

Research Article

Studies on the Seasonal Fluctuations in the Proximate Body Composition of *Paratelphusa masoniana* (Henderson) (Female), a Local Freshwater Crab of Jammu Region

¹Seema Langer, ¹Priya Manhas, ¹Yahya Bakhtiyar, ²Sheikh Rayees and ²Gurdarshan Singh

¹Department of Zoology, University of Jammu, Jammu (J&K)

²Pharmacology Division, Indian Institute of Integrative Medicine (CSIR), Jammu

Abstract: The freshwater crab, *Paratelphusa masoniana* was collected for a period of one year to investigate the seasonal fluctuation in the proximate composition. Marked seasonal variation in protein, lipid and moisture were observed during a period of one year to determine their viability in the course of the reproductive cycle. Both protein and lipid content are inversely related to moisture content. Maximum protein ($62.15 \pm 0.30\%$; 55.85 ± 0.48) and lipid ($5.85 \pm 0.46\%$; $5.49 \pm 0.38\%$) were observed during non-spawning period and minimum during spawning months. The relationship between protein and lipid is however a direct one. On the basis of the investigation, it has been recorded that the local freshwater crab, *P. masoniana*, is a biannual breeder.

Keywords: Ash, lipid, moisture, *Paratelphusa*, protein

INTRODUCTION

Crabs, among many other invertebrates, are considered to be important shell fishery products (Gokoglu and Yerlikaya, 2003). Crab meat is considered as a delicacy in many parts of the world but the limited utilization of shellfishes (crab) in our state (J&K) is due to conservative food habits and lack of knowledge about the nutritive value of crabs.

P. masoniana, a local freshwater crab of Jammu region, has been identified as a virgin species so far the scientific knowledge on this species is concerned. Nevertheless, before any species is subjected to commercial exploitation, it is important and essential requisite that knowledge about its life cycle, particularly maturation and reproduction (Mourente and Rodriguez, 1991) besides its biochemical nature is inquisitively studied and understood. Further the scope or role of a species in aquaculture practice is primarily determined by its nutritional status, especially the protein value. Keeping these facts in view, present study has been designed to generate the data regarding its nutritional status and the variation in the proximate composition which will help to establish the present species as a potential culturable candidate. When compared to marine decapods crustaceans, little attention has been paid on the biochemical changes in relation to reproductive cycle in decapod crustacean in India, especially on the freshwater crabs. The aim of this study was thus to generate data on the biochemical changes in the muscle of the crab during the course of reproductive cycle.

MATERIALS AND METHODS

Collection: Crabs after being collected from their natural habitat, at Gho-Manhasan stream, at a distance of about 12 km from University of Jammu, ($32^{\circ}67'$ Lat N; $74^{\circ}79'$ Long E) were brought to the Wet Laboratory, Department of Zoology, University of Jammu. During the present course of study, only adult female crabs (of carapace width 5-6 cm) were selected for the present study and the juveniles were again released into their natural habitat. Soon after catching, crabs were brought to the laboratory; crabs were then dissected for body meat.

Proximate body composition: The specimens collected from Gho-Manhasan stream on monthly basis were subjected to analyze proximate body composition. The analysis was performed for a period of one year (July 2010-June 2011). The organic body constituents of each component were determined by standard methods such as total proteins (Lowry *et al.*, 1951); lipid (Folch *et al.*, 1957); moisture and ash (Standard method of AOAC, 1980). The results were expressed on dry weight basis.

Statistical analysis: The data was analyzed on personnel computer to calculate correlation by Pearson's correlation method, ANOVA to test the level of significance with the help of Microsoft Excel 2003 and SPSS (12.0 Version, Chicago, USA) and mean compared by using Duncan's multiple range test taking ($p < 0.05$) as level of significance (Duncan, 1955).

Corresponding Author: Priya Manhas, Department of Zoology, University of Jammu, Jammu (J&K)

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Table 1: Seasonal variation in the proximate composition of *Paratelphusa masoniana* (female), a local freshwater crab of Jammu region during different months of the year (July 2010-June 2011)

| Months | Protein | Lipid | Ash | Moisture |
|----------------|-------------------------|--------------------------|--------------------------|----------------------------|
| July | 48.51±0.12 ^g | 3.99±0.32 ^d | 6.98±0.41 ^{fg} | 84.23±1.60 ^a |
| August | 50.98±0.71 ^f | 5.45±0.43 ^{ab} | 6.78±0.52 ^h | 81.30±1.53 ^{bcd} |
| September | 54.29±0.32 ^e | 5.85±0.46 ^a | 9.89±0.73 ^b | 81.90±1.61 ^{abc} |
| October | 55.85±0.48 ^d | 5.33±0.19 ^{ab} | 7.60±0.24 ^{def} | 81.29±1.57 ^{bcd} |
| November | 53.98±0.47 ^e | 4.41±0.53 ^{cd} | 8.32±0.63 ^{cd} | 81.76±1.48 ^{abcd} |
| December | 46.05±0.82 ^h | 4.08±0.40 ^d | 7.75±0.34 ^{de} | 82.56±1.40 ^{ab} |
| January | 54.75±0.47 ^e | 4.22±0.54 ^{cd} | 8.54±0.33 ^c | 82.20±1.65 ^{abc} |
| February | 56.03±0.24 ^d | 4.76±0.87 ^{bcd} | 9.67±0.33 ^b | 79.61±1.55 ^{cdef} |
| March | 62.16±0.30 ^a | 5.49±0.38 ^a | 12.35±0.72 ^a | 78.13±1.45 ^f |
| April | 60.50±0.50 ^b | 5.03±0.28 ^{abc} | 8.85±0.23 ^c | 78.53±1.40 ^{ef} |
| May | 57.54±0.42 ^c | 4.84±0.63 ^{bcd} | 7.17±0.30 ^{efg} | 79.28±1.61 ^{def} |
| June | 50.77±0.41 ^f | 4.44±0.51 ^{cd} | 6.54±0.35 ^h | 80.98±1.57 ^{bcd} |
| Annual average | 54.28±4.68 | 4.83±0.61 | 8.37±1.66 | 80.98±1.78 |

Data presented in the table is the mean of three readings i.e., Mean±S.D. (Annual average is mean of 12 readings i.e., Mean±S.D.); The values having the same superscript in a column do not differ significantly

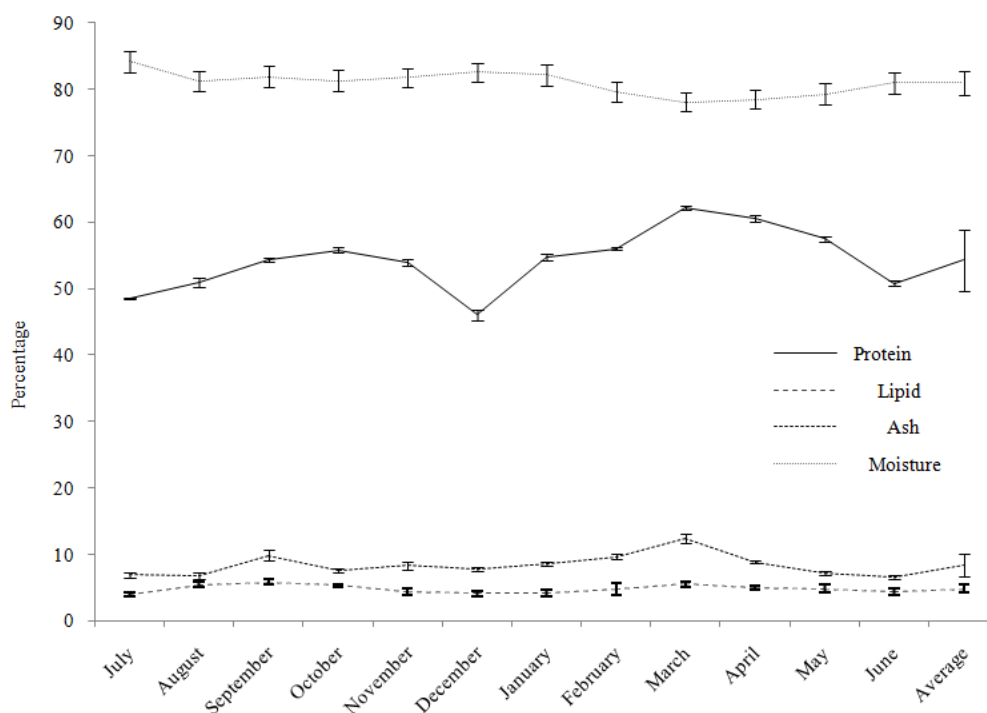


Fig. 1: Seasonal variation in the proximate composition of body meat of female *Paratelphusa masoniana*

RESULTS

The proximate body composition of the body meat of female *P. masoniana* was determined over a period of one year and the results so obtained are depicted in Table 1, Fig. 1. During the present course of study it was revealed that the highest values of the protein were obtained in the month of March (62.16±0.30) whereas the lowest values were found in the month of December (46.05±0.82%). The values so recorded were found to differ significantly among various months (p<0.05). The average value of protein content in the body meat of *P. masoniana* (female) throughout the year was found to be 54.38±0.43%. The perusal of the Table 1 also reveals the increasing trend of protein during the

months of March and October showing two peaks respectively.

The lipid content in body meat of female crab was observed to have maximum value in the month of September (5.85±0.46%) which was not found to differ significantly (p>0.05) from the values noted during the month of March (5.49±0.38%) and minimum values (3.99±0.32%; 4.08±0.40%) in the months of July and December. The average value of lipid content recorded throughout the year was 4.83±0.61%.

The moisture content in the body meat of *P. masoniana* (female) ranged between 84.23±1.60% (maximum) to 78.13±1.45% (minimum) with an annual average to be 80.98±1.78%. Maximum values of moisture content (84.23±1.60% and 82.56±1.40%)

were observed in the months of July and December, respectively.

The mean range of ash content in body meat of *P. masoniana* (female) is $6.54 \pm 0.35\%$ to $12.35 \pm 0.46\%$. Two peaks ($12.35 \pm 0.72\%$; $9.89 \pm 0.73\%$) were however, recorded in March and September respectively and the minimum values ($6.78 \pm 0.52\%$; $7.17 \pm 0.30\%$) were recorded in the months of August and May.

The values noted for protein, lipids, moisture and ash were found to have significant differences among various months of the year showing gradual increasing and decreasing trends. Correlating the various parameters among themselves revealed that protein and moisture showed negative correlation ($r = -0.84311$), lipid and moisture also showed negative correlation ($r = -0.49769$), protein and lipid showed positive correlation ($r = 0.549235$) among themselves.

DISCUSSION

In the present study, it has been observed that the protein content in female crab showed marked seasonal fluctuations in the body meat. The pronounced fall in the protein content in females suggested that it may be mobilised for gonadal development. The same trend was observed by Sriraman (1978) in shrimp, *Penaeus merguensis* and in freshwater prawn, *M. idae*. The protein content remain characteristically low during winter (December and January) and monsoon (July and August) which coincides with their spawning season (i.e., May to July and December to February) when the gonads are in advanced stage of maturity. There is however, an increase in the protein content during spring (February to April) and post monsoon (August to October). The quintessence of high protein content observed during spring and early winters happen to be due to active feeding, optimum temperature regime and optimum availability of food as algal blooms and plankton during this period acquire maxima. Our observations also get strengthened by the previous recordings made by Parveez (2005) from the same stream, which happen to the natural habitat of *P. masoniana*. He observed that benthic species like chironomous larvae sps and tipula sps were abundant during summer and monsoon (Nelofer, 2003; Sawhney, 2004). In crustaceans, a great amount of energy gets channeled to the gonads during reproduction, which is reflected in the deposition or depletion of nutrients with the advent or departure of reproductive period (Lambert and Dehnel, 1974). Samyal (2007) while investigating *Macrobrachium dayanum* recorded two peaks in muscles in the months of May and November when the ovaries are in early stage of development with stage I and stage II oocytes. Bakhtiyar (2008) also recorded a fall in the muscle protein in *M. dayanum* which coincides with their spawning season when gonads were in advanced stage of maturity.

In the present study, two peaks in the muscle lipid content were observed in the months of March ($5.49 \pm 0.38\%$) and September ($5.85 \pm 0.46\%$). Thus, high lipid content was observed in spring and Post monsoon and this could be due to active feeding and optimum availability of food, as algal blooms and plankton also are reported to acquire maxima during this period (Sharma, 2005). There was also a decline in the lipid content during spawning period and this is possibly due to mobilization of lipid as energy source to meet the high energy demands, during the act of ovulation and spawning on one hand and due to low feeding intensity and low availability of food items on the other. Reduction in the amount of lipid content in the muscles for the development and maturation of gonads has been well discussed by Idler and Bitner (1960), Jafri (1968), Diana and Mackay (1979), John and Hameed (1995), Raina (1999), Jonsson and Jonsson (2005), Langer *et al.* (2008) and Samyal *et al.* (2011).

There is significant variation in the moisture content of *P. masoniana* (female) throughout the period of investigation. The spawning of *P. masoniana* usually occurs during winters (December and January) and monsoon (July and August) since they are biannual breeders. It has also been recorded that during these months the moisture content is highest in muscles. Samyal *et al.* (2011) while investigating *M. dayanum* recorded that it is also biannual breeder and during these month i.e., May-June and Sep-Oct, the moisture content is highest in muscles. Bakhtiyar (2008) also observed similar trend in *M. dayanum* and *Labeo rohita* where the variation in the moisture content were related with the spawning. Moisture content thus showed significant but inverse relationships with lipid and protein contents. This inverse relation might be due to low temperature, low feeding rate and high energy demands to maintain body temperature and to cope up with food scarcity during winter. Similar results were earlier propounded by many authors (Brandes and Dietrich, 1953; Gerking, 1955; Brown, 1957; Suppes *et al.*, 1967; Jonsson and Jonsson, 2005; Nargis, 2006; Langer *et al.*, 2008; Samyal *et al.*, 2011).

The Ash or total inorganic content in present study varies on the average from $6.54 \pm 0.35\%$ to $12.35 \pm 0.72\%$. Two peaks ($12.35 \pm 0.46\%$, $9.89 \pm 0.73\%$) were observed in the body meat in the months of March and September. The increase in the ash content in the female crabs corresponds to the post spawning period. Love (1970) also witnessed that there is increase in the ash level during post spawning. Jafri (1968) stated that there is no direct relationship between the ash cycle and feeding or spawning activities of *Cirrhina mrigala*. Bakhtiyar (2008) while investigating *M. dayanum* recorded the minima in the months of October and November and maxima in the month of March. Such variability in ash content could be attributed to the utilization of mineral matter for the growth and maturation of ovaries and spawning purposes.

CONCLUSION

From the study of the seasonal variation in the biochemical composition of the body meat of *P. masoniana*, it appears that there are two distinct periods of variation i.e.:

- From December to January (winter) and July to August (Monsoon) which correspond to the spawning period when the gonads are in advanced stage of maturity and there is mobilization of nutrients from muscle to the gonads for their development.
- From February to April (spring) and August to October (Post-monsoon) which correspond to non-spawning period. During this period *P. masoniana* is nutritionally more rich as protein, lipid, moisture and ash content in the muscle are high.

Thus, these two periods are characterized by the variation in the chemical composition.

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