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Biochemical changes in Ovary and Hepatopancreas during the annual reproductive cycle in freshwater female prawn *Macrobrachium rosenbergii*

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Key Words: *Macrobrachium rosenbergii,* reproductive cycle, ovary, Hepatopancreas, protien

ABSTRACT

Monthly changes in Biochemical composition of the ovary and hepatopancreas tissue were studied for one year to determine their variability during the reproductive cycle in *Macrobrachium rosenbergii.* Highest protein level in the ovary was observed in August (50 ± 1.24).Low value (22± 0.18) in February. Highest hepatopancreatic protein content was noticed in the month of February (31 ± 0.52) and low in August (09 ± 0.51).Highest lipid level in the ovary in August (35 ± 0.26). Low value (10 ± 0.12) in February Highest hepatopancreatic lipid in February (48 ± 62) and low in August (17.5 ± 0.39) Glycogen content in the ovaries ranged between (1.0 ± 0.12) to (5.0 ± 0.29) and hepatopancreas (1.0 ± 0.43) to (3.5 ± 0.35) during October to September.. Observations for biochemical variations revealed that there was inverse relationship between hepatopancreas and ovary might be due to transfer of organic constituents to the ovary for maturation of oocytes.

INTRODUCTION

Biochemical changes during maturation and reproduction in gonads and Hepatopancreas have been examined for a number of crustacean species (Read and Caulton, 1980; Rosa and Nunes, 2003). In invertebrates, the gonadal growth during maturation involves active mobilization and synthesis of organic substances (Giese, 1958). Speck and Urich (1969) suggested that the hepatopancreas is a labile organ whose size and function varies with metabolic demands.Kyomo (1988) analysed the relationship between gonad and hepatopancreas in females and males of the crab, *Sesarma intermedia* with reference to reproduction. Biochemical variation in the gonad and hepatopancreas in correlation with reproductive cycle have been studied in crustaceans like

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Barytelphusa guerini (Sugita Mathur, 1994), and in *Penaeus monodon* (Tseng *et al.*, 2001). Since a great deal of energy is required to the gonads for the vast number of gamete production, biochemical constituents are chanalised from various tissues to the gonads (Quackenbush, 1991). To understand the importance of quantitative variations of the organic constituents like protein, lipid and glycogen in the tissue of ovary and hepatopancreas during annual reproductive cycle, the present investigation was designed on the freshwater female prawn, *M. rosenbergii*.

MATERIAL AND METHODS

Freshwater female prawns, *Macrobrachium rosenbergii* were collected monthly from the "Girna Dam", Tq. Malegaon Dist. Nasik, Maharashtra State, for the period of one year from October- to September. From the collection, only healthy female prawns were selected and were brought to the laboratory and immediately sacrificed. Fix date and time was followed to avoid any fluctuation. The biochemical changes were recorded on monthly basis of the ovary and hepatopancreas. Following methods were used for estimating the different biochemical constituents such as protein, lipid and glycogen in the ovary and hepatopancreas of freshwater prawn, *Macrobrachium rosenbergii*. Protein, lipid and Glycogen levels were calculated on dry weight basis and expressed as % mg. Protein level was estimated by the method of Lowry *et al.*, (1951) using ⌐olin phenol reagent method. Total lipid values were estimated by the method of Barnes and Blackstock (1973) using sulphovanaline reagent method. Glycogen values were measured by the method of De Zwann and Zandee (1972) using anthrone reagent method.

RESULTS AND OBSERVATIONS

Highest protein level in the ovary of *Macrobrachium rosenbergii* was observed in August (50 ± 1.24). Low value (22± 0.18) was noticed in February Highest hepatopancreatic protein content was noticed in the month of February (31 ± 0.52) and low August (09 ± 0.51) (Table- 1 Fig.1).Highest lipid level in the ovary of *M. rosenbergii* was observed in August (35 ± 0.26). Low value (10 ± 0.12) was noticed in February. Highest hepatopancreatic lipid content was noticed in the month of February (48 ± 62) and low August (17.5 ± 0.39) (Table 1, Fig.2). Glycogen content in the ovaries ranged between (1.0 ± 0.12) to (5.0 ± 0.29) and hepatopancreas (1.0 ± 0.43) to (3.5 ± 0.35) during October to

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September (Table 1, Fig.3). Highest protein and lipid level in ovary was recorded in August, which coincides with high breeding activity, and lowest in February, which correlated with low breeding activity.Observations for biochemical variations revealed that there was inverse relationship between hepatopancreas and ovary might be due to transfer of organic constituents to the ovary for maturation of oocytes.

Table-1:- Variation in the levels of protein, lipid & glycogen in the ovary and hepatopancreas during annual reproductive cycle of female prawn, *Macrobrachium rosenbergii* (% mg on dry weight basis)

	Protein		Lipid		Glycogen	
Month	Ovary	Hepatopancreas	ovary	Hepatopancreas	ovary	Hepatopancreas
Oct.	38 ± 1.07	16 ± 0.82	28 ± 1.24	28 ± 0.82	3.5 ± 0.07	3.5 ± 0.35
Nov.	45 ± 0.72	21 ± 0.35	20 ± 1.07	29.5 ± 0.35	01 ± 0.12	01 ± 0.43
Dec.	36 ±0.09	18 ± 0.39	18 ± 0.72	32 ± 0.39	03 ± 0.09	03 ± 0.39
Jan.	30 ± 0.12	27 ± 0.62	11.5 ± 0.09	30.5 ± 0.52	2.5 ± 0.21	2.5 ± 0.51
Feb.	22 ± 0.18	31 ± 0.52	10 ± 0.12	48 ± 0.62	2.5 ± 0.81	2.5 ± 0.25
Mar.	23 ± 0.25	30 ± 0.45	12 ± 0.18	42 ± 0.45	01 ±0.25	01 ± 0.19
Apr.	23 ± 0.19	28 ± 0.28	11 ± 0.25	41 ± 0.28	02 ± 0.19	02 ± 0.32
May.	25 ± 0.22	22 ± 1.24	12.5 ± 0.19	35 ± 1.24	03 ± 0.23	03 ± 0.39
June.	30 ± 0.28	20 ± 0.89	17.5 ± 0.22	38 ± 0.89	05 ± 0.29	2.5 ± 0.45
July	34 ± 0.17	17 ± 0.36	23 ± 0.28	30 ± 0.36	01 ± 0.15	01 ± 0.35
Aug	50 ± 1.24	09 ± 0.51	35 ± 0.26	17.5 ± 0.39	05 ± 0.22	2.5 ± 0.85
Sept	40 ± 0.26	12 ± 0.39	22.5 ± 0.17	21.5 ± 0.51	01 ± 0.24	01 ± 0.45

± S.D. – Standard Deviation

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Fig. 1: Variation in the levels of protein in the ovary and hepatopancreas

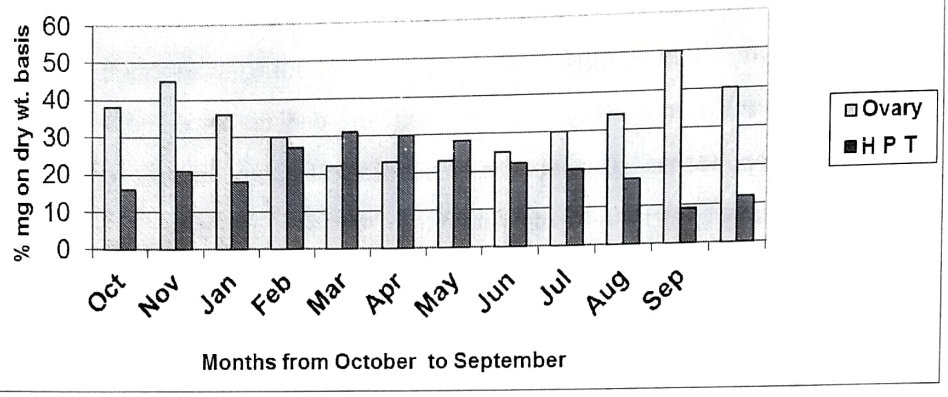


Fig. 2: Variation in the levels of lipid in the ovary and hepatopancreas

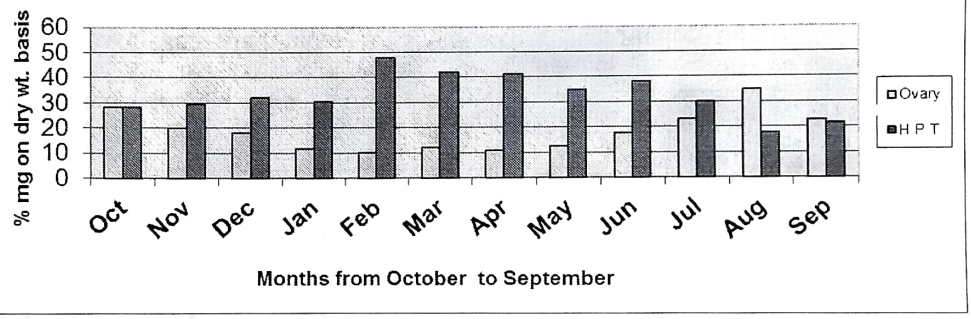
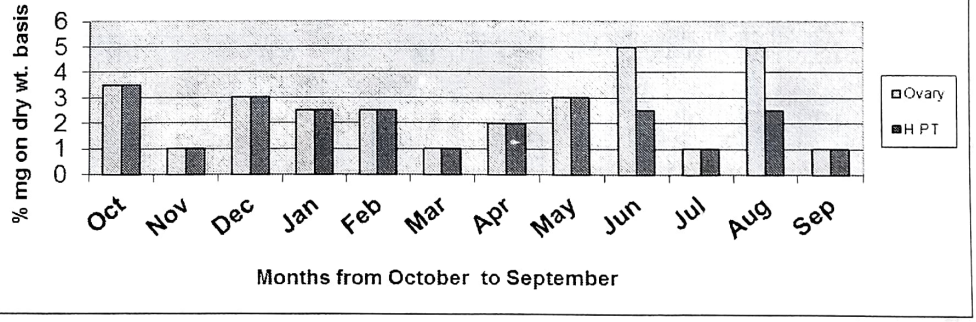


Fig. 3: Variation in the levels of Glycogen in the ovary and hepatopancreas



DISCUSSION AND CONCLUSIONS

The biochemical changes during maturation, moulting and reproduction in the gonads and hepatopancreas have been examined for number of crustacean species (Read and Caulton, 1980; Marangos et al,1988; Castille and Lawrence, 1989). The protein content in *Macrobrachium rosenbergii* showed significant rise in ovary during maturation .The protein level was highest (50 ± 1.24) in August when the gonads were at the highest breeding activity.The protein level decline to minimum in the month of February (22 ± 0.18) during the early mature stage of ovary. From March, onwards the level of protein was in-

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creased until the maturation of gonads. Highest hepatopancreatic protein content was noticed in the month of February (31 ± 0.52) and low in August (09 ± 0.51). Pillay and Nair (1973) in the crab, *Portunus pelagicus* found increase in the protein content in the gonad during ovarian maturation. Reddy (1982) noticed decreased protein level in hepatopancreas and muscle during ovarian maturation in freshwater prawn, *Caridina weberi*. Sarojini and Rajini (1987) have reported depletion in hepatopancreatic proteins as vitellogenesis proceeds in freshwater prawn, *Macrobrachium Lamerrii.* Ramadevi *et al.,* (1990) reported that the protein of the ovary increased as the ovary attained maturity. In the present investigation, protein might be mobilized from hepatopancreas to ovary during gonadal development as suggested by Adiyodi (1967).

Highest lipid level in the ovary of *M. rosenbergii* was observed in August (35 ± 0.26).and low (10 ± 0.12) in February.Highest hepatopancreatic lipid content in the month of February (48 ± 62) and low in August (17.5 ± 0.39). Hepatopancreas found to be an efficient organ for lipid storage and has the ability to provide energy whenever the metabolic demand arises (Warren, 1973). The mobilization and accumulation of lipid reserves in several tissues have been documented in crustacean species (Millamena and Pascual, 1990; Khayat *et al.,* 1994; Palacios *et al.,* 2000; Rosa and Nunes, 2002; Walker *et al.,* 2006; Barbara and Felder, 2006) and several of the cited authors noted that the increase in the ovarian lipids accompanied by a decrease in hepatopancreas lipids. Many researchers strongly reported that in crustaceans lipids initially be accumulated in the hepatopancreas and later transported to the ovaries during gonad maturation (Nagabhushanam *et al.,* 1984; Lautier and Lagarrigue, 1988; Castille and Lawrence, 1989;; Roustaian *et al.,* 1999; Wen *et al.,* 2001; Sivachandrabose, 2002; Shejule and Zambare, 2003). Among the different tissues analysed in the crustacean, noted that glycogen was mainly stored in the hepatopancreas and to a lesser extent in the muscle (Baden *et al.,* 1994; Rosa and Nunes, 2003). In the present study glycogen level did not showed significant variation through out reproductive cycle in relation to ovarian maturation Glycogen content in the ovaries ranged between (1.0 ± 0.12) to (5.0 ± 0.29) and hepatopancreas (1.0 ± 0.43) to (3.5 ± 0.35) during October to September .Biochemical changes in various tissues such as, ovary and hepatopancreas during ovarian cycle revealed that a considerable amount of energy is transformed

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from hepatopancreas to the ovary during vitellogenesis.. From the present findings and literature cited it is concluded that organic constituents of the hepatopancreas were mobilized for the maturation of ovary.

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