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GROWTH AND AGE DETERMINATION OF THREE JUVENILE CRAB SPECIES (CRUSTACEA, DECAPODA, BRACHYURA)

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ABSTRACT

*The present paper deals with the age determination and the increment of carapacial mean width in juveniles of three crab species (*Eriphia gonagra, Eurypanopeus abbreviatus *and* Sesarma rectum*) obtained in laboratory. A linear model is presented to represent their juvenile growth.*

INTRODUCTION

According to Olmsted & Baumberger (1923) one of the most striking features in the life history of the Arthropoda is their method of growth. Their increase in size is not a steady continuous process as in other phyla, but there appears a sudden and marked change at very definite periods. Among the crustaceans this phenomenon is most apparent, for at the time of shedding the old rigid exoskeleton and before the new covering has had time to harden, a sudden and rapid swelling takes place. Growth at other times is impossible because of the nature of the exoskeleton.

The fact that the arthropods have a hard exoskeleton that is periodically changed, causing a discontinuous growth for these animals, has attracted considerable interest of the researchers. On this aspect, several papers followed the Brooks's law demonstration, among them are Dyar (1890), Gurney (1942), Rice (1968), Heegaard (1971), Kurata (1962) and Mauchline (1977). In his law, Brooks (1886) demonstrated that could have a relationship between the larvae through the analysis of the growth factor.

Since the late 1800's, various approaches have been made as to quantitative description and analysis of the growth process by ecdisis in Crustaceans (Botsford, 1985).

Some tryings have been made to represent the general growth of the crustaceans mathematically: Hiatt (1948), Kurata (1962), Hewett (1974) and Mauchline (1977).

The life history of a typical decapod crustacean may be divided into three phases: the larval, the juvenile and the mature. Each one of these presents a peculiarity, that may be reflected in animal growth, mainly during the changes occurring from the larval to the juvenile phase. According to Kurata (1962) each phase may be identified on the inflexion points of a straight line that represents the growth of the analysed crustacean.

The juvenile phase of the Brachyurans have not been mentioned with frequency in literature. The reasons of this absence are due, probably, to the fact that the juvenile identification is extremely difficult, besides this, the survival in laboratory rearing is relatively low.

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With regard to the growth and age aspects of Brachyuran juveniles we can mention the papers of Butler (1961) with *Cancer magister;* Tagatz (1968) and Winget *et al.* (1976) with *Callinectes sapidus* and Dittel & Epifanio (1984) with *Callinectes arcuatus.*

The external morphological descriptions of the early juvenile stages and the sexual differentiation of *Eriphia gonagra* (Fabricius, 1781) and *Eurypanopeus abbreviatus* (Stimpson, 1860) were characterized by Fransozo & Negreiros-Fansozo (1987) and *Sesarma rectum* Randall, 1840 by Fransozo (1986/87). In an attempt to add some details to the knowledge of the postlarval phase of. *E. gonagra. E. abbreviatus* and *S. rectum,* to facilitate the identification of these juvenile crabs, we did this investigation. The purpose of the present paper is the age determination and the increment of the carapacial mean width in juveniles of these species obtained in laboratory.

Material and Method

The brachyurans studied here occur in the Southern and Southwestern Brazilian coast. The ovigerous females of *S. rectum* were collected handly at Bertioga (SP) channel mangle (23°52'S and 46°09'W) during the low tide periods. The ovigerous females of *E. gonagra* and *E. abbreviatus* were obtained handly in São Sebastião (SP) (23°49'S and 45°24'W) and Ubatuba (SP) (23°26'S and 45°05'W) shores, during the low tide.

The animals were transported to the laboratoy in 23 liter thermic boxes filled with 1 liter of sea water from the local collect. In the laboratory, the ovigerous females were maintained isolatedly in aquaria containing 20 liters of sea water, with continuous aeration, in a climatic room at 24 ± 1°C temperature, 35‰ of salinity for *E. gonagra;* 32‰ for *E. abbreviatus* and 28‰ for *S. rectum* and natural photoperiodism.

The food of the old crabs consisted of fish muscle pieces, offered twice a week. The aquaria were observed four times a day for the eclosion verification.

The zoeae were reared isolatedly in Petri dishes of 20 ml, at 24 ± 1°C of temperature and natural photoperiodism. The food of the larvae consisted of newly hatched *Artemia salina* nauplii. For the juvenile crabs its was added — minute pieces of fish muscle (1 to 2 mm). The water of the rearing vessels was changed daily before the food.

The salinities used in the rearings were 28‰ for *S. rectum*; 36‰ for *E. gonagra* and 30‰ for *E. abbreviatus.*

The animals which died during the culture were fixed in ethilic alcohol and glicerine, in the proportion of 1:1. The exuviae were maintained in glicerine.

The rearing methodology was based on that of Hebling *et al.* (1982), Fransozo & Negreiros-Fransozo (1987) and Fransozo *et al.* (1988).

The measures of juvenile carapaces were effectuated with a estereomicroscope with micrometrical ocular, adopting as carapace width to *E. gonagra* and *E. abbreviatus* the distance (mm) between the last two antero-lateral spines and to *S. rectum* the distance (mm) between the antero-lateral teeth.

The duration of the juvenile stages obtained recorded the eclosion dates and every change of stages that occurred for each specie studied, through the daily observation of all rearing vessels.

In all statistical analysis effectuated, we adopted the 5% of significance level.

Results and Discussion

The variation coefficient of the parameters: carapacial width and mean acumulated duration of each juvenile stage of *E. gonagra, E. abbreviatus* and *S. rectum* did not reach 15% (table I). This variation is considered low for those parameters so in the analysis mean values were utilized, such as widh as duration.

From the analysis effectuated (Table II) we can represent the duration on carapacial width by a straight line, where, y is the juvenile crab carapacial width (mm) and x is the mean accumulated age (days). The plots are presented in the figures 1, 2 and 3, respectively, for *S. rectum, E. abbreviatus* and *E. gonagra.*

Table I. Variation coefficient (%) of the parameters: carapace width (W) and accumulated duration (D) of each juvenile stage of *Sesarma rectum* randall, 1840, *Eriphia gonagra* (Fabricius, 1781) and *Eurypanopeus abbreviatus* (Stimpson, 1860)

Species	*S. rectum*		*E. gonagra*		*E. abbreviatus*	
Stages	W	D	W	D	W	D
I	5.70	9.74	2.34	2.76	3.88	6.35
II	4.76	11.78	4.23	1.51	6.02	4.47
III	3.68	9.65	3.47	1.90	5.44	8.58
IV	4.52	9.05	2.56	1.57	5.45	12.50
V	2.86	7.42	3.45	2.75	6.32	14.09
VI	3.61	6.54	4.03	8.30	5.51	4.98
VII	4.01	6.79	1.67	3.01	6.16	5.33
VIII	3.88	4.80	3.14	1.50	—	—
IX	2.51	5.82	1.79	0.33	—	—
X	2.14	7.67	0.78	0.59	—	—
XI	2.44	7.08	—	—	—	—
XII	3.07	13.33	—	—	—	—
XIII	3.20	13.20	—	—	—	—
XIV	3.94	10.16	—	—	—	—
XV	1.48	6.12	—	—	—	—

Table II. Equations obtained from the relation between mean carapacial width and mean accumulated duration of the juvenile crabs ($P < 0.05$)

Species	equations obtained		r
Sesarma rectum	y =	- 61.48 + 76.53 x	0.9895
Eurypanopeus abbreviatus	y =	15.93 + 19.21 x	0.9858
Eriphia gonagra	y =	9.02 + 25,87 x	0.9977

Such equation will allow to calculate the mean age in days of the juvenile individuals of each specie studied here, from their carapacial mean width.

According to Mauchline (1977) and Hartnoll (1982), the growth of animals that present a hard exoskeleton, such as crustaceans, is an essentially discontinuous process. There are successive moltings separated by intermolt periods and almost the totality of the growth occurs immediately after the ecdisis before the hardening of the new tegument. During the intermolts a little growth may occur due to the flexibility of the membranes that joint the esclerites which link the hard exoskeleton.

So, the above equations represent a sum of this process, on linear shape.

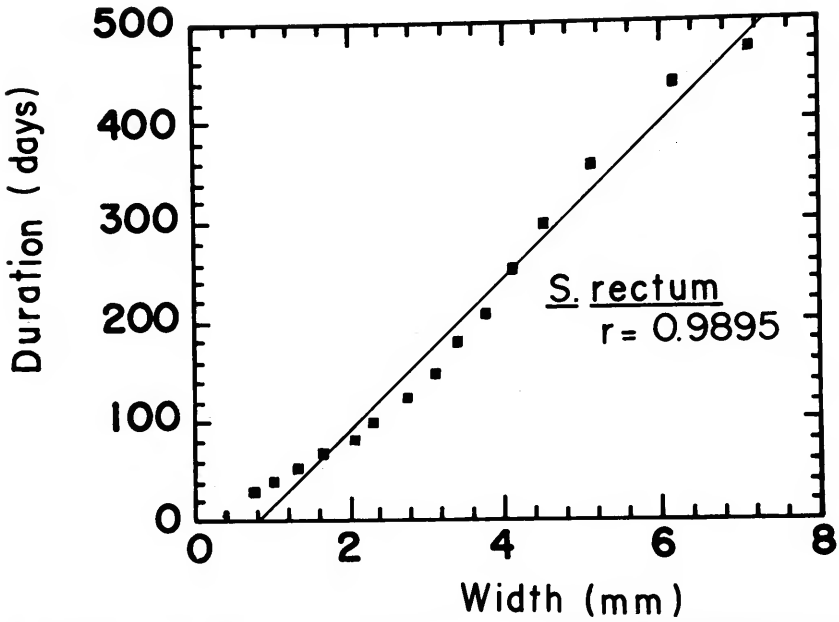

Fig. 1. Simple regression of the mean accumulated duration on the mean carapacial width to *Sesarma rectum* Randall, 1840.

The percentage of growth of the carapacial mean width of each juvenile stage, in relation to the previous stage, is presented in Table III to each studied species.

In the three species studied here the growth percentage can vary between the stages. However, an accentuated decrease occurs on the stage of the *E. gonagra* and *E. abbreviatus* in which appears the sexual diferentiation. Both species belong to the Xanthidae family and these facts can be associated, taking into consideration the fact that the food and the laboratory conditions were similar for both species.

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Resumo

Este trabalho tem por objetivo determinar a idade aproximada e o incremento médio na largura da carapaça, em jovens de três espécies de caranguejos (*Eriphia gonagra, Eurypanopeus abbreviatus e Sesarma rectum*), obtidos em laboratório. Um modelo linear é apresentado para representar o crescimento juvenil dessas espécies.

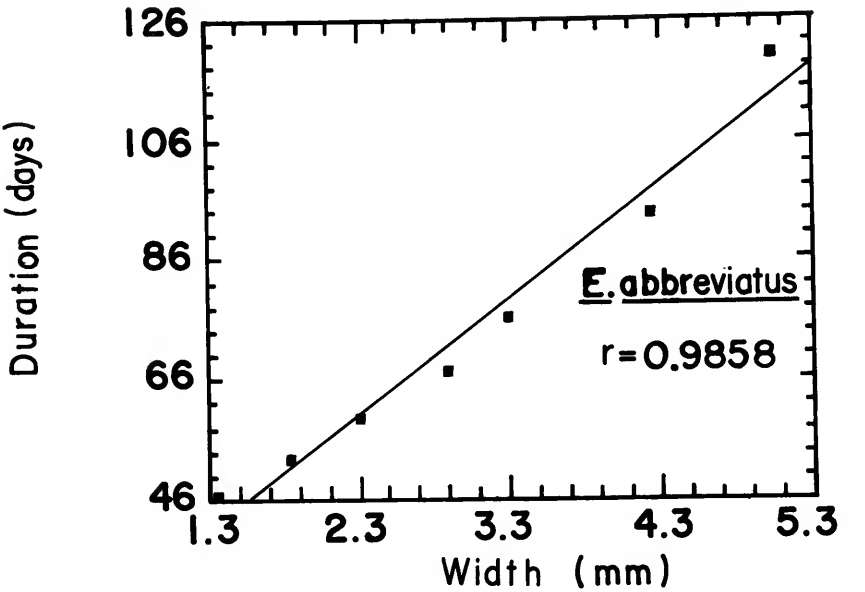

Fig 2. Simple regression of the mean accumulated duration on the mean carapacial width to *Eurypanopeus abbreviatus* (Stimpson, 1860).

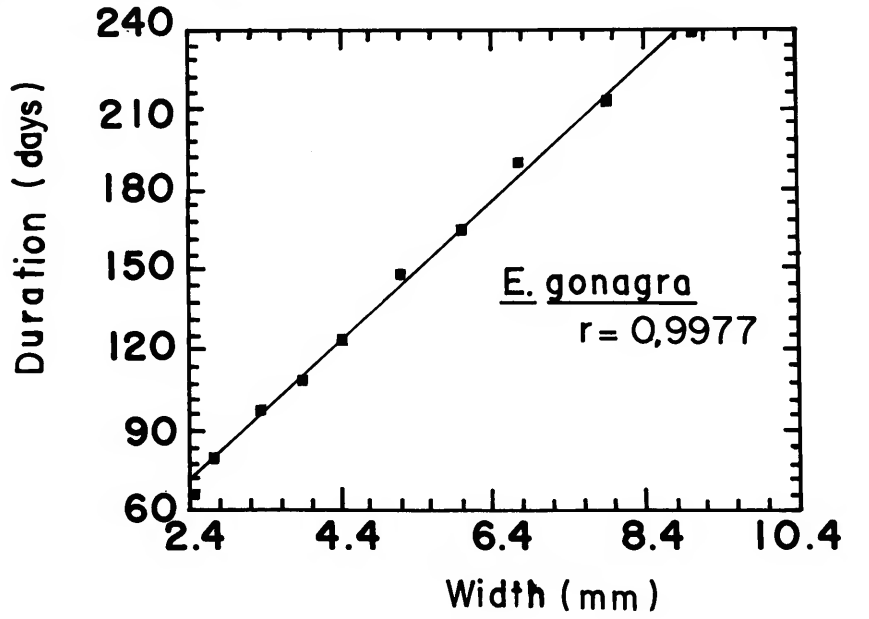

Fig. 3. Simple regression of the mean accumulated duration on the mean carapacial width to *Eriphia gonagra* (Fabricius, 1781).

Table III. Growth (%) of mean carapacial width from each juvenile stage of *Sesarma rectum* Randall, 1840, *Eriphia gonagra* (Fabricius, 1781) and *Eurypanopeus abbreviatus* (Stimpson, 1860)

Species / Stage	*S. rectum*	*E. gonagra*	*E. abbreviatus*
II	30.38	10.53	35.29
III	29.13	21.98	25.54
IV	24.81	17.12	25.11
V	24.10	13.59	14.19
VI	11.65	16.70	28.10
VII	19.13	16.05	19.39
VIII	13.87	12.50	—
IX	8.65	17.04	—
X	10.03	14.56	—
XI	9.92	—	—
XII	9.76	—	—
XIII	13.78	—	—
XIV	20.31	—	—
XV	15.26	—	—

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