicrograph of T.S. in the lips of *C. gariepinus* showing epidermis (E), dermis (De), taste buds (TB), mucus cells (MC), melanophores (Mph) and collagen fibers (CF) (H&E, X 40).

B: A photomicrograph of T.S. in the lips of *B. bajad,* showing the outer layer of the lips, epidermis (E) and the inner layer, dermis (De) (H&E, X 40).

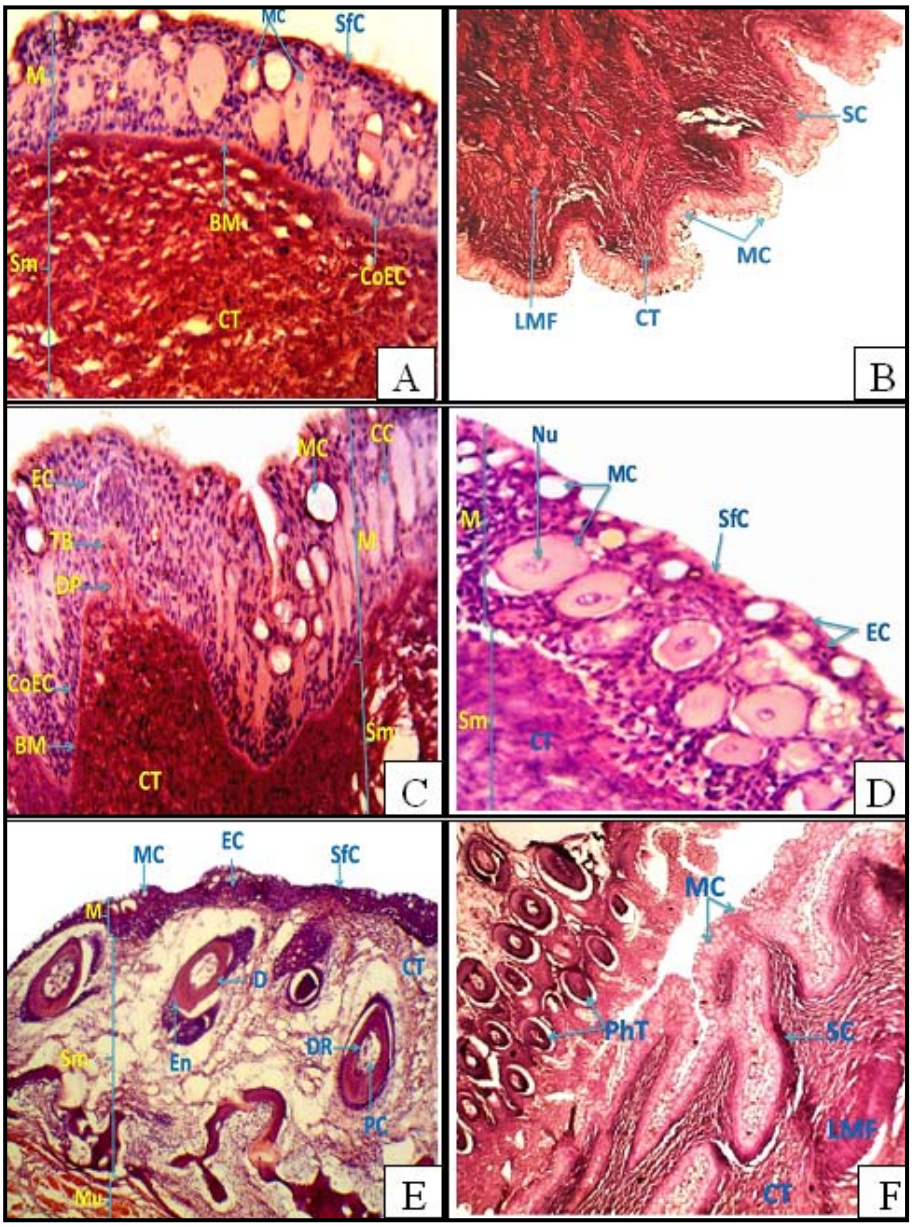
C: A photomicrograph of T.S. in the lips of *C. gariepinus* showing superficial cell (SfC), mucus cells (MC), taste buds (TB), epicelial cell (EC), wandering cells (WaC), melanophores (Mph), connective tissue (CT), stratum compactum (SC) and stratum compactum (SC) (H&E, X 100).

D: A photomicrograph of T.S. in the epidermis layer of the lips in *B. bajad* showing superficial cell (Sfc), taste bud (TB), mucous cells (MC) and connective tissue (CT) (H&E, X 100).

E: A photomicrograph of T.S. in the lips of *C. gariepinus* showing mucous cell (MC), taste buds (TB), dermal papillae (DP) and melanophores (Mph) (H&E, X 400).

F: A photomicrograph of T.S. in the epidermis layer of the lips in *B. bajad* showing mucous cells (MC), taste bud (TB), dermal papillae (DP), epicelial cell (EC) and basement membrane (BM) (H&E, X 400).

Plate II



A: A photomicrograph of T.S. in the buccopharyngeal cavity of *C. gariepinus* showing mucosa (M), submucosa (Sm), mucous cell (MC), superficial cell (SfC), basement membrane (BM), columnar epicelial cell (CoEC) and connective tissue (CT) (H&E, X 100).

B: A Photomicrograph of T.S. in the buccopharyngeal cavity of *B. bajad* showing longitudinal muscle fiber (LMF), connective tissue (CT), mucous cell (MC) and stratum compactum (SC) (H&E, X 100).

C: A Photomicrograph of T.S. in the buccopharyngeal cavity of *C. gariepinus* showing mucosa (M), submucosa (Sm), superficial cell (SfC), mucous cell (MC), epicelial cell (EC), taste bud (TB), dermal papillae (DP), basement membrane (BM), columnar epicelial cell (CoEC) and connective tissue (CT) (H&E, X 100).

D: A Photomicrograph of T.S. in the buccopharyngeal cavity of *B. bajad* showing mucosa (M), submucosa (Sm), nucleus (Nu), mucous cell (MC), superficial cell (SfC), epicelial cell (EC) and connective tissue (H&E, X 400).

E: A photomicrograph of T.S. in the buccopharyngeal cavity of *C. gariepinus* showing mucosa (M), submucosa (Sm), muscularis (Mu), mucous cell (MC), epicelial cell (EC), superficial cell (SfC), enamel (En), dentine (De), dentine ridge (DR), pulp cavity (PC) and connective tissue (H&E, X 100).

F: A photomicrograph of T.S. in the buccopharyngeal cavity of *B. bajad* showing mucous cell (MC), pharyngeal teeth ((PhT), stratum compactum (SC), longitudinal muscle fiber (LMF) and connective tissue (H&E, X 100).

RABIC SUMMERY

التشريح الوظيفي للشفاه والتجويف الفمي البلعومي للأسماك القطية؛ القرموط والبياض القاطنة لبحر شبين الكوم- محافظة المنوفية- مصر.

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تهدف الدراسة الحالية إلى دراسة التراكيب النسيجية لكلا من الشفاه والتجويف الفمي البلعومي فى كل من القرموط كسمكة خليطية التغذية والبياض كسمكة لاحمة التغذية. ولذلك تم تجميع عشرون عينة من الأسماك محل الدراسة من نهر النيل؛ من قناة بحر شبين – مدينة شبين الكوم – محافظة المنوفية – مصر.

أوضحت نتائج الدراسة أن الشفاه في كلا من سمكة القرموط وسمكة البياض تتركب من من طبقتي البشرة والأدمة وتتكون البشرة من طلائية طبقية مختلطة تحتوي على خلايا طلائية غير متميزة، وخلايا المخاطية، وخلايا متجولة و براعم الذوق. الخلايا المخاطية تأخذ الشكل البيضاوي وعديدة مع تنوع كبير في الأحجام والأشكال. براعم الذوق في شفاه سمكة القرموط أكثر في العدد من مثيلتها في سمكة البياض. تتركب الأدمة من النسيج الضام الغني بالصبغيات السوداء.

بينت نتائج الدراسة أن جدار التجويف الفمي البلعومي من الطبقة المخاطية و تحت المخاطية وفي بعض الأماكن تظهر الطبقة العضلية. تظهر الخلايا المخاطية في جميع أجزاء المخاطية الطلائية مع تنوع الأشكال والأحجام. تظهر خلايا إفراز المخاط، والخلايا المكعبية والخلايا العملاقة بوفرة عالية مكونة التركيب السائد في الطبقة الطلائية. إفراز المخاط يساعد على ترطيب جزيئات الطعام الخشنة التي يتم تناولها عادة وتسهيل مرور الغذاء.