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Monthly changes in tissue weight and biochemical composition of the musel *Mytella guyanensis* (Bivalvia: Mytilidae) in Costa Rica

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Abstract: Monthly changes in body weight and biochemical composition of *Mytella guyanensis* were studied in Nicoya, Costa Rica, (May 1989-April 1990). Dry tissue weight was minimal in December and rose to a peak in July, in accordance to periods of maturation and spawning. Mean percentage values of the main components of dry flesh were: proteins 58.3, carbohydrates 22.8, lipids 7.2 and ash 11.2. The mean caloric value of dry flesh was 5.2 Kcal/g. Decrease in the percentage of lipids, proteins and caloric values coincided with the spawnig period.

Key words: Biochemistry, reproductive cycle, energetic value, *Mytella guyanensis*.

A great deal of work has been done on the biochemical composition of the flesh of mussels (Gabbott 1976). Most studies however, refer to temperate species, such as *Mytilus edulis* (Dare and Edwards 1975), *M. galloprovincialis* (Bressam and Marín 1985) and *M. chilensis* (Duarte *et al.* 1980). In spite of the great diversity of tropical American species, there are only two important papers in this field (Benitez 1968, Benitez and Okuda 1971), both on the biochemical composition of the Venezuelan mussel, *Perna perna*. This paper decribes the variation in tissue weight and biochemical composition in *M. guyanensis* Lamarck, 1819 with reference to reproduction.

MATERIAL AND METHODS

Adult mussels (above 32 mm in lenght) of *M. guyanensis* were collected monthly between May, 1989 and April, 1990 at the mangroves of Colorado de Abangares, on the Gulf of Nicoya, Costa Rica (10°11'N, 85°06'W).

Animals were cleaned and the epibiontic *Crepidula marginalis* removed. The flesh of 50 randomly selected individuals was drained and weighted. Dry weight was obtained after dehydratation at 100°C for 24 hours.

Nitrogen content was estimated by the Kjeldhal method (AOAC. 1980) and converted to protein values by multiplying it by a 6.25 factor (Crips 1971). Lipids were extracted using a soxhlet extractor with petroleum ether (AOAC. 1980). Percentage of ash was estimated by calcination, slowly increasing the temperature up to 500°C for 5 hours. Carbohydrate content was then calculated from the diference between the percentage of lipids, proteins and ash. The caloric content value was determined using the following conversion factors recomended for molluscs: 4.2 Kcal/g for carbohydrates; 5.7 Kcal/g for proteins and 9.5 Kcal/g for lipids (Ansell *et al.* 1980).

RESULTS

Fig. 1 shows the monthly variation of the dry flesh weight in mussels with a total length ranging between 32 and 70 mm. The mean value was 0.42 g with two periods of decline, one from July (0.60 g) to December (0.26 g) and a second from February (0.50 g) to May (0.44 g). The highest values of dry flesh weight are

coincident with the maximum sexual maturation time as described by Cruz and Villalobos (1991 in press).

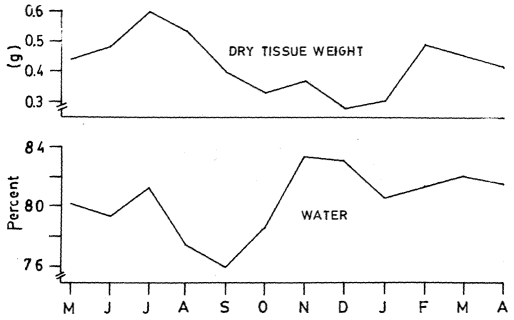

Fig.1. *Mytella guyanensis*. Seasonal changes in dry tissue weight and water content; Y axis: months.

Continuous spawning was observed throughout the year with two main peaks, one between September and November and a second one from February through March. Mean monthly values in water content, gross biochemical composition and caloric content are given in Table 1. Mean water content was 80.4 % with a maximum in November (83.4 %) and a minimum in September (76 %). It decreased from May through September and then increased until November after which it stabilized (Fig.1).

The percentage of proteins, carbohydrates, lipids and ash are shown in Fig. 2. Proteins exhibits two peaks of maximum accumulation. The first begins in May (52.3 %) with a maximum in July (60.5 %). The second one begins in October (53.6%) and ends in April, with a maximum in December (68.7%).

Carbohydrates show the values higher in May (27.3%), September (30.5%), October (29.9%) and April (30.9%), precisesly in the same months in which proteins exhibit the minimum values ($r=-0.94, P>0.05$).

Lipids represent the smaller fraction (4.6-12.7%), decreasing from June (12.7%) through October (4.5%). It declines again from December (8.1%) to March (6.4%).

The percentage of ash did not show any correlation with the monthly fluctuation of the other components. Mean value was 11.2 % with a maximum of 12.2 % in November and a minimum of 9.6 % in December.

The mean caloric value for *M. guyanensis* was 5.22 Kcal/g (Table 1), which agree with values reported for other aquatic invertebrates (Winberg 1971) and for mussels in general

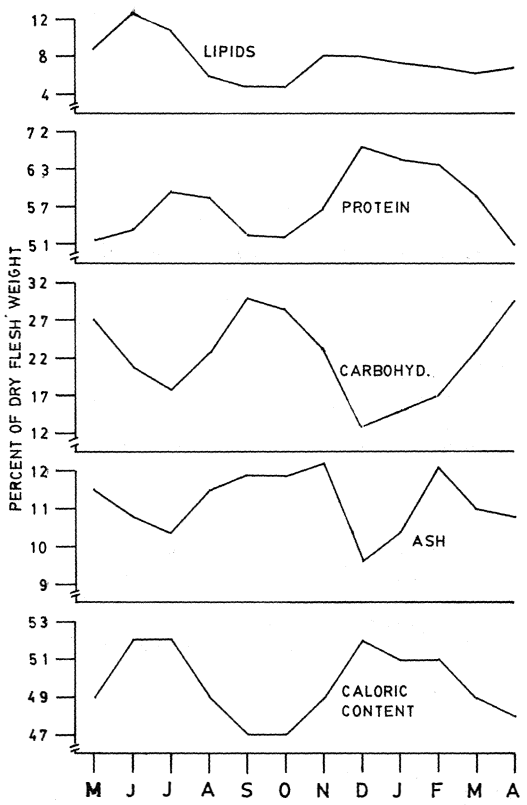

Fig. 2. *Mytella guyanensis*. Seasonal changes in the biochemnical lipids, protein, carbohydrate, ash, and caloric content; Y axis: months.

TABLE 1

Biochemical composition and caloric values from dry flesh of the mussel Mytella guyanensis *in Costa Rica*

Month	water %	Components (as % dry weight) Protein	Carbohyd.	Lipids	Ash	Cal. values Kcal/g
May	80.2	52.2	27.4	8.9	11.5	4.9
June	79.3	58.4	21.7	12.7	10.8	5.2
July	81.2	60.5	18.3	10.8	10.4	5.2
Aug.	77.5	58.7	23.5	6.3	11.5	4.9
Sept.	76.0	53.0	30.5	4.6	11.9	4.7
Oct.	78.7	53.6	29.0	4.6	11.9	4.7
Nov.	83.4	56.9	23.1	7.8	12.2	4.9
Dec.	83.0	68.7	13.6	8.1	19.6	5.2
Jan.	80.6	66.5	15.0	7.6	10.4	5.1
Feb.	81.4	64.0	17.1	6.8	12.1	5.1
Mar.	82.1	59.3	23.3	6.4	11.0	4.9
Apr.	81.6	51.5	30.9	6.8	10.8	4.8

(Dare and Edwards 1975). The caloric values varied monthly (Fig. 2) showing peaks in June, July and December (5.2 Kcal/g), at the same time when proteins exhibits the highest values and just before the onset of spawning.

DISCUSSION

Mytella guyanensis exhibits two reproductive peaks during the year. Considering that molluscs show a cycle of reproductive activity and that energy derived from food is stored to meet the requeriments of gametic production (Giese and Pearse 1974) it is possible to assert, as suggested by Bayne (1976), that there exists a biochemical cycle closely related with the gametogenic cycle (Taylor and Venn 1979, Chaparro and Winter 1983).

The lower percentages observed in lipids and proteins during spawning time are in accordance with the results obtained in other studies, such as the one by Gabbott (1976), Peiters *et al.* (1980), Davis and Wilson (1983) and Bressan and Marín (1985). These are important organic constituent of molluscan oocytes (Lucas and Benninger 1985).

In *M. guyanensis*, the level of carbohydrates vary inversely with those of proteins; similar results have been obtained by Benítez and Okuda (1971) in *Perna perna*, Dare and Edwards (1975) in *Mytilus edulis* and by Bressan and Marín (1985) in *M. galloprovincialis*. Decreasing values of carbohydrates are primarily related to conversion into lipids during gametogenesis, as suggested by Gabbott (1976).

Previous studies have shown that an increase in water content is indicative of spawning (Nair and Saraswasthy 1970, Ansell 1972, Pekkarinen 1983) and this is confirmed by the present study.

Sidwell *et al.* (1979) suggested that high values of inorganic components may be related to water salinity. In *M. guyanensis*, however, we did not find a significant relationship between - for instance- the percentage of ash and salinity ($r=0.19; P<0.05$).

The caloric value decreased during spawning and the observed fluctuations, as suggested by Tyler (1978) and Shafee (1981), should be related to the formation of gamets and spawning processes.

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RESUMEN

Se estudió la variación mensual del peso de la carne y composición bioquímica (proximal) de *M. guyanensis*. El peso seco de la carne fue mínimo en diciembre y máximo en julio en concordancia con los períodos de madurez y desove. El promedio de los componentes en base seca fue: proteínas 58.3 %, carbohidratos 22.8 %, lípidos 7.2 % y cenizas 11.2 %. El valor promedio del valor calórico fue 5.2 Kcal/g.

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