An International Biannual Refereed Journal of Life Sciences



Comparative study of pineal gland in *Gambusia affinis* and *cyprinnus carpio.*

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Received 18th December, 2013; Revised 30th January, 2013

Abstract :Pineal gland of a larvivorous and a herbivorous fish have been studied. The morphological, histological and histochemical features reveal that in both the uses pineal consist of end vesicle & pineal stalk. The end vesicle is present just below the cranium which is filled with lumen, which is connected to the third ventricle of brain through pineal stalk. The secretory material within the lumen give positive result of period acid SChiff, that conform the presence of glycogen in lumenal border cells.

Key words: Pineal gland, Gambusia affinis, Cyprinnus carpio histophysiology.

INTRODUCTION

The pineal organ is a part of central nervous system (Peter & Hilmar, 1991)¹. The pineal gland is a light sensitive (Studnicka, 1905)² neuroendocrine structure that lies in the anterior brain and is well vascularised organ. In fishes, (Dodl, 1963)³ the pineal organ as discribed by Sastry & Sathyaneson in 1981. The pineal gland has variously been described as the "seat of soul" by Ranee Descartes. This gland secrete melatonin (Gern *et al.* 1988)⁵ growth (Nayak & Singh 1987ab)^{6,7}, daily variation of locomotory activity, sleep like state, skin pigmentation and migration. Electron microscopic study revealed that the main cellular component of the fish pineal organ resembles many features with the cone photo receptors of the retina. (Ekstron & Meissle, 2003)⁸.

In this project an attempt is made for morphological & histological study of pineal organ concerning to *Gambusia affinis* and *Cyprinnus carpio*.

MATERIALSAND METHODS

For comparative microscopical study of pineal gland

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of *Cyprinnus carpio* and *Gambusia affinis* fishes are collected. Live fishes were dissected and the entire brain was separated from the body and was kept in the aqueous Bouin's fixative for 24 hrs. It was washed thoroughly in tap water so that the colour of Bouin's fluid was removed completely.

The material was than dehydrated in graded alcohol. It was washed by xylene twice with ten minutes interval. By this time material became translucent and was that put in xylol and Wax (1:1) and incubated at a temperature of 56-58°C. The material was then finally infiltrated with wax for twice. Each of half hour duration. Block was prepared and sections were cut at 8-10 microns and were subsequently spread and stained for normal histology Haemotoxyline – Eosin was used and for histochemistry periodic Acid Schiff's reagent/ Alcian Blue stains were used.

RESULTS AND DISCUSSIONS

In basic form, the fish pineal organ consists of a hollow, variously invaginated and well vascularized structure lying dorsal to the diencephalon to which it is connected by a hollow narrow stalk (Falcon, 1999).⁹ The pineal body consist of an expanded distal vesicular area

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containing a central lumen which connects with the third ventricle via the narrow proximal stalk. Posteriomedially the stalk connects with the sub commissural organ and commissural habenulae on its anterior side before joining the dorsal sac epithelium which comes to the directly ventral to the vesicle of the pineal body. With advancing age, the epithelium of the distal vesicle undergoes a gradual infolding with the result of the formation of central lumen. Adult pineal gland is well vascularized.

ANATOMY

The pineal maybe subdivided into a distal pineal end vesicle and a pineal stalk. Length of pineal stalk and end vesicle vary from species to species. Fig.1 of *Gambusia affinis* shows the saccular end vesicle is cylindrical in shape situated just below the craonium and remains in the same axis as the pineal stalk and makes a right angle with the cranial roof. The dorsal end of the end vesicle is blunt while the ventral end tapers and transforms itself into the pineal stalk. The stalk is short. (Fig.1) Fig.3 of *Cyprinus carpio* shows the anterior broad vasicular part the end vesicle and posterior elongated narrow portion of pineal stalk. Pineal stalk being half of the end vesicle in length. The end vesicle and pineal stalk remains in the same plane, the dorsal end of end. Vesicle is blund and ventral end tapers into pineal stalk. The lumen of bothend vesicle and pineal stalk is conspicuous by their presence.

Histology: Histologically the pineal body of fishes most closely resembles a sensory structure. The wall of the pineal organ i.e. the pineal epithelium. In case *Gambusia affinis* (Fig.1,2) it is thin while thick in *Cyprinus carpio* (Fig.3,4) consist of photoreceptors cells (PR) Neurons (N) and ependymal interstitial cells (IC) or supportive cells or interstitial cells. In addition, oligo-dendrocyte form myelin sheath surrounding some neural axon while macrophages are found mainly in the central lumen. Fig.1 of *Gambusia affinis* & fig. 4. of *Cyprinus carpio* shows a clear picture and position of photoreceptor cells, ependymal interstitial cells and neurons.

Histochemisty: Fig.2. in *Gambusia affinis*, the histochemical tests revealed the presence of glycogen in the luminal border cells both in the end. Vesicle and pineal stalk as they all give magenta colour after periodic acid Schiff (PAS) staining which is absent in diastase digested sections. The secretory materials within the lumen also give positive result.

Periodic acid Schiff (PAS) staining: PAS and AB positive monogenous coagulum and continuity between the luminal contents and the bordering cells through strand



Fig.1. Phtomicrograph of mid sagittal section (MSS) of brain of *Gambusia affinis* showing glub shaped pineal organ Cranium Pineal end vesicle and stalk.



Fig.2. Photomicrograph of mid sagittal section of pineal of *Gambusia affinis* showing PAS positive luminal lining cells.

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Fig.3. Photomicrograph of mid sagittal section of brain of *Cyprinus carpio* showing club shaped pineal organ, pineal end vesicle.

like extensions apparently suggest that at lest some part of the content is secreted the lining cells in *Cyprinus carpio* (Fig 3).

DISCUSSION

The pineal organ consists of the pineal gland and the parapineal organ, the parapineal organ is present in embryonic stages of development but is lacking in adult fish. (Falcon, 1999 & Holmgren, 1959)^{9,10}. Pineal is one of the circumventicular organ develops from the roof of the diencephalon. In some species of fishes the head skin above the pineal organ is translucent and lacking a melanophores. This translucent region of head skin is termed the 'Pineal window'. Through this window the pineal vesicle is visible as orange portion. Due to the rick vascularization of pineal organ (Omura & Ogouri, 1969)¹¹

According to Hore and Alim¹² pineal gland in *Gambusia affinis* is club shaped structure. The Pineal organ is often differentiated into proximal slender pineal stalk and a distal expanded end vesicle. The wall of the pineal organ is unstratified epithelium consists of three types of cells i.e. photo receptor cell, neurons and supporting cell neurons and supportive cell.⁸ Pineal organ secretes the hormone melatamin. (Menon & Pillai, 2001)¹³. Controls the growth, metabolic activities and reproduction. Melatonin play the role in colour change mechanism in fishes (Menon & Pillai, 2001)¹³. The Pineal gland is involved



Fig.4. Photomicrograph showing photoreceptor cells with dark blue stained nuclei.

in the control of behavioural thermoregulation in fishes (Kawaliers and Ralph, 1980)¹⁴. The Pineal gland in anadromous fish like salmonids may play a role in the migratory behaviour (Weber and Smith 1980)¹⁵.

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