



SURFACE ARCHITECTURE STUDY OF THE GENERAL BODY EPIDERMIS OF *PSEUDOCHEMEIS SULCATUS* (MCCLELLAND) (SISORIDAE) HILL-STREAM FISHES OF KUMAUN HIMALAYA. A SCANNING ELECTRON MICROSCOPE INVESTIGATION

¹Suresh Chandra Joshi

Assistant Professor

Department of Zoology

Government Degree College Haldwani City,

Kishanpur, Gaulapar (Nainital) 233139. Uttarakhand (India).

ABSTRACT: Surface architecture of the epidermis covering the general body of hill-stream fishes, *Pseudocheneis sulcatus* (McClelland) (Sisoridae) was examined by scanning electron microscopy, in an attempt to understand the structural and functional modifications in epithelia, in relation to life in torrential streams. The epithelial cells were characterized by the presence of well developed microridges. These microridges have been correlated to provide reserve surface area for stretching, when manoeuvring of fish. The presence of mucous has been described as an adaptation and to help an efficient aiming by reducing the friction. The free surface of epithelial cell is possesses neuromuscular organ.

Key Word: GBE, Kumaun Himalaya, *Pseudocheneis sulcatus*, Hill-stream fish, SEM.

I.

INTRODUCTION:

Many teleost fishes are reported to inhabit the sub- Himalayan streams and rivers of India. These mountain-streams are perennial shallow-water bodies, characterized by low temperature, high turbulent current and sandy-rocky substratum (Nag, T.C., & Bhattacharjee, J., 2002). To thrive successfully against the action of strong water currents, many hill-stream fishes demonstrate several unique adaptive modifications.

Epidermis or the top covering of the body is the outermost defence organ against the surrounding aquatic environment comes into direct contact with mechanical hazard. The remarkable abilities of fish to adapt to hill-stream, where chiefly the strength of water current is extremely high and the general body epidermis (GBE) is modified according to its role.

Studies of fish skin indicated that epidermis cells following separate pathways of differentiation in different fishes. In most of the fishes the epidermis is related more to the deposition of slime over its surface and undergo the process of mucogenesis and in some the epidermis cells undergo the process of keratinization forming a layer at the surface (Mittal & Benerjee 1979).

Some aspects of the ultra structure of the skin of several fishes have been studied earlier (Henrikson, R.C., & Malsitsy, A.G., 1966; Downing, S.W., & Novales, R.R., 1971; Whitear, M., 1971; Mittal, A.K. et al., 1971; Roberts, R.J., Young, H., & Milne, J.A., 1972). This study deals with the surface architecture of the general body epidermis of *Pseudocheneis sulcatus*.

II. Materials And Methods:

Live adult specimens of *P. sulcatus* (8-10 cm long) (Fig-1) were collected from east Ramganga River at Thal, Distt. Pithoragarh. Water current was very fast having velocity 0.5 to 2.0 m/sec. Specimens were maintained in laboratory at $25 \pm 2^\circ\text{C}$.

The fish were cold anesthetized (Mittal, A.K., & Whitear, M., 1978), to excise pieces of general body epidermis (GBE) covering body at back between dorsal fin and lateral line just behind the head. Pieces of GBE were treated and prepared for scanning electron microscopy (Pinky et. al., 2002). Critical point dried GBE

pieces attached to stubs were coated with gold and examined under a Scanning Electron Microscope (Leo, 435 VP, England).

III. Result And Discussion:

Integument of *P. sulcatus* is non-scaly (Fig.- 1). The hexagonal epithelial cells are present in the general body epidermis of *P. sulcatus* (Fig.- 2 Arrow head). the free surface of the epithelial cells was differentiated into microridges, forming characteristics patterns, these microridges were, however, not interconnected to each other but were elongated filamentous (Fig- 2 Arrow). Microridges have been reported to vary considerably in configuration and deposition, constituting varied patterns at different locations in different fish species, and have been implicated to play variable roles. These include to retain mucus secretions to the cells surface, to increase the surface area for excretion and absorption through the skin, to facilitated the spread of mucus away from mucous cells, to aid in producing laminar flow, to provide reserve surface area for stretching, and to have their relation with the process of secretion at the cell apex (Whitear, M., 1990). The microridges on the surface of the epithelial cells, like in the gills of other fish species, are after compactly arranged and organized into elaborate whorls forming intricate patterns. These structures providing mechanical flexibility and protection Whitear (1990). Suggested the mucogenic epidermis that form of the microridges is related to the process of secretion of slime. In addition to facilitating the spreading of the related the variations to locomotors activity and suggested that in faster swimming fish. The most development ridges served to trap mucus on the surface.

The epithelial cells were demarcated by well marked boundaries. Interspersed between the epithelial cells mucous cells apertures are distinguished on the general body epidermis, certain oval/ spherical opening are observed frequently in the surface of epithelial cells (Fig.- 3 Arrow head). Such structures are termed neuromuscular organ in adhesive apparatus of *G. garhwali* by Johal and Rawal (2003). Mucous cells apertures are rare comparatively and occurred at the border of three of four epithelial cells (Fig.-3 Arrow). *P. sulcatus*. Certain neuromuscular organs arising out of large opening, aid in sensing the stimuli. Mucus is secreted on receiving the necessary stimuli from the surrounding environment, providing a sort of platform in the feeble adhesion, such neuromuscular organs have also been reported in *G. garhwali* (Johal, M. S., & Rawal, Y. K., 2003), Bisht, I. and Agrawal, S. K. (2005).

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Figure-1

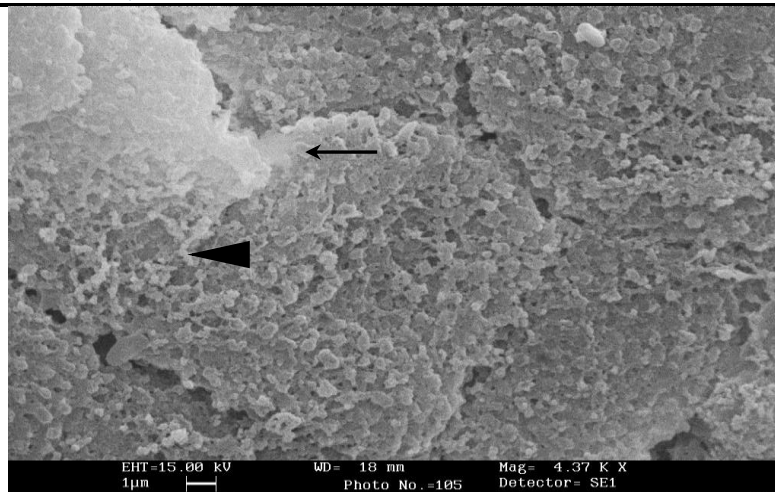


Figure-2

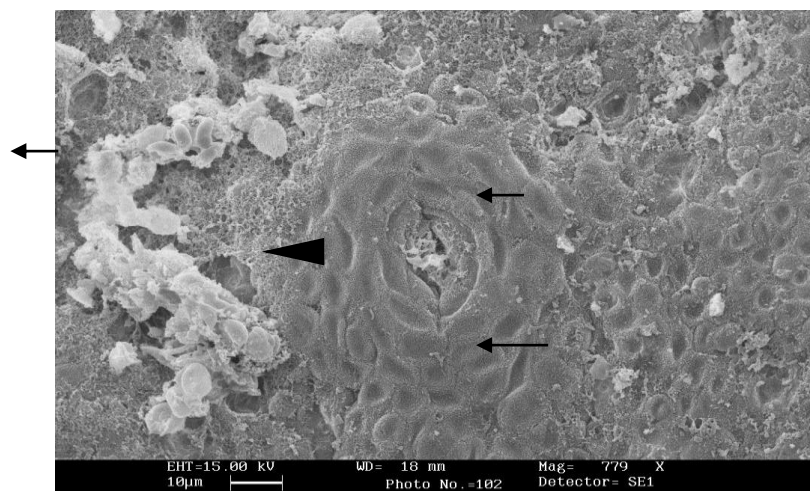


Figure-3

V. EXPLANATION OF FIGURES:

Figure 1: Dorsal view of *Pseudocheneis sulcatus* (non-scaly).

Figure2: S.E.M.P.H. of G.B.E. of *P. sulcatus* showing numerous elongated microridges (Arrow head). (Scale bar-1μm).

Figure 3: S.E.M.P.H. of G.B.E. of *P. sulcatus* showing neuromuscular organ (Arrow head). (Scale bar-10 μm).

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