

SEASONAL VARIATIONS IN THE NUCLEIC ACID AND RNA: DNA RATIO IN THE GONAD OF THE FRESHWATER BIVALVE *L. CORRIANUS* FROM NANDRABAD POND

Nagawanshi M.

Department of Zoology, Deogiri College, Aurangabad, India

(E-mail: Meenan_2568@yahoo.com)

ABSTRACT

The RNA and DNA content in the male and female gonads of freshwater bivalve *L. corrianus* have been studied for different season from Nandrabad pond. 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.

KEYWORDS: Nucleic acids, *L. corrianus*, reproduction, RNA: DNA ratio

INTRODUCTION

The process of cellular growth and division require the synthesis of nucleic acids and protein. 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, is stable under changing environmental situations within the somatic cells of a species (Bulow, 1987), 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 of different tissues like mantle, gill, gonad and hepatopancreas of male and female *L. corrianus* have been carried out throughout the an annual cycle.

MATERIALS AND METHODS

Adult animals were collected from Nandrabad pond near Aurangabad city, in three different seasons' monsoon, winter and 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. Ten individuals of *Lamellidens corrianus* and *Lamellidens marginalis* (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. The extraction of nucleic acids was followed as per Axygen company protocol. Eluted RNA was dissolved in 20 µl 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/µl. 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.

RESULTS AND DISCUSSION

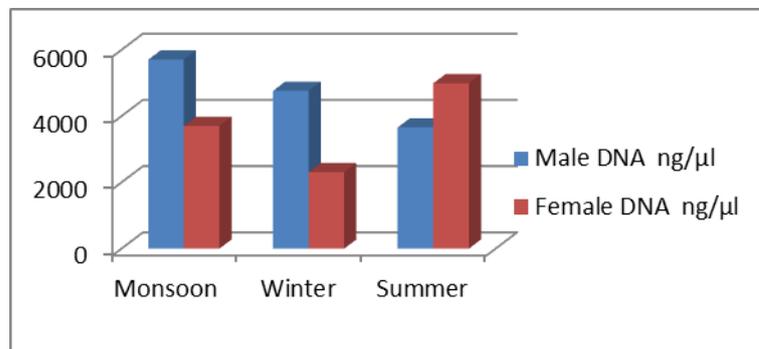
The gametogenic cycle of freshwater bivalve *Lamellidens corrianus* from Nandrabad pond has been described by Nagawanshi (1998). During the year 1994-1995 cycle *L. corrianus* exhibited two gametogenic phases 1st long and slow phase from February to July and 2nd short and fast from November to January. The numbers of gametes produced during long phase are large in numbers in both male and female gonads than the number of gametes produced during short phase in winter season. Many relict gametes were lysed, this phenomena of oocytes autolysis is observed with only the final generation reaching full maturity. In the present study *L. corrianus* exhibited similar pattern of life cycle.

DNA content

The DNA content of the male and female tissues shows higher DNA concentrations in the male Gonad tissue than female gonad in monsoon and in winter seasons. This period corresponded with the 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 is low in summer season when compared with monsoon and winter but at the same time DNA concentration is higher in female gonad than the male gonad. This indicates that gametogenesis has begun in both the tissues but the process commenced in females earlier than males. Gonads also show presence of some relict gametes undergoing lysis.

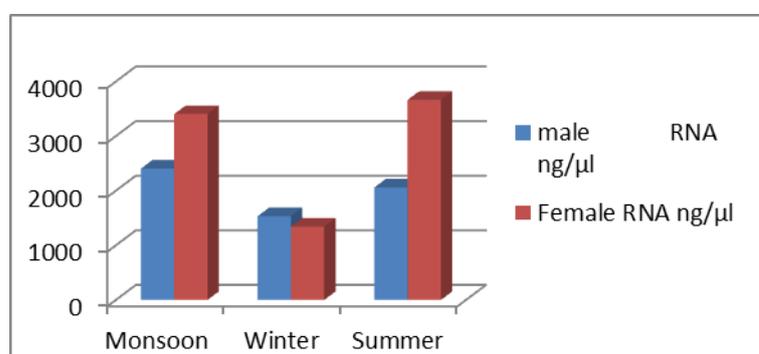
Figure.1 showing seasonal changes in DNA content in gonad tissue of male and female *L. corrianus* from Nandrabad pond



RNA Content

In females RNA concentrations are found higher than males in monsoon and summer seasons. This clearly shows that vitellogenesis process was taking place in oogonia during maturation in the monsoon season. In winter RNA concentration found high in male gonad than in female gonads. This phase in *L. Corrianus* corresponds to second gametogenic phase in winter in both male and female gonads (Nagawanshi, 1998). The RNA concentrations found high again in female gonad than male gonads during summer period. 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 period corresponds to second gametogenic phase which is short and produce less number of gametes.

Figure 2. showing seasonal changes in RNA content in gonad tissues of male and female *L. corrianus* from Nandrabad pond

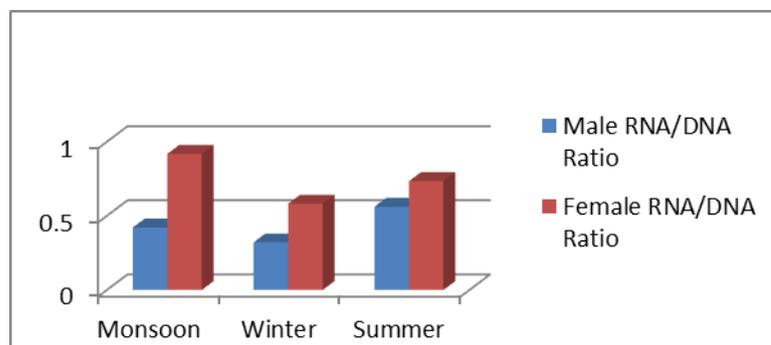


RNA: DNA ratio

The RNA: DNA ratio of the male gonad was consistently found lower than that of female gonad. 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 seasonal changes in RNA/DNA ratio of gonad tissues of *L. corrianus* from Nandrabad pond



ACKNOWLEDGEMENTS

- Thankful to University Grants Commission for Sanctioning Research Project.
- Indian Academy of Sciences, Bangalore, Indian National Academy of Sciences, New Delhi, The National Academy of Sciences India, Allahabad, for awarding Summer Research Fellowship 2011.
- Dr. S. Mahale, Deputy Director, NIRRH, Mumbai, for training under Fellowship.
- For Kind permission for DNA RNA analysis, Director, PHCDB&B, Department of Zoology, Dr. B. A. Marathwada University, Aurangabad.

REFERENCES

- Buckley L.J., Calderone E. and Ong T.L. (1999).** RNA-DNA ratio and other nucleic acid-based indicators for growth and condition of marine fishes. *Hydrobiology*. 401:265-277.
- Bulow J.F. (1987).** RNA-DNA ratios as indicators of growth rates in fish: A review. In *The age and growth of fish*; Summerfelt, R.C., Hall, G.E. Eds.; The Iowa State University Press: Ames, Iowa; pp. 45-64.
- Bulow F.J. (1970).** RNA-DNA ratios as indicators of recent growth rates of a fish. *J. Fish Res. Board Can.* 27:2343-2349.
- Nagawanshi M. (1998).** Reproductive physiology of freshwater bivalve molluscs from Aurangabad, Maharashtra State. Ph. D. Thesis. Dr. Babasaheb Ambedkar Marathwada University, Aurangabad.
- Kelley N. R., Ashwood-Smith and Ellis D.V. (1982).** Duration and timing of spermatogenesis in a stock of the mussel *Mytilus californianus*. *J. Mar. Biol. Ass. U.K.* 62:509-519.
- Robbins I. P., Lubet and J. Y. Besnard (1990).** Seasonal variations in the nucleic acid content and RNA: DNA ratio of the gonad of the scallop *Pecten maximus*. *Marine Biol.* 105: 191-195.
- Sambrook J. and Russel D.W. (2001).** Molecular Cloning. A Laboratory Manual, Vol. 1, 2, 3, Cold Spring Harbor Laboratory Press, New York.