Development and growth of the early juveniles of the spider crab *Maja squinado* (Brachyura: Majoidea) in an individual culture system

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Abstract: The spider crab *Maja squinado* is an endangered Mediterranean species; therefore, culturing it successfully is essential for developing restocking programs. The survival, growth and development of post-larval stages (juvenile crabs, C1-C8) were studied using larvae obtained from adult individuals collected in the Catalan Sea. The juvenile crab stages were cultured individually from a megalopal stage using a semi-open recirculation system to obtain the precise growth data of each juvenile crab stage until C8. Development up to C8 at 20°C lasted 154 ± 10 days. Survival from C1 to C8 was 5.8 %. Moulting increment values in cephalothoracic length were similar in all the crab stages (21-35 %). Intermoult duration (9 ± 1 in C1-C2 to 51 ± 8 days in C7-C8) increased sharply from juvenile stage 5. Males and females can be distinguished from C4 based on sexual dimorphism in the pleopods and the presence of gonopores. The allometric growth of the pleon is sex-dependent from C4, with females showing positive allometry and males isometric growth. The juvenile growth rate was lower compared with that of the previously studied Atlantic species *Maja brachydactyla*.

Résumé:

L'araigne de mer *Maja squinado* est une espèce Méditerranéenne en danger, l'amélioration de son élevage est indispensable pour le développement des programmes de repopulation. La survie, croissance et développement post larvaire (crabes juvéniles, C1-C8) a été étudié à partir des larves obtenues d'individus récoltées dans la mer Catalane. Les stades juvéniles des crabes ont été élevés individuellement à partir des mégaloques utilisant un système de recirculation semi-ouvert à fin d'obtenir des données précises sur leur croissance à chaque stade juvénile jusqu'au crabe juvénile en stade C8. La durée du développement des juvéniles jusqu'à C8 à 20 °C était de 154 ± 10 jours. La survie de C1 à C8 était de 5.8 %. Les valeurs de l'incrément en longueur céphalothoracique étaient semblables pendant tous les stades juvéniles (21-35 %). La durée du stade d'intermue (9 ± 1 in C1-C2 to 51 ± 8 jours in C7-C8) augmentait considérablement à partir du juvénile 5. Les mâles et les femelles peuvent se distinguer à partir du stade C4, basé sur le dimorphisme sexuel des pléopodes et la présence des gonopores. La croissance allométrique du pleon est dépendante du sexe à partir de C4; les femelles présentent une allométrie positive et les mâles une croissance isométrique. Le taux de croissance était inférieur en comparaison à l'espèce Atlantique *Maja brachydactyla* étudiée préalablement.

Introduction

Four species of spider crabs of the genus *Maja* Lamarck, 1801 (Majoidea, Majidae) have been reported along the European coast: *M. brachydactyla* Balss, 1922; *M. crispata* Risso, 1827; *M. goltziana* D'Oliveira, 1888; and *M. squinado* (Herbst, 1788) (Neumann 1998; Sotelo et al. 2009). *M. brachydactyla* and *M. squinado* reach the largest sizes and have a high commercial value. They were considered to be the same taxon (*M. squinado*) until morphological and genetic analyses showed that *M. brachydactyla* and *M. squinado* are actually different species (Neumann 1998; Sotelo et al. 2008, 2009). *M. brachydactyla* has been reported in the eastern Atlantic, while *M. squinado* is restricted to the Mediterranean Sea (d'Udekem d'Acoz 1999; Sotelo et al. 2009). There is little information available on the biology and ecology of *M. squinado* compared with that available for *M. brachydactyla*. Ovigerous females of *M. squinado* have been reported from January until the summer months, with peaks in spring and at the end of summer, and larvae attributed to this species have been obtained from plankton in spring-summer (Bourdillon-Casanova 1960). The morphology of the larval stages of *M. squinado* is very similar to that of the other species studied of the genus *Maja* (Paula 1988; Rodríguez 2002; Guerao et al. 2008). Larval development consists of two zoeal stages and one megalopal stage and takes a total of 18 to 22 days at 18°C (unpublished data).

Detailed studies on juvenile development are very scarce in Majoidea; however, the growth, survival and morphology of early stages of juvenile crabs have been studied for the related species *M. brachydactyla* (Guerao and Rotllant 2009). Juveniles of *M. brachydactyla* were reared in an individual culture system and survival was high during

the entire experiment (43.7% of the first crabs survived to perform the moult to juvenile stage 8 in 115-125 days).

M. squinado is considered in danger of extinction (UNEP 1996) and is now rarely caught. A restocking project for *Maja squinado* is currently being carried out in Spain, but little is known about the juvenile development and culture of this species. Therefore, research is needed to establish the optimal individual and mass culture systems for post-settlement crabs. Recent advances in crab hatchery technology have enabled trial release programs for a range of crab species including *Callinectes sapidus* M. J. Rathbun, 1896 (Davis et al. 2005; Zmora et al. 2005), *Portunus trituberculatus* (Miers, 1876) (Okamoto 2004) and the mud crabs *Scylla tranquebarica* (Fabricius, 1798) (Secor et al. 2002) and *Scylla paramamosain* (Estampador, 1949) (Obata et al. 2006).

The aim of the present study is to provide survival rates, growth parameters, and the main morphological characteristics of the post-larval stages (C1-8) of *M. squinado* reared in individual conditions in order to be able to produce a large number of juvenile spider crabs for re-stocking. The results are compared with the juvenile development previously described for *M. brachydactyla*.

Materials and methods

Adult specimens of *M. squinado* (6 females and 2 males) were captured on the NW Mediterranean (Catalonia, Spain) during 2008-2009, and transported alive in cool containers (approximately 8°C) to IRTA (Sant Carles de la Ràpita). The broodstock was kept in 2000 L tanks connected to a recirculation unit. Actively swimming larvae were collected from the broodstock tanks and transferred to mesh-bottomed PVC baskets.

These baskets were immersed in 1500 L holding tanks connected to recirculation units. The initial larval density was kept around 50 larvae L⁻¹, at a temperature of 18±1°C and 34±1 ppt of salinity. Enriched *Artemia* metanauplii were given as food every day at a prey:larva ratio of 60 nauplii larva⁻¹. ‘Green water’ culture conditions were maintained by adding *Tetraselmis chuii* and *Isochrysis galbana* to the larval tanks every second day. For further details on broodstock and larval culture conditions see Andrés et al. (2007, 2008).

Methacrylate rearing tank systems were used for settlement and juvenile individual culture. After 16 to 18 days of larval culture, megalopae were placed individually in 300 compartment boxes (50 x 40 x 45 mm) connected to a recirculation circuit with partial renewal (20%) of the water twice a week (for more details see Guerao and Rotllant 2009). Rearing conditions were as follows: natural photoperiod in spring-summer, salinity of 34±1 ppt, and temperature of 20±1°C. Megalopae were fed *ad libitum* with a combination of adult *Artemia* and frozen mysids once a day. The megalopae that died before metamorphosis were replaced by others in order to obtain a start number of 250 first juveniles in individual compartments. Every day, mortality and moulting were recorded in order to calculate survival (S) and the duration of the moult interval (INT). Exuviae were preferred for morphological examinations and measurements; for each stage, 5 to 20 individuals were used. Dissection was performed and measurements were taken with an image analyzing system (AnalySIS, SIS, Münster, Germany) connected to a stereomicroscope (Nikon SMZ800). Carapace width (CW) was measured as the greatest distance across the carapace (measured between the tips of the 3rd branchial spines); carapace length (CL) as the distance between the rostral margin (without rostral spines) and the posterior margin of the carapace (without intestinal spines); postorbital spine length (POSL) was measured as the distance

between the tips of the postorbital spines (see Fig. 3); and pleon width (PW) was measured as the width of the pleonite 6. Wet weight (WW) was determined on a Sartorius BP211D balance to the nearest 0.01 mg for a sample of 5 to 20 individuals at each juvenile stage. Moulting increment of carapace length (% CL), specific growth rate (SGR), and percentage of wet weight gain (% WG) were used as growth indices and calculated using the following formulas:

$$\% \text{ CL} = ((\text{final CL} - \text{initial CL}) / \text{initial CL}) \cdot 100$$

$$\text{SGR} = ((\ln \text{ final WW} - \ln \text{ initial WW}) / \text{days between stages}) \cdot 100$$

$$\% \text{ WG} = ((\text{final WW} - \text{initial WW}) / \text{initial WW}) \cdot 100$$

The regression coefficients were analyzed using a Student's t test. Statistical significance was accepted at $P < 0.05$. The relative growth of body parts was determined using the allometric equation: $y = ax^b$. Using the logarithmic equations: $\log y = \log a + b \log x$, tests for departures from isometry ($H_0: b = 1$) were performed on the slope values obtained using the Student's t test.

Results

Survival and growth

The survival of megalopae in the individual compartment culture system was low; it did not exceed 20%. At 20°C juvenile development of *Maja squinado* up to C8 lasted 154 ± 10 days, with a survival of 5.8 %, and the moulting interval increased from 9 ± 2 to 58 ± 5 days (Table 1). From juvenile 5, the intermoult period increased sharply. The percentage moulting increment of carapace length (%CL) was high and variable in all crab stages examined (21-35%). The %CL values were higher in the first four juvenile stages, from C5 the %CL was observed to decrease but no clear trend was observed in

successive juvenile stages. Juveniles had a high percentage of wet weight gain, between 100 and 200%, but the % WG values were highly variable between stages. The SGR was high until C6 and then diminished due to the significant increase in the intermoult period (Table 1). The mean accumulated duration of each juvenile stage increased according to an exponential model (Fig. 2B).

The increase in CL and WW during the juvenile development of *M. squinado* is shown in Fig. 1 and Table 2. From jC1 to C8, the mean CL increased constantly up to 639% of the initial value (initial value 2.30 ± 0.04 mm and final value 14.70 ± 1.22 mm), the mean growth rate value was 0.08 mm day^{-1} . The mean WW increased sharply after stage 6 up to 23.41% (initial value 3.2 ± 0.19 mg, and final value 749.4 ± 180.8 mg). The relationship between the CL and WW is shown in Fig. 2A. The WW showed isometric growth ($b = 2.95$; $H_0: b = 3$, $t = 1.874$, $P < 0.001$). The relationship between CL and CW is shown in Fig. 2B, and a positive relative growth pattern can be seen ($b = 1.133$; $H_0: b = 1$, $t = -18.45$, $P < 0.001$). Data show that the carapace grows wider at each moult, and the CW/CL ratio increases in the successive stages, becoming similar to the adult ratio at stage C8. The CW/POSL ratio increases during juvenile development (Table 2, Fig. 3); the relationship between CW and POSL shows a negative allometric growth pattern ($b = 0.884$, $H_0: b = 1$, $t = 6.97$, $P < 0.001$).

The mean accumulated duration of each juvenile stage increased according to an exponential model (Fig. 3B), and moult intervals increased sharply after C4.

Morphological remarks

The main morphological characteristics of first juveniles of *Maja squinado* are summarized in Table 3 and compared with those of *M. brachydactyla*. During juvenile ontogeny, the size and setation of the appendages increase. In addition, the number of

segments of the antennular endopod and exopod and the antennal flagellum increases (Table 2). The spinulation pattern of the carapace was similar to that of the adults from juvenile stage C7, when the main spines are similar in shape and relative size. The sexes can be differentiated from C4 based on pleopod morphology and the presence of gonopores (Fig. 4). There are four pleopod pairs on pleonites 2-5, and a pair of uropods on pleonite 6 in C1 and C2, and those in C2 are uniramous and slightly shorter than those in C1. In C3, pleopods are very minute and there are no uropods. After moulting to C4, females retain the four appendage pairs (located on pleonites 2-5), which become biramous; in males the appendage pairs are reduced to two pairs located on the first and second pleonites. The pleopods increase in length in successive juvenile stages and have setation from stage 7. In juvenile males, gonopores closely resemble those of the adult, both in shape and location (coxa of the pereopod 5). In females, gonopores appear as a slight opening in the exuviae on sternite 6. Sex-related differences can also be detected by examining the shape of the pleon (Fig. 5): in females, the relationship between PW and CL shows a positive relative growth pattern ($\log PW = -0.845 + 1.24 \log CL$, $H_0: b=1$, $t = -3.969$, $P < 0.001$), while in males the same relation shows an isometric growth pattern ($\log PW = 0.0145 + 1.03 \log CL$, $H_0: b=1$, $t = -1.978$, $P < 0.001$).

Discussion

Survival and growth

Survival during the settlement period (megalopa to first juvenile crab) in individual culture of *Maja squinado* did not exceed 20% and was lower than the survival observed by Guerao and Rotllant (2009a) for *Maja brachydactyla* (about 48%) in similar experimental conditions. Larvae of *M. squinado* might be more sensitive to

handling stress than *M. brachydactyla*. The settlement and moult to first juvenile period was found to be critical in *M. brachydactyla* (Iglesias et al. 2002; Palma et al. 2008) and seems to be more critical for *M. squinado*. Iglesias et al. (2002) suggested that early juveniles of *M. brachydactyla* are very delicate, since high mortalities were observed due to handling stress. Therefore, we should study this in detail with the aim of increasing survival in further post-larval stages. Survival of early juveniles of *M. squinado* was also lower compared with the survival of *Maja brachydactyla* in the same rearing system in a previous study (Guerao and Rotllant 2009a): the accumulated survival after 4 months of culture was only 5.8 % in *M. squinado* compared with 43.7 % in *M. brachydactyla*. The culture conditions provided lower intermoult survival values in *M. squinado* (43-80%) during juvenile development compared with those obtained for *M. brachydactyla* (78.6-100%). Iglesias et al. (2002) obtained *M. brachydactyla* individuals 9.5 months in age with a survival of 66% from 50 day old juveniles in semi-intensive culture conditions. Domingues and Alaminos (2008) studied the effect of culture density on 2 month old juveniles of *M. brachydactyla* and obtained high survival (83 %) at the lowest density tested (11 crab m⁻²). Porter et al. (1989) reported survival values to 100 days post-hatch from 2.9% to 6.7% for another crab from the superfamily Majoidea, *Mithrax spinosissimus* (Lamarck, 1818) (family Mithracidae), in cages suspended in lagoonal tropical waters. Zmora et al. (2005) obtained survival values between those of *M. brachydactyla* and *M. squinado* for *Callinectes sapidus* (family Portunidae) in mass culture (the survival rate from megalopae to juvenile 6 averaged 11.5%).

The moult increment percentages (% CL) from C1 to C4 of *M. squinado* were very similar to values obtained for *M. brachydactyla* (27-35 % versus 28-36 %); however, these increments were lower from juvenile 5 (21.4-25.7 % versus 31.5-37 %).

In both species, the %CL was similar to that observed for larger individuals of *M. brachydactyla* (60–134 mm CL; increment of 23–33%) (Teissier 1935; González-Gurriarán et al. 1995), and *M. squinado* (115 mm CL; increment of 25.5 %) (Simeó, personal communication). The moult increments were also similar to values obtained for other species in the superfamily Majoidea, such as *Mithraculus forceps* (A. Milne-Edwards, 1875) of the family Mithacidae (28-36.7%, Penha-Lopes et al. 2007). In other crabs not in this superfamily, the moult increments decrease during development as in many other studied decapod crustaceans (Thomas 1965; Weber 1967; Josileen and Menon 2005). Harnoll (1982) noted that the moult increment in crustaceans depends on the aquaculture maintenance conditions; it must always be suspected that increments in captivity are different from, and probably smaller than, those in the wild. In the Majoidea crab *Pisa tetraodon* (Pennant, 1777) (family Pisidae) the increment declines with prolonged captivity (Vernet-Cornubert 1958).

The intermoult period (INT) of post-settlement of *Maja squinado* followed a typical pattern for decapods, increasing exponentially with the age of the crabs (heterochronal development). The INT values for *Maja squinado* and *M. brachydactyla* juveniles were found to be different: the intermoult periods (INT) between C1 and C4 were very similar in the two species (9.2, 9.5 and 11.7 mean days in *M. squinado* versus 9.3, 9.8 and 11.4 mean days in *M. brachydactyla*), but from C4 the INT values were higher in *M. squinado* than those reported for *M. brachydactyla*, and the differences with respect to *M. brachydactyla* were greater in the following juvenile stages (17.1, 21.8, 34.5 and 58.5 days versus 11.6, 14.9, 24.7 and 33.5 mean days) (Guerao and Rotllant 2009a). González-Gurriarán et al. (1995) reported that the intermoult period for prepubertal and pubertal adults (CL range of 61-118 mm) of *M. brachydactyla* lasted between 84.7 and 104 days. The mean accumulated duration of each stage followed a

pattern similar to that of *M. brachydactyla* and other crab species such as the panopeid *Eurytium limosus* Say, 1818 (Guimarães and Negreiros-Fransozo 2005; Guerao and Rotllant 2009a). The extended INT explains the lower SGR values obtained for *M. squinado* from C5 compared with the values obtained for *M. brachydactyla*, while in the first four juvenile stages both species had very similar values (Table 1; Guerao and Rotllant, 2009a). The % WG values were similar to those obtained in juveniles of *M. brachydactyla* except in C6 and C7, which showed lower values in *M. squinado*. Although the mean wet weight of the first six juvenile stages of *M. squinado* was slightly higher than that of *M. brachydactyla*, from C7 the mean weight of *M. squinado* was lower. The size values (CL) were more similar in the two species than the weight values, although the final increase in size was lower in *M. squinado* (639 % versus 742 %). However, a re-examination of the morphometric data on *M. brachydactyla* confirmed that the first crab stage of *M. squinado* is longer than that of *M. brachydactyla* (Table 3; $t = 5.995$, $P < 0.001$). The growth observed in the two species is similar to or lower than the values obtained by Alaminos and Dominguez (2008) for *M. brachydactyla* in mass culture (about 0.4-1 g for 150 days). The growth of *M. squinado* was lower than reported by Porter et al. (1989) for *Mithrax spinosissimus* in cages suspended in lagoonal tropical waters: crab growth ranged from 0.1 to 0.21 mm/day at 100 days post-hatch (about 0.08 mm/day at 172 days post-hatch in *M. squinado*). Recently, Alaminos and Domingues (2009) showed that the bottom area has a significant effect on growth of *M. brachydactyla* juveniles placed in individual chambers; after 75 days, there were differences between the smaller (60x80x35 mm) and larger chambers (350x270x150 mm). Therefore, the compartment size may be a growth limiting factor in *M. squinado* juveniles.

Morphological remarks

Guerao and Rotllant (2009b) described the juvenile development of *M. brachydactyla* in detail and, as expected, the juvenile morphology of *M. squinado* is very similar (Table 3). The shape and carapace spinulation of the early juveniles are indistinguishable from *M. brachydactyla* (Guerao and Rotllant 2009b). As in *M. brachydactyla*, in successive juvenile stages, the number of segments (exopod and endopod of the antennula and antennal flagellum), annulations (flagellated part of the exopod of the maxillipeds), and setation of the appendages increased (Table 2). Some differences between congeneric species are noted in setation: the number of marginal plumose setae of the maxillar exopod (scaphognathite) is higher in *M. squinado* in all studied juvenile stages (Guerao and Rotllant, 2009b). The first juvenile of *M. squinado* has a pleopods biramous with a vestigial endopod; Guerao and Rotllant (2009b) described these appendages as uniramous in *M. brachydactyla*. However, a re-examination of fixed material of *M. brachydactyla* also confirmed the presence of a vestigial endopod in the pleopods of the first juvenile stage, very similar to the one illustrated in the present study for *M. squinado* (Fig. 3). The great similarity between the juveniles of related species has been previously documented in other families of brachyuran crabs (Ingle and Rice, 1984; Martin et al. 1984; Felder et al. 1985). Martin et al. (1984) found that it was very difficult to distinguish between four species of brachyuran crabs from the superfamily Xanthoidea at the first crab stage, and phenotypic divergence increases with juvenile ontogeny.

Males and females of *M. squinado* and *M. brachydactyla* can be distinguished from juvenile 4; in both species, there is sexual dimorphism in pleopods and in the presence of gonopores from C4. Therefore, sexual differentiation appears early in the ontogeny as in other crab species of Majoidea, for example, in juvenile 2 in *Pyromaia*

tuberculata (Lockington, 1877) (Flores et al. 2002), and juvenile 3 in *Inachus dorsettensis* (Pennant) (Ingle 1977). Many other brachyuran species not in the Majoidea superfamily show abbreviated juvenile (undifferentiated sexes) development (see for review Guerao and Rotllant 2009b). Dimorphic pleonal growth, was apparent from juvenile stage 5 in the two *Maja* species: the pleon of males grows isometrically, whereas that of females shows positive allometry. This dimorphic growth has been reported in juveniles of other brachyuran species (e.g., Hoestlandt 1948; Pohle and Telford 1982; Guimarães and Negreiros-Fransozo 2005; Vinuesa and Ferrari 2008). This sexual difference in allometric growth is explained by the different role played by the pleon in the two sexes (Hartnoll 1982).

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Table 1. Growth and survival characteristics in juveniles of *Maja squinado* from juvenile (C) 1 to C8. AS: accumulated survival; INT: moult interval in days (mean $\pm$ S.D.); %CL: percentage moult increment of carapace length; %WG: percentage of wet weight gain; SGR: specific growth rate; S: survival.

	C1-C2	C2-C3	C3-C4	C4-C5	C5-C6	C6-C7	C7-C8
S (%)	43.2	53.8	72.4	68.7	80.4	73.5	85.1
AS (%)	43.2	23.2	16.8	11.5	9.2	6.7	5.8
%CL	27.1 $\pm$ 2.6	33.4 $\pm$ 3.9	35.3 $\pm$ 2.8	24.3 $\pm$ 4.8	22.5 $\pm$ 3.0	21.4 $\pm$ 2.8	25.7 $\pm$ 2.5
INT	9.2 $\pm$ 1.0	9.5 $\pm$ 1.1	11.7 $\pm$ 1.8	17.1 $\pm$ 2.7	21.8 $\pm$ 3.8	34.5 $\pm$ 10.4	58.5 $\pm$ 9.8
SGR	5.8 $\pm$ 1.1	11.2 $\pm$ 1.4	6.7 $\pm$ 1.5	4.4 $\pm$ 1.2	3.5 $\pm$ 1.7	1.9 $\pm$ 1.5	1.9 $\pm$ 0.7
%WG	70.0 $\pm$ 15.0	189.5 $\pm$ 34.7	119.6 $\pm$ 23.1	113.0 $\pm$ 30.2	112.2 $\pm$ 58.0	90.6 $\pm$ 43.5	126.2 $\pm$ 94.2

Table 2. Morphometric and morphological characteristics of early juvenile stages of *Maja squinado*

Balss, 1922 useful for their identification. Abbreviations: A, annulations; C, juvenile crab stage; ps, marginal plumose setae; S, segments; s, setae; Scaphog, scaphognathite; SD, sexual dimorphics.

	C1	C2	C3	C4	C5	C6	C7	C8
N	20	10	10	5	5	4	4	3
CL (mm)	2.3±0.04	3.0±0.10	3.9±0.16	5.0±0.26	6.6±0.42	8.5±0.69	11.1±1.40	14.7±1.22
CW (mm)	1.7±0.04	2.4±0.06	3.2±0.19	4.3±0.21	5.7±0.40	7.7±0.61	10.4±1.17	14.3±1.20
POSL (mm)	1.8±0.02	2.3±0.10	3.0±0.12	3.9±0.16	5.0±0.27	6.7±0.41	8.4±1.14	10.9±0.50
CW/CL	0.75	0.80	0.82	0.86	0.88	0.91	0.93	0.98
CW/POSL	0.98	1.04	1.08	1.10	1.20	1.15	1.24	1.31
Gonopores	Absent	Absent	Absent	Present	Present	Present	Present	Present
Antennule								
Endopod S	2	3	3	4	4-5	5	5-6	6
Exopod S	4	5	6-7	7-8	9-10	11-12	14-15	18-19
Antenna								
Flagellum S	6	7-8	9	11	16-17	16-17	18-19	19-20
Mandible								
Palp (s)	0,5	0-1,5	2-3,7	8,10	20,14	22,14	29,19-20	>40,20
Maxilla								
Scaphog (ps)	44-48	53-57	78-85	101-108	138-143	160-161	230-236	>280
Maxilliped 3								
Flagellum A	nf	nf	3-4	4-5	8-9	11-12	14-15	17-18
Pleopods (SD)	-	-	-	+	+	+	+	+

Table 3. Morphometric and morphological comparisons of the first juvenile stages of *Maja squinado* and *M. brachydactyla*. Abbreviations: a, aesthetascs; ls, lateral setae; ps, marginal plumose setae; s, setae; Scaphog, scaphognathite; sp, spines; CL, cephalothorax length; CW, cephalothorax width.

	<i>M. squinado</i>	<i>M. brachydactyla</i>
CL (mm)	2.3±0.04	2.1±0.05
CW (mm)	1.7±0.04	1.5±0.07
Antennule		
Peduncle (s)	7,1,3	5,1,3
Exopod (a+s)	0,7+1,4+0,0+5	0,5+1,4+0,0+3-4
Endopod (s)	0,5	0,5
Antenna		
Flagellum (s)	0,1,2,0,3,2	0,1,1-2,0,3,2
Mandible		
Palp (s)	5	5
Maxillule		
Coxal end (s)	12	10
Basial end (s)	20	18
Maxilla		
Coxal end (s)	5+5	5+5
Basial end (s)	6+6	6+6
Scaphog (ps+ls)	44-48+6-7	42-43+6-7
Maxilliped 1		
Coxal end (s)	14-15	9-13
Basial end (s)	23-24	20-24
Epipod (s)	16-17	13-16
Maxilliped 2		
Endopod (s)	1,2,1,6,8-9	1,2,1,6,7-8
Exopod (s)	7-8,6-7	5-6,7
Maxilliped 3		
Endopod (s)	22,14,11,11,6	21-19,6-9,10,9,6
Exopod (s)	8,6-7	6-7,6
Epipod (s)	13	13-15
Pereiopods 1-5		
Merus (sp)	2,1,1,1,1	3,1,1,1,1

Figure captions

Fig. 1. Growth of *Maja squinado* juveniles (crab stages 1-8): (A) carapace length (CL); (B) wet weight (WW). Bar lines correspond to standard deviation.

Fig. 2. *Maja squinado*. (A) allometric growth relationship between wet weight (WW) and carapace length (CL). (B) allometric growth relationship between carapace width (CW) and carapace length (CL).

Fig. 3. *Maja squinado* juveniles. (A) allometric growth relationship between postorbital spine length (POSL) and carapace width (CW). (B) Age at the different juvenile stages.

Fig. 4. *Maja squinado*. Pleopods of pleonites 1-5 (Pl₁-Pl₅), and uropods of pleonite 6 (ur) of juveniles stages 1-7 (C1-C7). Scale bars of C1-C6 = 100 μ m; of C7 = 300 μ m.

Fig. 5. *Maja squinado*. Variation of pleon width (PW) according to carapace length in males and females from juvenile stage 4.

Fig. 1. Growth of *Maja squinado* juveniles (crab stages 1-8): (A) carapace length (CL); (B) wet weight (WW). Bar lines correspond to standard deviation.

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