

Research Article

**STUDIES ON DIFFERENCES IN NUMBER, LOCATION AND
SIZE OF THE CORPUSCLES OF STANNIUS IN
FRESHWATER AND SEAWATER FISHES**

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ABSTRACT

In this study morphology, number, location and histology of corpuscles of Stannius in six freshwater fishes and six sea water fishes have been investigated. The comparison of corpuscles of Stannius is made as these fishes have different aquatic habitat. The calcium content of the aquatic medium differs in the freshwater and sea water as a result changes in the corpuscles of Stannius activity was observed.

Keywords: Corpuscles of Stannius, Number, Seawater, Size.

INTRODUCTION

Bauchot (1953) studied comparative anatomy of the corpuscles of Stannius (CS) in 47 different species of fishes including both marine and freshwater forms, attempting to relate their anatomical location to phylogeny. He concluded that the most primitive position of the corpuscles is on anterior one about midway of the length of the kidney, and the most evolved, a posterior one. With the experimental results (Rasquin 1956) has shown by the cytological evidence for a role of the corpuscles of Stannius in the osmoregulation of teleosts.

The present report deals with comparative Studies on differences in number, location and size of the corpuscles of Stannius in freshwater and seawater fishes. This study provide information on the difference in the CS of fishes having different habitat i.e., freshwater and marine water.

MATERIALS AND METHODS

Fish collection for comparative studies: The fish, *Notopterus notopterus*, weighing 90-100 ± 10g were collected from Khaja Kotanoor reservoir 15 km away from Gulbarga University campus. The live fish were brought to the laboratory and kept in large plastic tanks having size of 90 cms in diameter and 60cms in height

for acclimatization to the laboratory conditions (25 ± 2°C) for a week. Fishes were fed with live earthworms and boiled egg albumen.

This study was carried out on 12 species of fishes, The six fishes were collected from Karwar coast (marine habitat) and the other six fishes were collected from Bheema river, Khaja Kotanoor reservoir (freshwater habitat) for comparative studies of corpuscles of Stannius. All the fishes were photographed by Sony digital camera. The fishes were weighed and the weights ranged from 150-220 gm and measured 30-45 cm in length, in each species, six fishes were used to demonstrate the gross morphological features. They were transported to near by laboratory in an hour. Firstly, the fishes were sacrificed and dissected and removed the CS from each fish. The tissue (CS) was fixed in Bouin's fluid, about an hour later the tissue was kept in the fresh fluid. This procedure insured rapid fixation of the rather labile granules of the glandular tissue. After fixation, the samples were extensively washed in 70 % alcohol (3 × 24 hr) to get rid of the fixative before the subsequent step of tissue processing. The tissue samples were then dehydrated in graded series of ethanol (80%, 95% and absolute), cleared in xylene and impregnated and embedded in paraffin wax. Sections of 5-7 µm were cut using Rotary microtome and mounted on glass slides. Paraffin

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sections were kept in incubator at 40°C until used for conventional staining (H and E).

For transmission electron microscopic study, two fishes were used. Small samples from different parts of the corpuscles Stannius were taken. The samples were fixed in a mixture of paraformaldehyde 2.5 % and glutaraldehyde 2.5 % solution in 0.1 M phosphate buffer for 4 hours at 4°C. After washing in the same buffer, the specimens were post-fixed in osmiumtetroxide 1% in phosphate buffer for two hours followed by washing in the same buffer. The samples were then dehydrated in ascending grades of ethanol followed by critical point drying in carbon dioxide, then sputter-coated with gold and examined with transmission electron microscope.

The corpuscles of Stannius (CS) of two species of fish having different habitat has been compared under electron microscopic observation. The two species of fish are; a freshwater fish, *Notopterus notopterus* and *Rastrelliger kanagurta* [Indian mackerel].

The histological structure of CS of following freshwater and marine fishes was also studied.

OBSERVATION

The CS of this fish are two in number forming two bunches which are larger in size and cream coloured. The gland is embedded in the anterior region of posterior kidney on the dorsal side. The CS cells are having vesicular nucleus with nucleoli clearly visible. Most of the cells are similar in size and cytoplasm has vacuoles and are very active. Only one type of cell can be differentiated.

The corpuscles of Stannius (CS) of freshwater and sea water fishes studied above indicates that in all the fishes a pair of CS are presented and are clearly located either in the anterior, middle or posterior region of the posterior kidney on the dorsal side. The colour of the gland varies from white to yellow or cream (Figures 1, 2, 3 and 4).

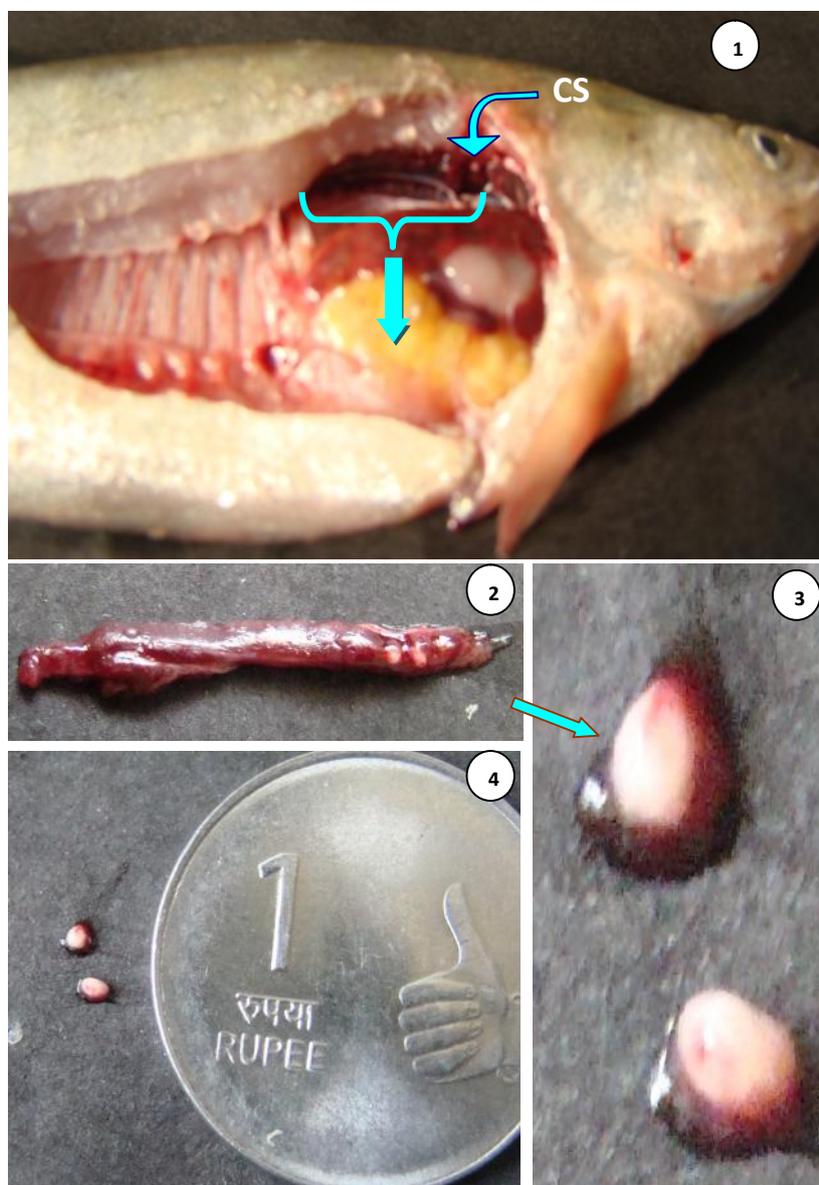
The size of the gland compared between freshwater fish and sea water fish indicates that the fish from sea water has larger glands than the freshwater fish.. This suggests that calcium concentration of sea water is higher than that of freshwater. A relation may exist between calcium concentration and CS. It is known that CS is involved in calcium regulation by secreting a hormone called Steniolcalcin.

Table 1. Showing number, location and size of the corpuscles of Stannius (CS) in freshwater and seawater fishes.

Sl. No.	Name of the fish Species	No. of CS	Location in the posterior Kidney	Size	Color
Freshwater fishes					
1	<i>Notopterus notopterus</i>	2-4	Anterior region (Dorsal)	Small	White
2	<i>Labeo bata</i>	2	Completely embedded	Small	-
3	<i>Kalapi mosombica</i>	2	Middle region	Large	White
4	<i>Chenna panctatus</i>	2	Anterior region	Small	White
5	<i>Chenna marulis</i>	2	Anterior region	Small	White
6	<i>Clarias gariepinus</i>	2	Posterior region	Small	White
Seawater fishes					
1	<i>Rastrelliger Kanagurta</i>	2	Anterior region	Large	White
2	<i>Hemiramphus far</i>	2	Anterior region	Large	White
3	<i>Parastromateus niger</i>	2	Middle region	Large	Yellow
4	<i>Sillago Sihama</i>	2	Middle region	Large	Yellow
5	<i>Pampus argenteus</i>	2	Anterior region	Large	White
6	<i>Scoliodon laticaudus</i>	2	Anterior region (Big bundle)	Large	Cream

Table 2. Showing phosphate and calcium concentration in freshwater and seawater.

water	Phosphate	Calcium
Freshwater	0.018	3.9
Sea Water	0.030	85.5

**Figure 1.** Photograph showing the freshwater fish *Notopterus notopterus* dissected for exposing corpuscles of Stannius embedded in the kidney of fish.**Figure 2.** Photograph showing corpuscles of Stannius embedded in the kidney.**Figures 3 & 4.** Photographs showing a pair of corpuscles of Stannius.

DISCUSSION

As per survey of literature on the corpuscles of Stannius, their number and location in different species of fish has some significance. In the present study six fishes collected from freshwater and six fishes collected from sea water, the

number and location of the CS has been observed and found that in all the fishes studied has a pair of CS embedded in the posterior portion of the kidney. The numbers of CS in several teleostean fishes have been studied. In *Onchorhynchus gorbuscha*-2 pairs (Ford, 1959), *Oncorhynchus*

tshawylscha and *Oncorhynchus kisutch* – 5-6 CS (Nadkarni and Gorbman, 1966). In *Salmo airdnerii* – 4-6 CS *Oncorhynchus kisutch* 4-5, *Atheronopsis californiensis*, – 2,3 or 4 and *Sepastodes auriashiva* – 3 CS (Krishnamurthy and Bern, 1969). The CS may vary from 4-10 in *Salmo solar* (Heyl, 1970) and 6-8 in *Salmo trutta* (Bauchot, 1953). In catfish *Heteroprenstes fossilis*, the CS are as many as 4 corpuscles (Subhedar and Rao, 1976). In the bow fin, *Amia calva*, there are very many corpuscles, numbering fifty or more; it is thought that in the evolution of bony fish there has been a general contraction in numbers and an increase in relative size of the corpuscles of Stannius. The CS of the fishes studied in the present investigation a pair of CS is present in the fishes of freshwater and sea water and all these fishes are advanced fishes.

The location of CS in the teleostean kidney presents several variations and it has been suggested by Bauchot (1953) that it is related to the taxonomic position. In fishes such as *Carassius auratus* (Ogawa, 1967) the CS were present in mesonephros and embedded in the dorsal and dorsolateral parts of the kidney, similar location has been observed in two species of *Oncorhynchus* (Nadkarni and Gorbman, 1966). In salmonid fish *A. californiensis* the CS are situated near the middle of Mesonephros (Krishnamurthy and Bern, 1969). In majority of fish they are located at the posterior end. In *H. fossilis* they are found in the posterior third of the mesonephros. It was suggested that the CS move progressively backwards during the evolution as a result of actual shortening of body cavity rather than a migration of CS (Garrett, 1942). In view of localization of the CS in the kidney of the fishes studied in the present investigation that other than *N. notopterus*, all other freshwater fish have the CS situated at the middle portion of the posterior kidney this is also true with the location of CS in marine fishes.

CONCLUSIONS

The calcium content of the aquatic medium differs in the freshwater and sea water as a result changes in the corpuscles of Stannius activity was observed.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest associated with this article.

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