

**ANATOMY AND HISTOMORPHOLOGICAL CHARACTERIZATION OF
OLFACTORY NEUROEPITHELIUM IN AN INDIAN LOACH
LEPIDOCEPHALICHTHYS GUNTEA (HAMILTON, 1822): A COMPREHENSIVE
INTERPRETATION**

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ABSTRACT ■ *Lepidocephalichthys guntea* (Hamilton, 1822) is a common scavenger fish of South East Asia. This species is listed on IUCN Red List as 'Least Concern'. The present study highlights detail olfactory structure of a common Indian scavenger loach, [Order: Cypriniformes, Family: Cobitidae] to explore the morphoanatomical peculiarities in special reference to their habitat concern.

Key words: *Lepidocephalichthys guntea*, cobitidae, scavenger, olfactory, loach etc.

INTRODUCTION

Fishes show diversity of ethological pattern mediated by olfactory structures (Hara, 1971). *Lepidocephalichthys guntea* is a common scavenger loach (Order: Cypriniformes, Family: Cobitidae) of South East Asia. This species is listed in IUCN Red List as 'Least Concern'. They are bottom dwellers and mostly perform their biological functions in disphotic conditions. They mostly based on their chemical senses for their various biological activities (Günther, 1989). Therefore it would be more significant to study a chemosensory system of a bottom dweller fish that is adapted in dark condition. The objective of this study is to emphasize on microscopical details of olfactory apparatus in *L. guntea* to explore their special anatomical features in correlation to their bottom dwelling habitat.

METHODS

The live, sex-independent specimens of *L. guntea* were collected from fresh water system viz., river, pond, lakes etc, of Midnapore district of West Bengal, India and brought to the laboratory. Specimens were acclimatized for 24 hours in laboratory condition and anaesthetized by using MS-222, (100-200) mg/L. The olfactory apparatus were dissected out and observed under trinocular stereozoom light microscope [ZEISS: Stemi 508 doc] using aqueous bouins fluid as fixative. Bouins fixed tissues were cryo-protected by graded sucrose solution [15% for 2 hours and 30% for overnight] at 4°C. Sections (5-7) μm were cut with the help of Leica Cryo-microtome: DM-18500 and stained with Delafields Haematoxylin followed by counter staining by eosin. Sections were observed under Compound

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microscope (Leica: DM 3000). For scanning electron microscopical (SEM) study, olfactory tissue were carefully dissected out and fixed in 2.5% Gluteraldehyde in 0.1(M) Phosphate buffer (pH 7.2) for 2 hours, were washed in the same buffer and dehydrated through graded acetone. After critical point drying, gold coated samples were observed under scanning electron microscope [ZEISS EVO 60] operated at 20 kV.

RESULTS

Anatomically olfactory apparatus of *L. guntea* is comprises of olfactory rosette and paired accessory nasal sacs, olfactory bulbs, olfactory nerves and brain. The paired olfactory rosette are situated on either side of the anterodorsal side of the head (Fig. 2) and communicated to the exterior by anterior nasal opening (length of opening is 165.9 μm), through a tubular structure (avg. length of tube 338.4 μm) and posterior nasal opening (avg. length of opening is 338.7 μm) respectively. The olfactory rosette are oval in structure that composed of multiple folds of olfactory lamellae (Fig. 3). Which are pinnately arranged around stumpy axis called raphe. The accessory nasal sacs *viz.*, ethmoidal and lachrymal sacs are also observed. Olfactory nerve tract appear from olfactory bulb and enters the olfactory lobes of the brain. The olfactory neuroepithelium is tightly packed with sensory receptor cell, supporting cell, basal cell, mucous cell and mast cell etc. The receptor cells are bipolar in nature, extended from apical surface to the basal lamina of the epithelium. They are intermingled with the supporting cells within the olfactory neuroepithelium. Basal cells are situated above the basal lamina (Fig. 4). Supporting cells are classified as ciliated and microvillous cells. Each olfactory lamella shows distinct ciliated and non-ciliated region under SEM

(Fig. 5). The non-ciliated region composed of microridges. Sensory receptor cilia are originated from olfactory knob of the sensory receptor cell. The non-sensory cilia (NSC) are originated from the wide surface of supporting cell *i.e.*, lack a knob orogin. Goblet cell exists only in the non-ciliated region of the neuroepithelium. Apical part of goblet cells are also named as olfactory pits (1.68 μm). The surface of the midline raphe is mainly covered by non-ciliated cells. These are composed of microridges and also provided with numerous scattered olfactory pits.

DISCUSSION

Olfaction is a primitive type of neurochemical sense to perceive external cues and plays indispensable role in arousing different behavioral activities in fishes. Olfactory organ of fish originates from paired cranial ectodermal placode. Fish morphoanatomy based on their food habits and food availability during development (Bone and Moore, 2008). Fishes of different ecological habitat shows significant morphoanatomical variation in their snout structure (Sarkar, *et al.*, 2014). The Sensory receptor cell (ciliated cell, microvillous cell and crypt cell), supporting cell and basal cell are the prime components of olfactory neuroepithelium, which are involved in alarm reaction, feeding behaviour and reproduction respectively (Hamdani *et al.*, 2001a, Hamdani and Doving, 2002, Sarkar and De, 2018). Mucus layer takes primary health care of fish olfactory neuroepithelium from water thrust, microscopic debris and heavy metal salts *etc.*, (Banerjee, 1993; Rahamani and Khan, 1980; Bandyopadhyay and Datta, 1998; Ojha, 1993). The relevant question is now, whether the neural cell types, their topological distribution and functions in olfactory

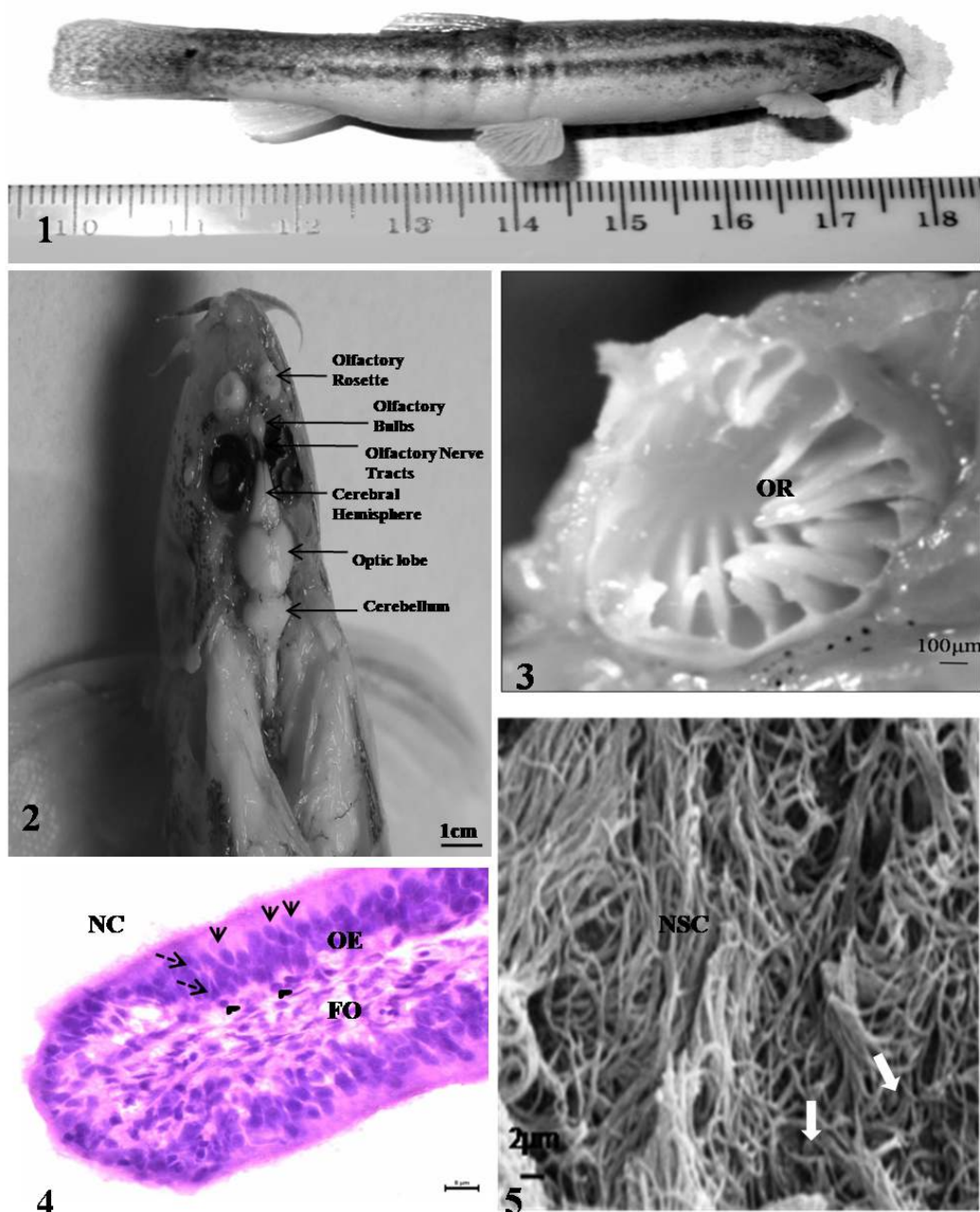


Fig. 1: *Lepidocephalichthys guntea* [order: Cypriniformes, Family:Cobitidae]. Fig. 2: Dissected anterior part of the head showing different components of olfactory apparatus. Fig. 3: Multilamellar olfactory rosette (OR). Fig. 4: Histological sections of an olfactory lamellae within the nasal cavity (NC), Olfactory neuroepithelium (OE) composed of sensory receptor cell (broken arrow), supporting cell (arrow), basal cell (arrow head) resting on the basal lamina. Fila olfactoria (FO) is situated just beneath the basal lamina. Fig. 5: Scanning electron micrographs of the epithelial surface showing non sensory cilia (NSC), arrow indicates olfactory knob.

systems of various fish species is playing a pivotal role in their distribution of a particular habitat concern?

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