

SEASONAL VARIATIONS IN THE NUCLEIC ACID CONTENT AND RNA: DNA RATIO AND PROTEIN CONTENT OF THE GONADS OF THE FRESHWATER BIVALVE *L. CORRIANUS*

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ABSTRACT

Abstract: The freshwater bivalve *L. corrianus* from Godavari River, Kaygaontoka, District Aurangabad, Maharashtra state, India have been studied to find out changes in nucleic acid contents and RNA/DNA ratio in male and female gonad tissues. The DNA content of male gonad was found higher than that of female gonad. The RNA content found high in female gonad. RNA: DNA ratios are higher in females than males.

KEY WORDS: *L. corrianus*, Nucleic acids, reproduction, RNA/DNA ratio

INTRODUCTION

The RNA: DNA ratio index gives a measure of the synthetic capacity of the cell and usually correlates with nutritional status (Buckley, et.al, 1999). The RNA: DNA ratio is based on the assumption that the amount of DNA, the primary carrier of genetic information, whereas the amount of RNA directly involved in protein synthesis, is known to vary with age, life-stage, of organism with changing environmental conditions (Bulow, 1970). Thus, organisms in good condition tend to have higher RNA: DNA ratios than do those in poor condition (Bulow, 1987). In order to gain better understanding of synthetic processes involved in the reproduction activities and the nucleic acid contents and RNA: DNA ratio and protein content of gonad of male and female *L. corrianus* have been carried out throughout the an annual cycle.

MATERIALS AND METHODS

Adult animals were collected from Godavari River at Kaygaontoka (Plate 1) in three different seasons monsoon and winter summer, during the months April/May, July/August and December/January respectively. Ten individuals of *L. corrianus* (6.5 cm in shell length) were collected from Collection sites. Animals were immediately brought to the laboratory and acclimatized for 24 hrs for defecation. Three individuals from each site were dissected and gonad smears were observed under microscope in order to find male and female individuals and 70-100 mg of gonad tissue was homogenized in 750 µl of trizol Sambrook and Russel (2001).



Plate 1. showing Collection site of specimen at Kaygaontoka, Godavari River, Aurangabad.

The extraction of nucleic acids was followed as per Axygen company protocol. Eluted RNA was dissolved in 20 μ l of DEPC water. The solution was passed through the tips several times in order to dissolve RNA. RNA concentrations were read (without further dilution) on Nanodrop at 260nm at Paul Herbert Centre for DNA Barcoding and biodiversity and expressed ng / μ l. The A260/280 ratio for RNA found above 1.9-2.3. The DNA concentration read at 280 nm and the A260/280 ratio found between 1.7-2.0. In order to know male and female individuals and the gonad status, gonad smears were observed under microscope. Total protein contents were estimated by Lowry *et al.*, (1951). Gonad smears were observed under microscope in order to find male and female reproductive status.

RESULTS AND DISCUSSION

DNA content

The DNA content gonad tissues shows higher DNA concentrations in the male gonad tissue than female gonad in monsoon, winter and in summer seasons. Observation shows phase of maturation in both the sexes. Higher concentration of DNA contents in the male due to formation large number of sperms and comparatively less number of oogonia in females. This underlines the basic premise that spermatogenesis involves the production of large numbers of small gametes, whereas oogenesis involves the production of few, large, synthetically active gametes Robbins *et.al.* (1990). The concentration of DNA in female gonad is low in winter than monsoon and summer season but highest in male gonad.

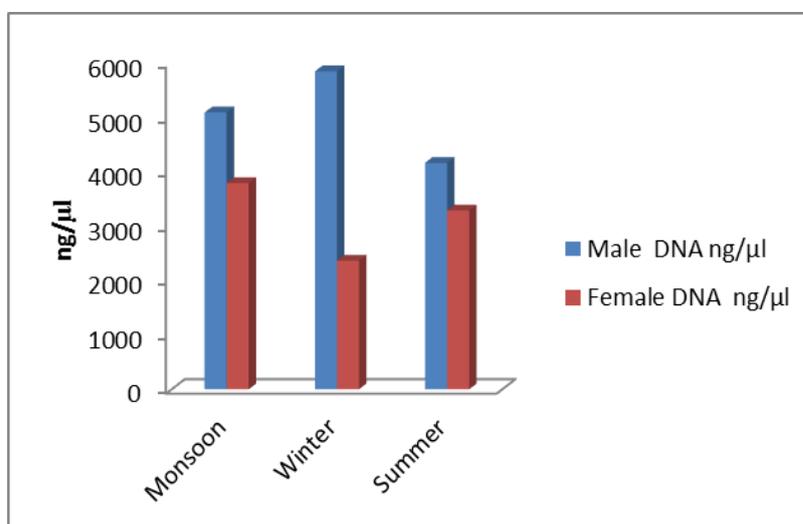


Figure 1. Showing DNA content in male and female gonads of *L. corrianus* from Kaygaontoka Sangam

RNA Content

In females RNA concentrations are found higher than males in monsoon and low concentration in winter and summer seasons. This clearly shows that vitellogenesis process was taking place in oogonia during maturation in the monsoon season. In winter and in summer RNA concentration found high in male gonad than in female gonads. This is phase of beginning of new gametogenesis process in both the male and female gonads. The relict gametes are lysed in females.

The spermatozoa are less synthetically active than the spermatogonic and it might be considered that their presence in large number dilutes the total RNA content. Intense spermatogenesis is continuous after spawning in males and the higher RNA content of female gonad reflects the synthetic activity of the female gamete (Kelley *et al.* (1982). Thus the RNA content increased in female in the beginning and during first gametogenic phase in monsoon during vitellogenesis and summer period active gametogenesis but showed decreased in winter.

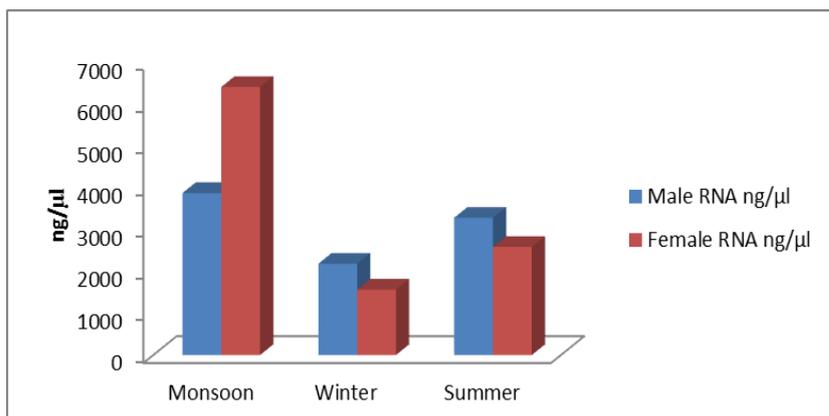


Figure 2. showing RNA contents in male and female gonads of *L. corrianus* from Kaygaontoka Sangam

RNA: DNA ratio

The RNA: DNA ratio of the male gonad was consistently found lower than that of female gonad in monsoon and winter season. Higher RNA: DNA found in monsoon than in summer and lowest value found in winter. In somatic tissues this could suggest a reduced protein synthetic activity. This, however, is probably not the case for the gonad, being merely a reflection of high DNA content due to the large numbers of very small cells compared to the female gonad. Although the RNA: DNA ratio of the female gonad might give some idea of the synthetic activity of the gonad. It is difficult to envisage its use as an indicator of sexual state. In male gonad, on the other hand, RNA: DNA ratio would appear to be a good indicator of sexual state, as would measurements of DNA alone. In this respect the RNA: DNA ratio is preferable as it is self-referencing (Robbins et.al. 1990).

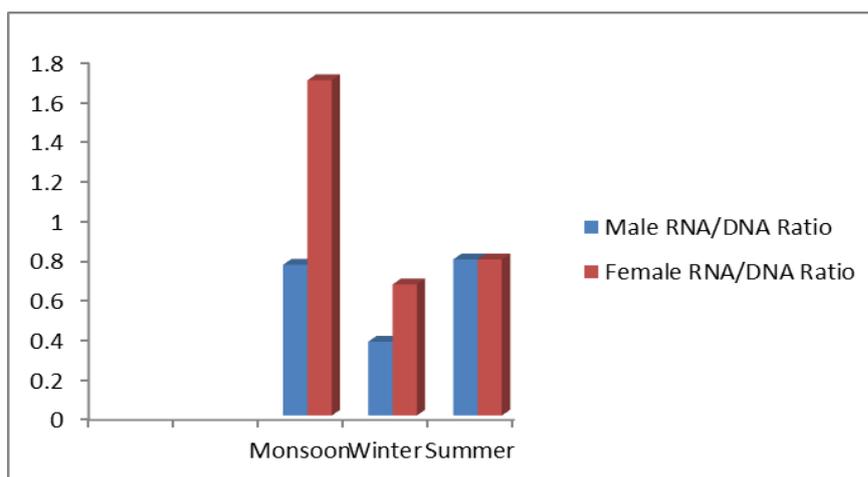


Figure 3. Showing RNA: DNA ratio in male and female gonads of *L. corrianus* from Kaygaontoka Sangam

Protein

The protein concentration was high in female gonads than in male gonads of *L. corrianus*, in three seasons. This clearly indicates that high concentration in the monsoon is due to presence many matured oogonia undergone vitellogenesis in the female gonads. Low concentration of proteins during winter may be due to released matured oogonia from female follicles. Many of male and female follicles were seen empty during this period. Increase in the protein concentration in summer can be correlated with the active gametogenic phase in both the sexes. Accumulation of large number of nutritive material has been observed in both gonads. Maturation and reproduction, which differ between males and females, often require different amounts of energy, as discussed by Paon & Kenchington (1995) and Pérez et al. (2003). According to authors, reproductive costs are much greater for females than for a male, which implies that protein synthesis and therefore RNA content is greater in females than in males.

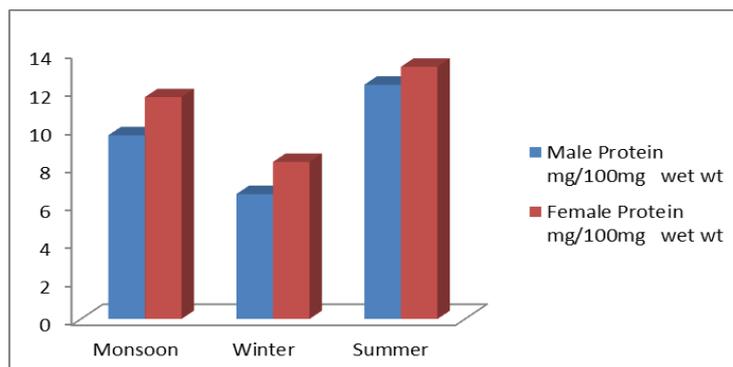


Figure 4. Showing Protein content in male and female gonads of *L. corrianus* from Kaygaontoka Sangam

The clam *Ruditapes decussates* (Pérez et al. 2003) exhibits clear sexual differentiation in biochemical composition. Nutritional stress results in a moderate degree of organic weight loss in clams, but protein and lipid levels remain constant in females. The results of these various studies highlight the importance of protein synthesis for females, especially during spawning activity, which could explain the higher RNA content and RNA: DNA ratios of female bivalves observed in our study. Protein was found maximum in gonads during summer, in mantle during winter season than. Variations in organic constituents in different soft body parts of *L. marginalis* found in Pravara River near Aurangabad were observed during different seasons by Sheikh (2011).

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