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SEASONAL CHANGES IN THE PITUITARY GONADOTROPS DURING THE  
ANNUAL REPRODUCTIVE CYCLE OF THE MURREL *CHANNA PUNCTATUS*  
(BLOCH)

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**RESUMO:** Foram observadas mudanças sazonais na estrutura e comportamento dos hormônios gonadotrópicos pituitários durante o ciclo reprodutivo anual de *Channa punctatus*. Os hormônios gonadotrópicos demonstram mudanças morfológicas marcantes na forma da granulação, degranulação e vacuolização com o ciclo sexual sugerindo sua tendência de armazenamento e liberação durante atividades gonadais.

**ABSTRACT:** Seasonal changes in the structure and behaviour of pituitary gonadotrops were observed during annual reproductive cycle in *Channa punctatus*. The gonadotrops display marked morphological changes in the form of granulation, degranulation and vacuolisation with the sexual cycle suggesting its storing and releasing tendency during gonadal activities.

### INTRODUCTION

Now it is well established fact that gonadal function in teleosts are maintained by gonadotropic hormone(s) of the pituitary gland. In spite of wealth of literatures available on the pituitary gonadotrops in teleosts in relation to gonadal activities (review: by Ball and Baker, 1969; Schreibman et al, 1973; Donaldson, 1973; Holmes and Ball, 1974; Van Oordt and Ekengren, 1978; Van Oordt and Peute, 1983; Breton and Billard, 1984) information on tropical fishes in this regard is scanty (Khanna and Pant, 1969; Singh, 1970; Pant and Bisht, 1973, Bisht 1975; Haider 1978; Srivastava, 1979 1983). Therefore, in the present study seasonal changes in the pituitary gonadotrops were observed

during the annual reproductive cycle of a murrelet, *Channa punctatus*.

### MATERIAL AND METHODS

Adult specimens of *Channa punctatus* were collected locally throughout the year. The pituitary gland and gonads were dissected and fixed in aqueous Bouin's solution and were subjected to routine procedures for histological studies and for identification of sexual status. The pituitary were sectioned at 5-6  $\mu$ m and stained with Heidenhain's Azan, PAS and AF and gonads with hematoxylin/eosin.

### OBSERVATIONS

The marked seasonal changes were observed in the activity of gonadotrops of the proximal pars distalis in relation to the reproductive cycle (Fig. 1 and Table I). These changes corresponds to the five different phases of the gonadal cycle i.e. (i) Resting phase (Late November to December and early May); (ii) Preparatory phase (January to February and late May to June); (iii) Prespawning phase (March and July), (iv) Spawning phase (Early April and August to September) and (v) Post-spawning phase (Late April & October to early November).

- i) **Resting phase:** The gonadotrops are less in number with little cytoplasm. The cytoplasm contains fine granules stained poorly with PAS, AF and aniline blue. These cells exhibit minimum activity and nuclear size during this phase (Figs. 1, 2 and Table I).  
During this phase the ovary display large number of oogonia and non-yolkly oocytes while testes are characterized by resting germ cells and spermatogonia. The GSI records its minimum value (Fig. 1).
- ii) **Preparatory phase:** The gonadotrops exhibit a gradual increase in the amount of their cytoplasm and nuclear size (Fig. 1). The cytoplasm gets more granulated and stained lightly with PAS, AF and aniline blue (Fig. 3 and Table I).  
The ovary is characterized by appearance of yolk vesicles in the oocytes and testes exhibit advance

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spermatogenic stages, i.e. spermatogonia, spermatocytes and sometime spermatids. During this phase the GSI records a gradual rise (Fig. 1)

- iii) **Prespawning phase:** The gonadotrops exhibit maximum activity during this phase which is evident from the increase in their nuclear size (Fig. 1) and densely granulated cytoplasm stained darkly with PAS, AF and aniline blue. Occasionally, few vacuoles were also encountered in the cell (Fig. 4 and Table I)

The ovary contains fully mature yolky oocytes during this phase and the tests are characterized by all spermatogenic stages including scattered spermatozoa in the lumen of the lobules. The GSI records its maximum value (Fig. 1)

- iv) **Spawning phase:** The gonadotrops show marked degree of hypertrophy and preponderance over the other cell types. Their cytoplasm gets densely granulated and are intensively stained with PAS, AF and aniline blue. Most of the cells showing beginning of degranulation and vacuolisation. A few desintegrating cells were also encountered. There is a gradual decrease in their nuclear size (Figs. 1, 5 and Table I)

The ovary is packed with mature oocytes. Few discharged follicles are also encountered among mature oocytes indicating beginning of spawning act. The tests also display either empty lumina or lumina with spermatids/spermatozoa. The GSI records a fall (Fig. 1)

- v) **Post spawning phase:** The gonadotrops show mostly degranulated cells. Most of them showing nuclei naked or with scanty cytoplasm stained feebly with PAS, AF and aniline blue. There is a further decrease in the nuclear size of gonadotropic cells (Figs. 1, 6, 7 and Table I)

During this phase gonads are in spent condition. Ovary display large number of immature and atretic oocytes in the process of resorption. Likewise tests exhibit empty lumina or lumina with relic masses of spermatozoa. The GSI records a further decline (Fig. 1)

## DISCUSSION

Ball and Baker (1969) stated that "any pars distalis basophils that are quiescent or absent before sexual activity, and which show pronounced secretory changes in correlation with the gonadal cycle are gonadotrops". They are typical mucoid cells containing granules that react strongly in PAS procedure and are assumed to contain glycoproteins. Earlier light microscopic and electron microscopic studies have also revealed the seasonal activity of gonadotrops in relation to the sexual cycle in teleosts. (Ball and Baker, 1969; Khanna and Pant, 1969; Singh, 1970; Pant and Bisht, 1973; Schreibman *et al.*, 1973; Homes and Ball 1974; Bisht, 1975; Haider, 1978; Chiba *et al.*, 1978; Srivastava 1979, 1983; van Oordt and Peute, 1983; Munkittrick and Leatherland 1984; Kaneko *et al.*, 1986a, b). The result of the present study also confirms that the PAS-positive cyanophil cells which are concentrated in the ventral region of the PPD display marked seasonal changes in their structure and behaviour in relation to the reproductive cycle. During the resting phase, the gonadotrops exhibit weak staining affinity for PAS, AF and aniline blue on account of the poor concentration of glycoproteinaceous contents in them suggesting that resting phase in *C. punctatus* is not influenced by gonadotropic hormones as also reported in other teleosts (Khoo, 1979). With the onset of gonadal maturation the activity of gonadotrops starts increasing and finally during prespawning and spawning phases their activity is at its maximum. The maximal activity of gonadotrops is assessed by their synthetic and secretory activities, i.e. heavy accumulation of glycoproteinaceous granules in the cytoplasm which results hypertrophy in these cells and marked secretory changes in the form of degranulation and vacuolisation. Lindahl (1980) suggested that gonadotrops with numerous secretory granules represent a storing phase, probably with a low release rate and that degranulation and vacuolisation of the gonadotrops reflect a high level of hormone release. In the case of *C. punctatus* also storing and releasing tendency of gonadotrops correspond to the prespawning and spawning phases of gonadal activity. It is also reported that gonadal maturation is a gonadotropin mediated event which further supports the above observations (Wallace and Selman, 1978, 1980; Singh and Singh, 1984). During post-spawning phase the activity of gonadotrops is at its minimum which is evident by heavy vacuolisation of their cytoplasm on account of the discharge of their secretory granules resulting weak staining of these cells to various dyes.

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Further exhaustive condition of gonadotrops suggests that regressed gonads are formed as consequence of the withdrawal of gonadotropic hormone from the pituitary as also suggested in other teleosts (Rajalakshmi, 1966; Srivastava, 1983)

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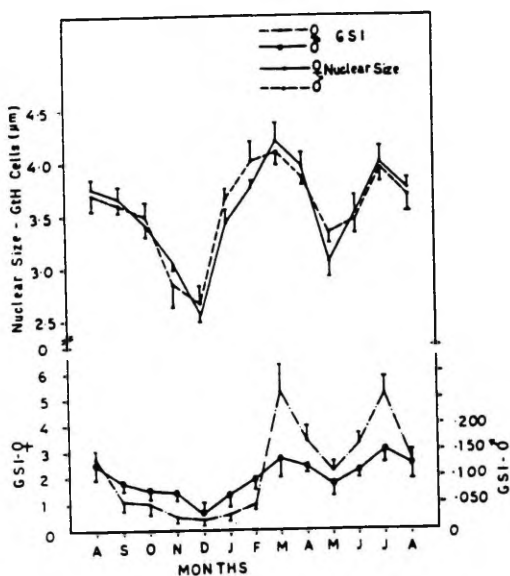


FIG.1

Fig. 1 Seasonal changes in the nuclear size of gonadotrophs (µm) and GSI of male and female *Channa punctatus*

*Channa punctatus*: photomicrographs of pituitary gonadotrophs

- Fig. 2 Showing poor cytoplasmic granulation during resting phase. Azan  $\times 1000$
- Fig. 3 Showing an increase in cytoplasmic granulation during preparatory phase. PAS  $\times 1000$
- Fig. 4 Showing heavy cytoplasmic granulation during prespawning phase with few vacuoles indicated by arrows PAS  $\times 1000$
- Fig. 5 Showing beginning of vacuolisation indicated by arrows during spawning phase. PAS  $\times 1000$
- Fig. 6 Showing heavy vacuolisation indicated by arrows during postspawning phase AF  $\times 1000$
- Fig. 7 Showing sieve-like appearance pycnotic nuclei during postspawning phase. Azan  $\times 1000$



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