



## MICROARCHITECTURAL STUDY OF THE OLFATORY ORGAN OF *DEVARIO REGINA* (FOWLER, 1934) USING PAS TECHNIQUE

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### Abstract

**Context:** Microarchitectural observation of the olfactory organ in *Devario regina* (Fowler, 1934) is still unknown.

**Objectives:** The normal histology and chemical detailed of glycoprotein in *D. regina* olfactory organ were investigated using histochemical analysis.

**Materials and Methods:** Fishes were collected from the Tapee River, Nakhon Si Thammarat Province, Thailand and were processed by the standard histological technique.

**Results:** Microarchitecture of olfactory organ revealed that it was a paired olfactory sac. Each sac was composed of the olfactory chamber and many lamellae surrounding by olfactory epithelium. This epithelium contained the differential cell types in both sensory (sensory ciliated cells) and non-sensory olfactory epithelium. The special localization of glycoprotein was intensively detected on the mucous cells.

**Conclusion:** This study provided the basic histology of the fish olfactory organ that will support the investigation regarding the physiological and ultrastructural analysis.

**Key words:** Fish, histology, histochemistry, periodic-acid Schiff

### Introduction

In teleost, olfactory organ is essentially considered as chemoreception. It is well known that this organ directly interacts with the mediating behavior including feeding, predator detection and reproductive synchrony (Sorensen and Caprio 1998). Therefore, it was exclusively attracted by several researchers concerning with the morphological and histological structures (Zielinski and Hara 1988). Nonetheless, only histology is exclusively examined of olfactory organ in many teleost due to providing the microscopic organization including *Scyliorhinus canicula*, *Polypterus senegalus*, *Pangio kuhlii* (Genten *et al.* 2008), *Danio rerio* (Menke *et al.* 2011), *Oreochromis nilotica* (Chakrabarti and Ghosh 2011a) and *Terapon jarbua* (Chakrabarti and Ghosh 2011b). Overall research showed that olfactory organ was a paired olfactory sac. Each sac was composed of olfactory chamber and many lamellae surrounded by olfactory epithelium. This epithelium contained two cell types viz., sensory and non-sensory olfactory epithelium. In this study, *Devario regina* was used considering it as an ornamental fish which is commonly found in natural habitat of Thailand. The objective was to examine the microarchitecture of olfactory organs using periodic acid-schiff (PAS) reaction.

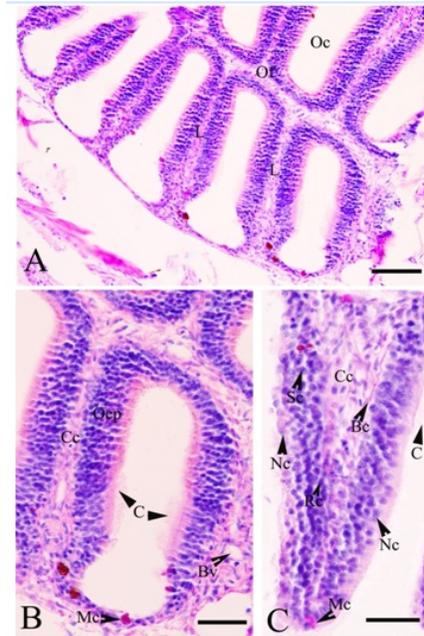
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## Materials and Methods

Healthy adult fish *D. regina* (n = 20) were collected from the Tapee River, Chawang District, Nakhon Si Thammarat Province, Thailand (8°28'10" N, 99°29'45" E) during the fishing season. These fishes were euthanized by rapidly cooling shock (Wilson *et al.* 2009) and were immediately fixed in Davidson's fixative for 36 hrs at room temperature. For histological analysis, these samples were processed by fixation, dehydration, embedding, sectioning and staining by the standard histological technique. Paraffin blocks were sectioned at 5-6  $\mu\text{m}$  in thickness and stained with PAS (Bancroft and Gamble 2002).

## Results and Discussion

The olfactory organ of *D. regina* was stained with PAS which could observe not only normal microarchitecture but also detection and localization of glycoprotein. In general, transverse sections of olfactory organ in *D. regina* was located in olfactory sacs on the snout of the head. It contained a paired of olfactory sac surrounded by fibrocartilage and hyaline cartilage. Each sac comprised the lamellar arrangement or olfactory folds (approximate 120  $\mu\text{m}$  in thickness) about 8-9 pieces which protruded into olfactory chambers (Fig. 1. A-B).



**Fig.1. A - C.** Micrograph of olfactory organ (Of) of *Devario regina*; Bc = basal cell, Bv = blood vessel, C = cilia, Cc = central core, L = lamellae, Mc = mucous cells, Nc = nonsensory olfactory epithelium, Oc = olfactory chamber, Oep = olfactory epitheliums, Rc = sensory olfactory epithelium, Sc = supporting cell (A: 50  $\mu\text{m}$ ; B-C: 20  $\mu\text{m}$ .).

This discovery differs from *Oreochromis nilotica*, which is found to have about 19-20 pieces of arranging lamellar in each sac (Chakrabarti and Ghosh 2011a). Our observation revealed that each lamellar was lined by pseudostratified columnar epithelium. The thickness of the epithelial layer (about 20  $\mu\text{m}$ ) contained two distinct types; sensory and non-sensory olfactory epitheliums. The sensory epithelium or receptor cell was

ciliated columnar stratified. Each cell was oval and prominent nucleus as basophilic part that was surrounded by eosinophilic cytoplasm. The non-sensory olfactory epithelium is characterized by oval nucleus as basophilic part and near with upper of epithelial surface. Other cells i.e., supporting, mucous and basal cells were also exhibited based on localization and histological characterization. This structure was similar to that of some other fishes such as *P. kuhlii*, *P. senegalus* (Genten *et al.* 2008) and *D. rerio* (Menke *et al.* 2011).

Among the various cell types of olfactory organ, both detection and localization of glycoprotein showed the ciliated sensory receptor cells of stratified epithelium. In addition, PAS reaction intensively showed reddish color in various mucous cells of the olfactory epithelium (Figures B-C), indicating the presence of glycoprotein. The present result was almost similar to those of reported in various teleost including *Channa punctata* (Datta and Singh, 1975), *Cyprinus carpio* (Ghosh and Chakrabarti 2012), *Rita rita* (Chakrabarti and Ghosh 2013). Olfactory epithelium and central core were separated by basement membrane. Central core contained the connective tissue and numerous capillaries.

It may be concluded that the olfactory organ in *D. regina* was composed of a paired olfactory sac. It consisted of many lamellae, which covered by olfactory epithelium. This epithelium contained two cell types, namely; sensory and non-sensory olfactory epithelium. However, these cells will be confirmed with immunocytochemistry again for further study. Observation from this study is considered to be the first report in Thailand which offers further detailed physiology and immunological examination.

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