

Histological Structure of the integument in *Mystus pelusius (Solander)*

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Abstract

The histological structure of the integument in *Mystus pelusius* have been investigated. The study based on the micro- anatomical investigation of the skin fragments taken from nine specific regions of the body.

The results of the present study revealed that the integument comprise three principal layers, represented by the epidermis, the dermis (corium) and the subcutis. The epidermis may further be divided into the outer most epithelial layer (coverage), the middle layer and the basal layer (stratum germinativum) .The thickness of the epidermis in the investigated fish varies to a great extend (50-250 μm).

The dermis of *M. pelusius* is consisting of a relatively thin upper layer of loose vascular connective tissue called the stratum laxam and a thic lower compact layer called stratum compactum. The thickness of the dermis showed a great exterd (25-250 μm).

The subcutis is the inner most and almost the thinnest layer of the skin. It shows some empty spaces which are occupied by fat cells. The thickness of the subcutis layer in *M. pelusius* is ranged from 38 μm to 175 μm .

التركيب النسيجي للجلد في سمكة ابو الزمير *Mystus pelusius* (Solander)

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الملخص

تم دراسة التركيب النسيجي للجلد في سمكة ابو الزمير *Mystus pelusius* . استندت الدراسة الى بحث التشريح الدقيق لقطع من الجلد في تسع مناطق خاصة بالجسم . اوضحت النتائج ان الجلد يتكون من ثلاث طبقات اساسية ممثلة بالبشرة والادمة والطبقة تحت الجلدية . والبشرة قد تقسم الى طبقة خارجية ظهارية مغطية وطبقة وسطى وثالثة قاعدية (طبقة مولدة) اظهر سمك البشرة في السمكة المدروسة تبايناً كبيراً في مدى السمك (250-50 مايكروميتر) . الادمة هي الاخرى تتكون من طبقة علوية نحيفة نسبياً من نسيج ضام مفكك وعائي تدعى بالطبقة المنحلة (المفككة) , واخرى سفلية سميقة مكتنزة تدعى بالطبقة المتراسة , وسمك الادمة اظهر ايضاً مدى واسع في سمكة (250-25 مايكروميتر) . الطبقة تحت الجلدية وهي الداخلية تكون انحف الطبقات وهي تظهر فصح مشغولة بخلايا دهنية , وهي اسوة بالطبقات الاخرى تظهر تبايناً في السمك (175-38 مايكروميتر) .

Introduction

The integument is one of the largest organs of the body, making up some 15% of the human body weight(1). The different layers of the integument form some of the most varied structures found within vertebrates , as they are producing several structures which are representing the integument derivatives(1,2,3) .

A review of the literature shows that quite extensive work has been done on the integument of different species of fishes(4,7,8,9,10,11) The present paper report part of an extensive study which has been carried out in an attempt to study the histological structure of the integument of different Iraqi freshwater fishes. One of the major drawbacks with the current investigation the almost lack of scientific data about the histological structure of the integument of the Iraqi freshwater fishes with the exception of the preliminary data reported by Jasim and AL-Daham(12) and Hamed(13).

Materials and Methods

The specimens of *M. pelusius* for this study were collected from

the central marshes near AL-chebaesh city at Thiqr province.

Integument fragments of about 1×1 cm were cut from nine regions of the body, (regions listed in table 1) and fixed in 10% formalin. Ethyl alcohol was used as a dehydrating agent. Paraffin sections were cut at 6 µm and were stained by Harris haematoxylin and counter stained with eosin (H & E) .Periodic Acid Schiff (PAS) was also used to recognized the basement membrane. Masson Trichram stain (MTC) was also used to differentiat the different structures and layers of the integument of the fish under investigation. All the above materials prepared and used according to Humason,(14) and Bancroft and Stevens(15).

Results

The integument of *M. pelusius* comprises three main layers- the epidermis, the dermis (corium) and the subcutis. The epidermis and the dermis are separated by a basement membrane which follows the depressions and elevations of the upper surface of the dermis (Figure 1).

The epidermis of *M. pelusius* may further be divided into three layers. These were the outermost epithelial layer, the middle layer and the basal layer (germinativum layer). The thickness of the epidermis of *M. pelusius* varies to a great extent (Table 1).

The stratum germinativum layer is composed of a single layer of cuboidal cell. Each such cell is provided with oval or spherical nucleus placed in the center of the cell. The cuboidal cells layer situated just above the basement membrane (Figure 1).

In between the cuboidal cells found small oval or round lymphatic spaces which contain lymphocytes with deeply stained nuclei. The middle layer of the epidermis is composed elongated epithelial cells with oval or spherical nuclei. In between these elongated cell found many mucous and club cells which are differ in their number in different integument regions of the body and they have differ measurement in their length and width. The club cells appeared with single centrally placed nucleus or two, sometime three and rarely four and the cytoplasm appear homogenous in rotine stain (H&E) (Figures 2,3,4).

The outermost layer is composed of rather flattened cells arranged in two to six layers (upper and lower lips, 3-6 layers ; head, 2-4 layers; dorsal surface, 2-4 layers; ventral surface, 3-5 layers; at lateral line within the trunk region 3-5, layers; caudal peduncle 5-6, layers and caudal and pectoral fins, 2-3 layers). Goblet cells which are opened to the surface of the body represented clearly in this layer of epidermis (Figure 5).

The dermis consists of relatively thick outer loose connective tissue layer (stratum laxum). The loose connective tissue layer situated below the basement membrane is richly supplied with blood capillaries (Figure 4).

The second or deep layer of epidermis is relatively thin layer and is characterized by the presence of coarse compactly arranged bundles of collagen fibers. The thickness of dermis in *M. pelusius* varies to great extend (25-250 μm).

Histological examination showed that there are number of dermal papillae, which are penetrate deep into the epidermis. These papillae are usually straight and cylindrical in shape and do not break through the basement membrane and the germinal layer

of the epidermis. Dermal papillae appear above the dermal stalk and they are richly supplied with nerves and blood capillaries and lie freely in the epidermis (Figures 2,4). Pigment cells are also found in these papillae.

Taste buds are pear shaped structures found either singly or in groups of two or three situated in certain specialized area of epidermis above the supported dermal papilla. The taste bud formed basal cells, sensory hair cells & supporting cells (Figure 2 &4).

The subcutis layer is bind the stratum compactum with undelying muscle bundles.It is richly supplied by nerves and blood vessels (Figure 6). The sub cutis layer is also varies in its thickness (38-175 μm)

Sections of the integument at lateral line system within the trunk region showed that the trunk canal of lateral line situated in stratum laxum of the dermis. It's opening surrounded by regular dense connective tissue and lined by stratified squamous epithelium. The trunk canal surrounded by white fibrous cartilage (Figures 6 and 7). The neuromast situated deeply in the canal and appear oval in its

shape. It is formed from two parts, the first consist of two rows of cells (Sensory hair cells and supporting cells). The second part of the neuromast represented by cupula (Figures 8 and 9).

Discussion

The integument of *M. pelusius* comprise three principal layers which are the epidermis, the dermis and the subcutis. The subcutis is present in all fishes except in *Amia calva* (16,17,18,19). Liem(20) and Mittal and Munshi (4,21), have recognized the subcutis as one of principal layers of the integument in different fish species.

Mittal and Munshi(4) stated that the presence of lymphatic spaces in the stratum germinativum of the epidermis in teleostean fishes is interested, as they supply nutrition to the stratum germinativum for cell proliferation and protect the epidermis from microorganism or foreign protein. The appearance of a large number of lymphocytes indicate the pathological condition(4). Results of the present study showed few lymphatic spaces with lymphocytes within the stratum germinativum layer. It is not unexpected as the

fish collected from relatively clean water.

Review of the literature declare that the epidermis of fishes is usually equipped with various types of unicellular glands which secrete a slippery, gluey viscous substance that keeps the body of the fish slimy. These literature described the different types of slime cells in the epidermis of various fishes, these were : (a) beaker-shaped or flask-shaped cells (Becherzellen), (b) club cells (Kolbenzellen or Kolbenformige gebilde), and (c) sacciform cells (Sack formige seröse drüsen) (4,22,23) . The slime cells found in the epidermis of *M. pelusius* are of various shapes and sizes. They were represented by small goblet cells situated in the outermost layer of the epidermis; mucous cells which are larger in their sizes and concentrated in the middle layer of the epidermis and the third type is club cells which are appeared clearly in the middle layer of the epidermis.

In the dermis of the fish under investigation two distinct layers, the stratum laxum and the stratum compactum may be distinguished. The first is formed from loose connective tissue situated below

the basement membrane and it is richly supplied with blood capillaries. The second is formed from compactly arranged bundles of collagen fibers. In the present study the results dealing with the histological structures of the dermis agree with the results reported by several researcher in different species of fishes (4,13,17,18,21,24,25, inter alia).

Examination of the dermis layers in investigated fish showed that there are numbers of dermal papillae which are straight and cylindrical in their shaped and are penetrate deep into the epidermis. They are richly supplied with nerves & blood capillaries and lie freely in the epidermis. This result agree with the data reported by several workers such as Mittal & Munshi(4), who are worked on *Heteropneustes fossilis* , *Amphipnous cuchia* and *Mastacembelus punctatus* ; Hamed (13) and AL- Nakeeb (30), who were working on different Iraqi fish species.

Results of the presents study showed that there are numbers of taste buds in the epidermis of *M. pelusius* in different regions of the body. Each taste bud formed from sensory hair cells, supporting cells & basal cells. This result supported

by the foundation of Lance(26); Hamed(13) and AL- Nakeeb(30).

Results of the presents study showed that the trunk canal of lateral line system situated in stratum laxum of dermis and it is surrounded by white fibrous cartilage(5,30).

The neuromast situated deeply in the canal and appear oval in its shape. The canal neuromasts consist of two main portions (a) the first represented as a cellular

portion which composed of two types of cells (hair sensory cells and supporting cells) and (b) the second represented as cupula which embedded in canal cavity. Such results agree with the results obtained by several researchers(27,28,29,30).

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Table (1): The thickness of the epidermis, dermis and subcutis in *M. pelusius* at different region of the body.

| Region | Range and mean (-)/µm | | |
|-----------------|-------------------------|-----------------|------------------|
| | Epidermis | Dermis | Subcutis |
| Upper Lip | 125 (172) 213 | 75 (117.5) 175 | Undifferentiated |
| Lower Lip | 100 (168.8) 250 | 50 (106) 150 | Undifferentiated |
| Head | 100 (134.4) 175 | 150 (193.7) 250 | 50 (61) 75 |
| Dorsal surface | 100 (134.3) 163 | 88 (102.5) 130 | 50 (77) 100 |
| Ventral surface | 125 (153.7) 175 | 125 (192) 250 | 55 (94) 150 |
| A lateral line | 113 (153) 188 | 130 (182.5) 250 | 38 (84) 175 |
| Caudal peduncle | 100 (134.4) 175 | 138 (156.3) 175 | 50 (75) 100 |
| Caudal fin | 88 (128) 163 | 25 (44) 63 | Undifferentiated |
| Pectoral fin | 50 (66.4) 88 | 25 (47) 75 | Undifferentiated |

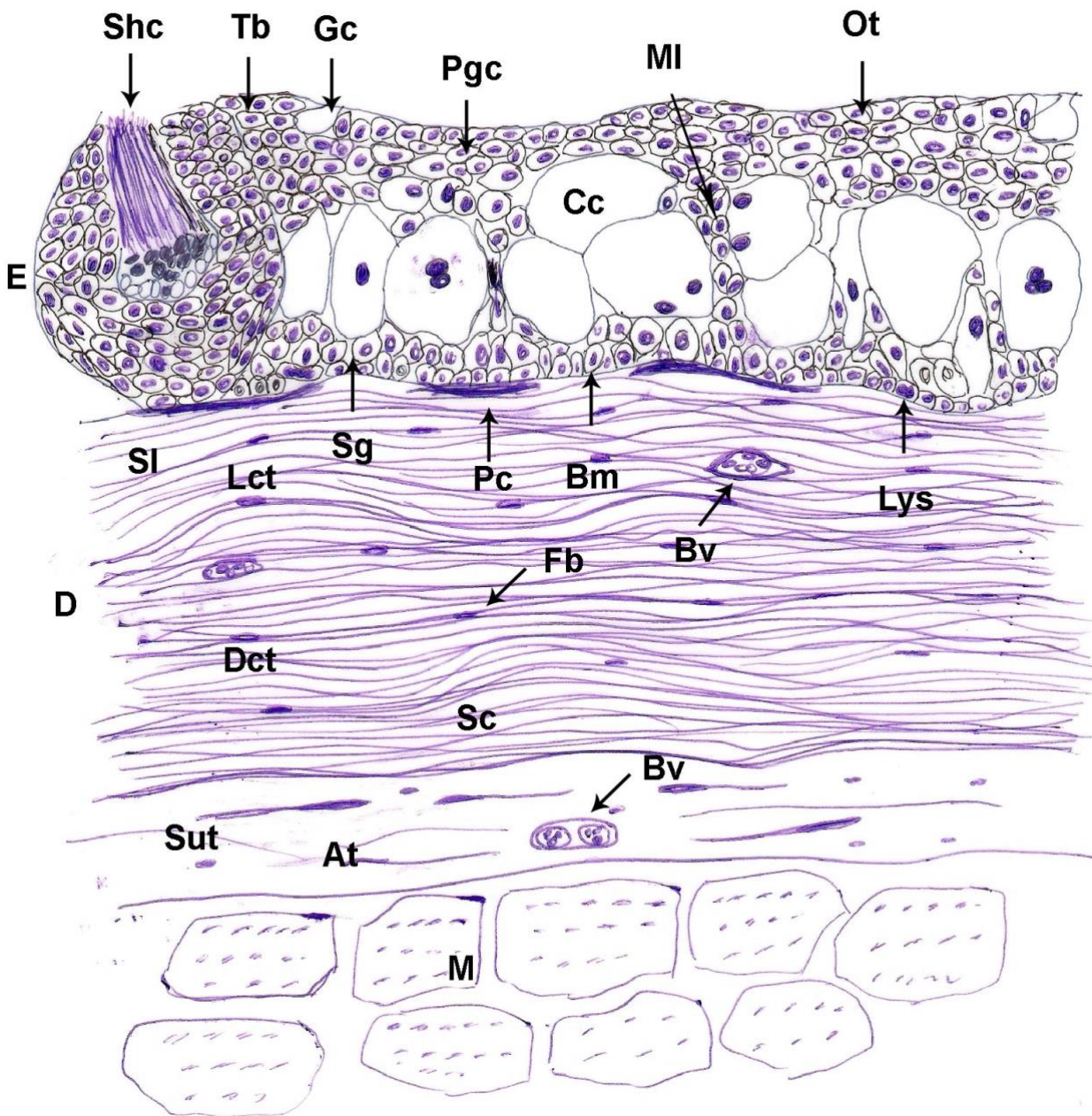


Figure (1). A diagrammatic representation of the integument of *Mystus pelusius* showing its structure organization, (1000 x).

(At)Adipose tissue;(Bm) Basement membrane;(Bv) Blood vessels; (Cc)Club cell;(D) Dermis;(Dct) Dense connective tissue; (E)Epidermis; (Fb) Fibroblast; (Gc) Goblet cell; (Lct)Loose connective tissue; (Lys) Lymphocyte; (M) Muscle; (MI) Middel layer; (Ot) Outer layer; (Pc)Pigment cell; (Pgc)Polygonal cell; (Sc)Stratum compactum; (Shc)Sensory hair cell; (Sg)Stratum germinativum; (Sl) Stratum laxum; (Sut) Subcutis; (Tb) Taste bud.

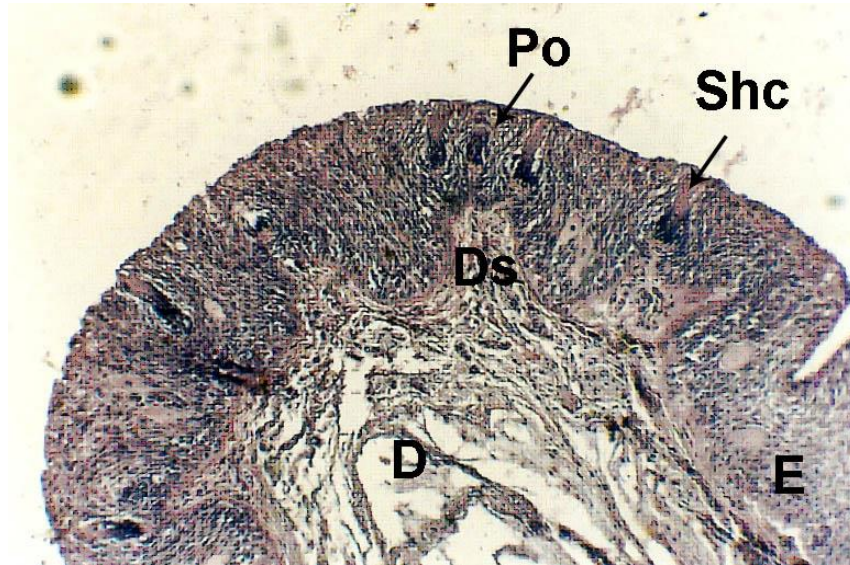


Figure (2). Vertical section of the integument of *Mystus pelusius* at lower lip region showing the general organization, papillary organ and dermal stalk, (PAS) (100X). (D) Dermis ,(Ds) Dermal stalk, (E) Epidermis ,(Po) Papillary organ (Shc) Sensory hair cell

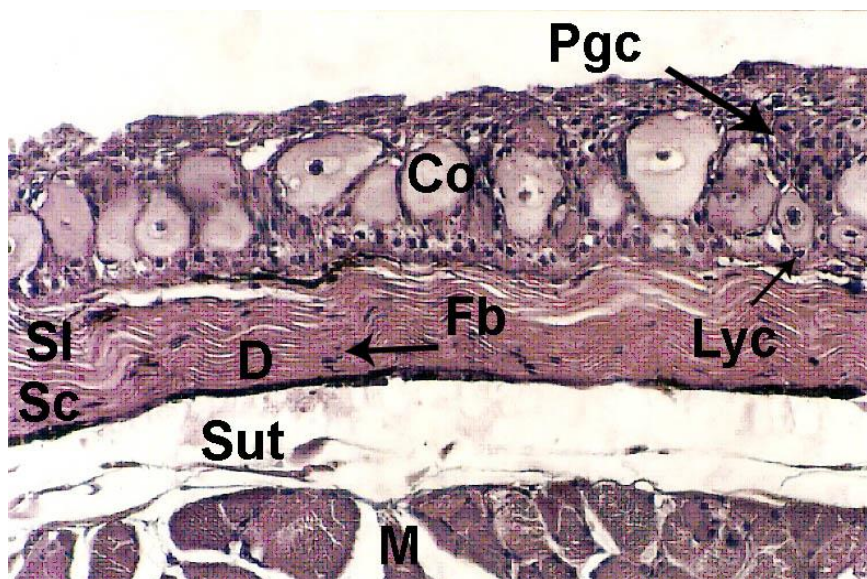


Figure (3). Vertical section of the integument of *Mystus pelusius* at head region showing the different integument layer and the types of cells , (HE) (200X).(Cc) Club cell, (D) Dermis,(Fb)Fibroblast,(Lys)Lymphatic space,(M)Muscle(Pgc)

Polygonal cell, (Sc)Stratum compactum, (SI) Stratum laxum, (Sut) Subcut

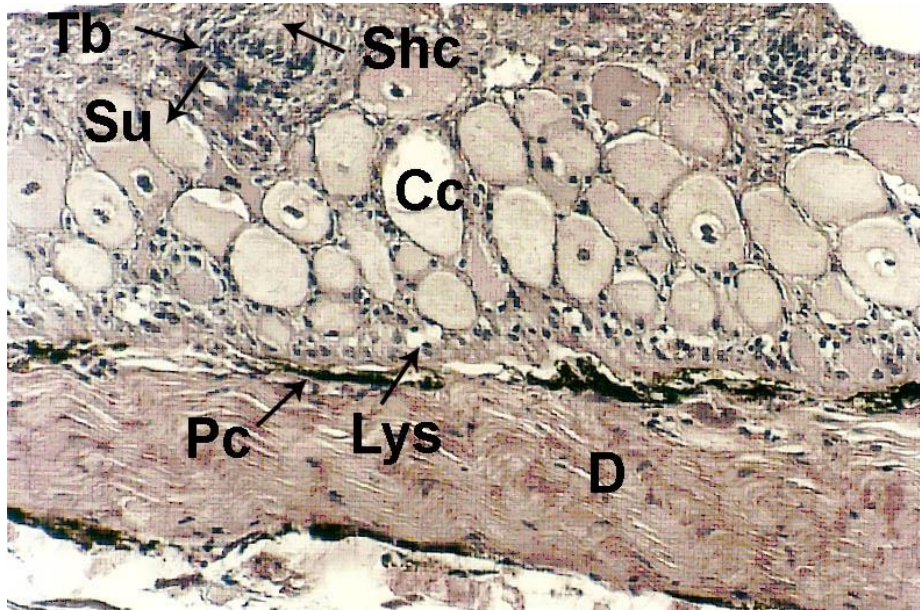


Figure (4). Vertical section of the integument of *Mystus pelusius* at dorsal region of the trunk showing the epidermis layers and the taste bud, (HE) (200X) .(Cc) Club cell, (D) Dermis ,(Lys)Lymphatic space,(Pc) pig mentcel ,(Shc) Sensory hair cell,(Su) Supporting cell (Tb) Taste bud

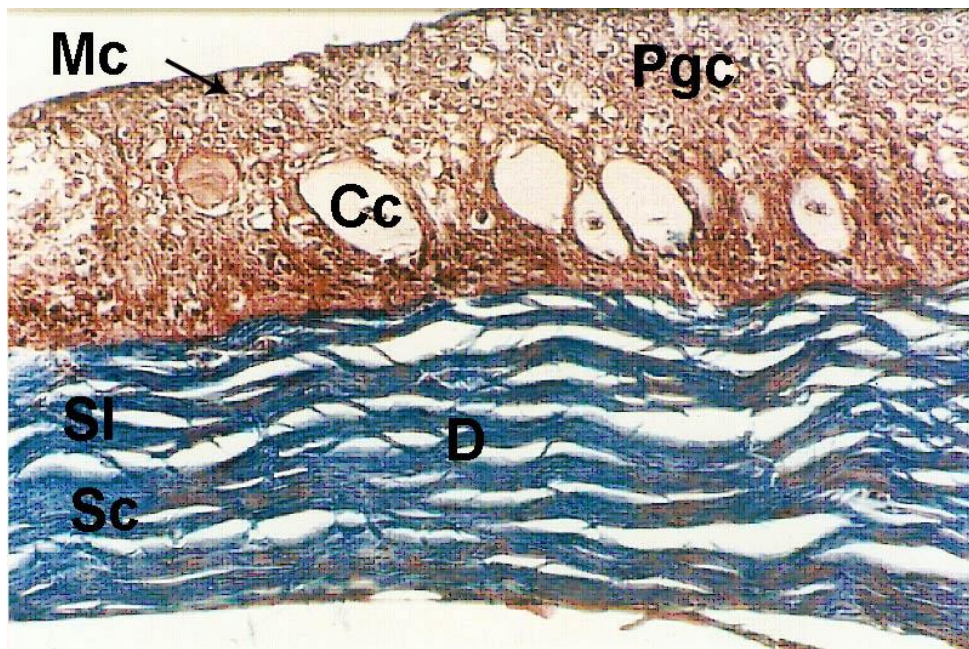


Figure (5). Vertical section of the integument of *Mystus pelusius* at caudal peduncle region showing the cellular layers of epidermis and arrangement of the dermal collagen fibers, (MTC)(200X) .(Cc) Club cell, (D) Dermis, ,(Pgc)Polygonal cell, (Sc)Stratum compactum, (Sl) Stratum laxum

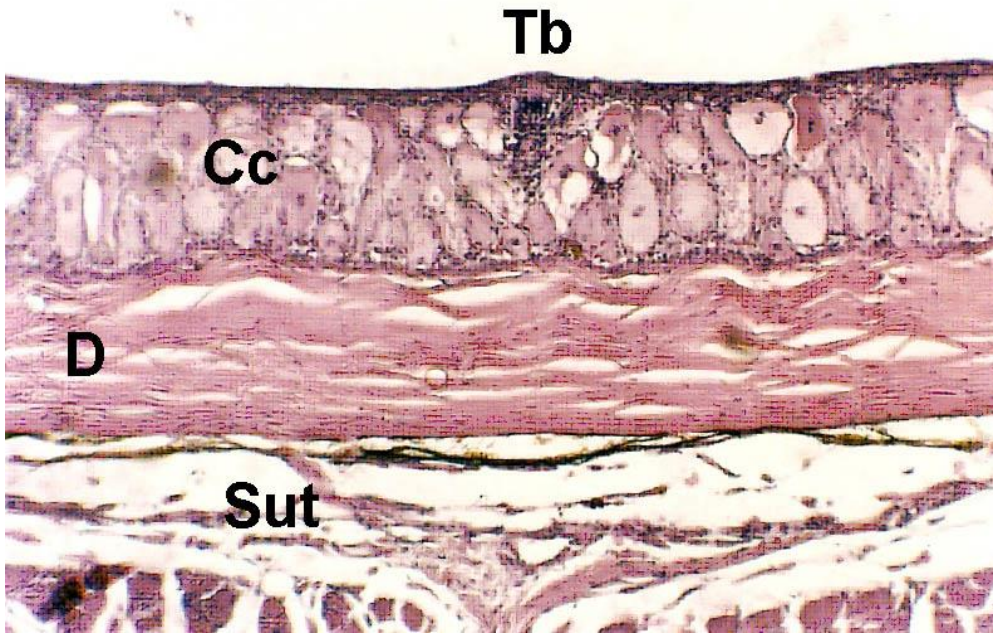


Figure (6). Vertical section of the integument of *Mystus pelusius* at ventral region of the trunk showing the integument layer, the position of subcutis layer, different types of epidermis cells and the position of taste bud,(HE)(100X). (Bv) Blood vessel,),(Cc) Club cell, (D) Dermis, (Sut) Subcutis, (Tb) Taste bud.

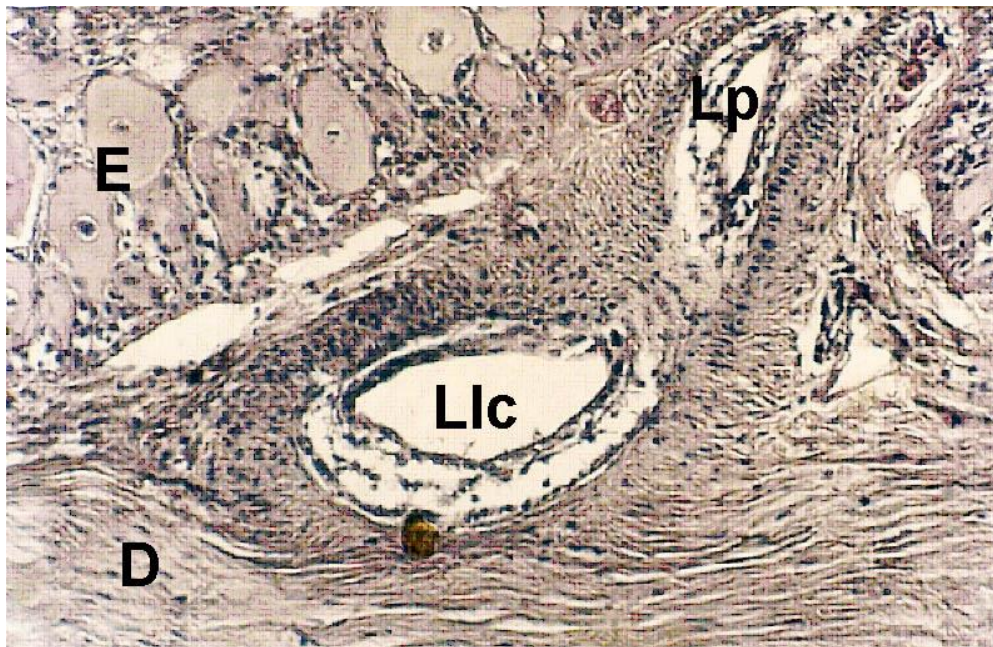


Figure (7). Vertical section of the integument of *Mystus pelusius* at lateral line region showing the connection of the lateralis pore and the lateral line canal, (HE)(200X).(E) Epidermis , (D) Dermis, (Llc) Lateral line canal,(Lp) Lateralis pore.

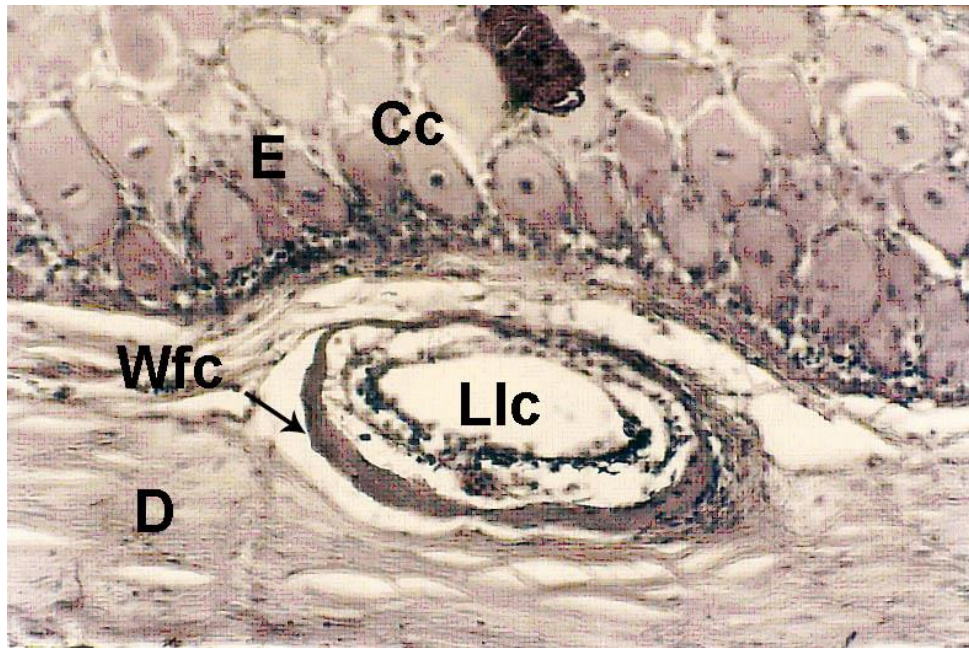


Figure (8) Vertical section of the integument of *Mystus pelusius* at lateral lin region showing the white fibrous cartilage which surrounded the lateral line canal , (HE)(200X). (c) Club cell. (D) Dermis, (E) Epidermis , (Llc) Lateral line canal, (Wfc) White fibrous cartilage.

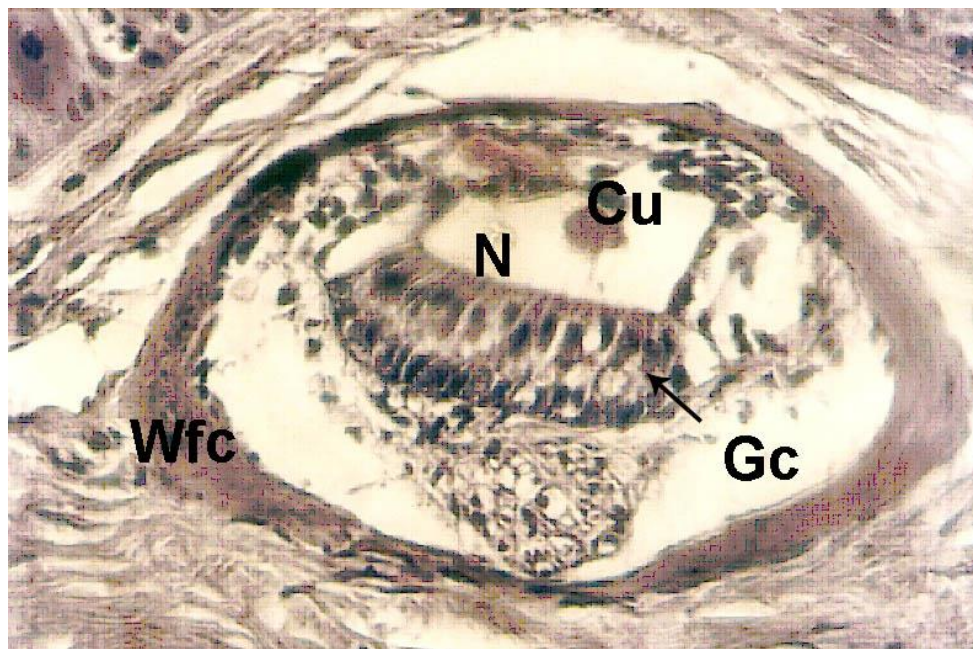


Figure (9) Vertical section of the integument of *Mystus pelusius* at lateral lin region showing the Neuromast and its cells and the cupula (HE) (400X).(Cu) Cupula ,(Gc) Goblet cell, (N) Neuromast , ,(Wfc) White fibrous cartilage.