E.Ü. Su Ürünleri Dergisi 2009
E.U. Journal of Fisheries & Aquatic Sciences 2009
Cilt/Volume 26, Sayı/Issue 1: 77–80

ISSN 1300 - 1590
http://jfas.ege.edu.tr/

Short Note / Araştırma Notu

Fecundity and Egg Development of Four Decapoda Species (Decapoda, Crustacea) in the Aegean Sea

*Kerem Bakır, İlker Aydın, Ozan Soykan, Celalettin Aydın

Ege Üniversitesi, Faculty of Fisheries, 35100, Bornova, İzmir, Turkey
**E mail: kerem.bakir@ege.edu.tr*

Özet: Ege Denizi'ndeki dört Dekapod (Decapoda, Crustaceae) türünün fekonditesi ve yumurta gelişimi. Bu çalışmada, *Plesionika martia, Plesionika heterocarpus*, *Chlorotocus crassicornis*, *Munida rutllanti* türlerinin fekonditesi, yumurta boyutu ve gelişimi incelenmiştir. Decapod krustase örnekleri, ticari "Hapuloğlu" trol teknesi ile Ege Denizi'nin uluslararası sularında 240 m ile 460 m derinlikler arasından toplanmıştır. *P. martia, P. heterocarpus*, *C. crassicornis*, *M. rutllanti* türlerinin, karapas uzunluğu – ağırlık ilişkisi sırasıyla W = 0.4945 × CL–3.9564, W = 0.3681 × CL–2.8551, W = 0.1963 × CL–1.3166, W = 0.3904 × CL–3.0074 olarak bulunmuştur. *P. martia* için ortalama yumurta sayısı 11671 (S.D.±752) olarak hesaplanmıştır. *M. rutllanti* için ortalama yumurta sayısı 2895 (S.D.±1386), *P. heterocarpus* için 2925 (S.D.±721), *C. crassicornis* için 2056 (S.D.±533) olarak hesaplanmıştır. Türlerin karapas boyu ve yumurta sayıları arasındaki ilişkiler şu denklemlerle belirlenmiştir: *P. martia* için F= 730.38 × CL – 579.4, *P. heterocarpus* için F = 374.99 × CL – 2277.7, *C. crassicornis* için F = 194.2 × CL – 1080.8 ve *M. rutllanti* için F= 689.47 × CL – 5895.6.

Anahtar Kelimeler: Fekondite, Yumurta gelişimi, Ege Denizi, Decapoda.

Abstract: In this study, fecundity, egg size and development of *Plesionika martia, Plesionika heterocarpus* (Caridae), *Chlorotocus crassicornis* (Pandalidae), *Munida rutllanti* (Galatheidae) were studied. The Samples of Decapod crustaceans were collected by commercial trawler "Hapuloğlu" between the depths of 240 m and 460 m from the international waters of middle Aegean Sea. Carapace length–weight relationship were found W= 0.4945 × CL – 3.9564, W= 0.3681 × CL–2.8551, W= 0.1963 × CL–1.3166, W= 0.3904 × CL – 3.0074 for *P. martia, P. heterocarpus*, *C. crassicornis*, *M. rutllanti* respectively. The mean brood size was calculated as 11671 (S.D. ± 752) for *P. martia.* Average number of eggs was estimated as 2895 (S.D. ± 1386) for *M. rutllanti,* 2925 (S.D. ± 721) for *P. heterocarpus* and 2056 (S.D. ± 533) for *C. crassicornis.* Relationship between number of eggs and carapace length of species were determined by the following equations as F = 730.38 × CL – 579.40 for *P. martia,* F = 374.99 × CL – 2277.7 for *P. heterocarpus*, F = 194.20 × CL – 1080.80 for *C. crassicornis,* F = 689.47 × CL – 5895.60 for *M. rutllanti.*.

Key Words: Fecundity, Egg development, Aegean Sea, Decapoda.

Introduction

Some decapoda species inhabiting in the continental shelf and compose a significant by-catch of deep-water trawl fisheries in the Aegean Sea and several Mediterranean regions. Among them, *Plesionika martia* A. Milne-Edwards, 1883, with a worldwide distribution occurs throughout the Mediterranean Sea at depths between 165m and 871m (Company and Sardà, 2000); *Plesionika heterocarpus* (Costa, 1871), usually occur at depths from 300m to 500m; *Chlorotocus crassicornis* (Costa, 1871), found between 200m and 400m frequently (Fischer et al., 1987); *Munida rutllanti* Zariquiey-Alvarez, 1952, reported 109-290m by Ateş (2003) and Katağan et al. (1988) are ubiquitous species.

Despite the species' extensive occurrence among fishery research samples, very few studies have focused on the reproduction and fecundity of the species in the eastern Mediterranean Sea. The growth (Company and Sardà, 2000; Maiorano et al., 2002), reproductive patterns (Company and Sardà, 1997; Campisi et al., 1998; Marsan et al., 2000; Maiorano et al., 2002; Company et al., 2003), feeding habits (Cartes, 1993a; 1993b) and distribution (Relini et al., 1986; Petruzzi et al., 1988; Thessalou-Legaki et al., 1989; Maynou et al., 1996; Company and Sardà, 1997) have been investigated mainly in the western and the eastern-central Mediterranean or the Atlantic Ocean (González and Santana, 1996). Some studies have been performed about the reproduction and population characteristics of decapods in the eastern Mediterranean (Chilari et al., 2005; Vafidis et al., 2008).

The aim of this work is to describe the fecundity, egg size and embryonic development in the egg of *P. martia, P. heterocarpus*, *C. crassicornis*, *M. rutllanti* in the Aegean Sea.

Materials and Methods

Samples of decapod crustacean species were collected during a selectivity study carried out on the commercial trawler "Hapuloğlu" in international waters of the middle Aegean Sea, between 17 and 21 August 2008. (Fig. 1). The water depth of the trawled areas varied between 240 m and 460 m. A 1100

mesh commercial trawl net was used for the hauls, and the mesh size and the number of meshes around the circumference of the cod end were 44 mm and 300, respectively. Carapace lengths (CL) of the specimens of each species were measured from the post-orbital socket to the posterior-median edge of the cephalothorax, and body widths (BW) were also measured from the widest part of the carapace to the nearest 0.1 mm. Body weight (W) was taken to the nearest 0.0001 g.

Three stages of egg development (Fig. 2) were considered on ovigerous females: early stage (I), eggs recently produced, uniform yolk, no eye pigments visible; middle stage (II), eggs with slight embryonic development visible; late stage(III), colourless eggs with embryo eye pigmentation well visible and embryo well developed (Company and Sardà, 1997). Gonad weight (GW) was taken to the nearest 0.0001 g, on a subsample of females. Egg number was counted on a subsample of ovigerous females with eggs in different stages of development under a binocular microscope. The egg size, to the nearest 0.01mm, was measured for each stage of egg development. The major and minor axes of ellipsoidal eggs were measured under a binocular microscope using a micrometer lens.

Figure 1. Map of sampling area.

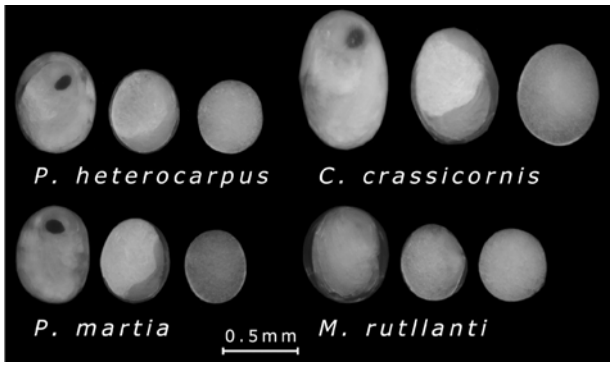

Figure 2. Egg stages of the decapod species.

Results and Discussion

Carapace length–weight relationships have various differences in growth parameters of species. The differences in *b*- values may be attributed to one or more factors: the season and effects of different areas, changes in water temperature and salinity, sex, food availability, differences in the number of specimens examined as well as in the observed length ranges of the species caught (Weatherley and Gill, 1987; Tesch, 1971; Moutopoulos and Stergiou, 2002). According to these, *P. martia* (n = 82) has a positive allometry (b > 3), although *M. rutlanti* (n = 62) has an isometric growth (b = 3). However, *P. heterocarpus* (n = 30) and *C. crassicornis* (n = 28) have shown negative allometry (b < 3) (Fig. 3). In the study of Vafidis et al. (2008), females of *P. heterocarpus* shown also a negative allometry and females of *C. crassicornis* has an isometric growth.

The most frequently used dimensions among a variety of body measurements crustaceans are carapace length, body length, total length, body width, and wet weight (Sukumaran and Neelakantan, 1997; Primavera et al., 1998). Measuring of any specific length measurement, such as total length or body length compared to the carapace length, may often be somewhat difficult and therefore take much time. It is thus convenient being able to convert into the desired length measurement when only one of the other length measurements is known (Tosunoğlu et al., 2008). In this context, CL-BW (Carapace Length; Body Width) relationships for various species were given in Table 1.

The mean brood size based on the number of eggs of 82 ovigerous females of *P. martia* was calculated at 11671 (S.D. ± 752, min-max: 9345 – 13750). There were 62, 30 and 28 ovigerous females belong to species *M. rutlanti, P. heterocarpus, C. crassicornis* respectively. Average number of eggs was estimated for *M. rutlanti* at 2895 (S.D. ± 1386, min-max: 1224 – 7348), for *P. heterocarpus* at 2925 (S.D. ± 721, min-max: 1446 – 3981) and for *C. crassicornis* at 2056 (S.D. ± 533, min-max: 1062 – 2932). In the study of Company and Sardà (1997), relative brood size of females of *P. martia* (4105) and *P. heterocarpus* (5851) were unlike to this study. This could be caused by the sampling method. Trawl fisheries to put pressure on the specimens in the net and this could be resulted in egg losses.

Mean egg sizes of specimens of *P. martia* (stage I: 0.520 mm, stage III: 0.621 mm) show bigger values as is *P. heterocarpus* (stage I: 0.543 mm, stage III: 0.651 mm) then the specimens in the western Mediterranean Sea (Company and Sardà, 1997) and smaller then the specimens in the eastern-central Mediterranean Sea (Maiorano et al., 2002). Just as in the study of Chilari et al. (2005), an increase in mean egg size of all species were observed from stage I to stage III (Table 2) and relative fecundity was significantly positively correlated to the animal size (CL) by a linear relationship (Fig. 4).

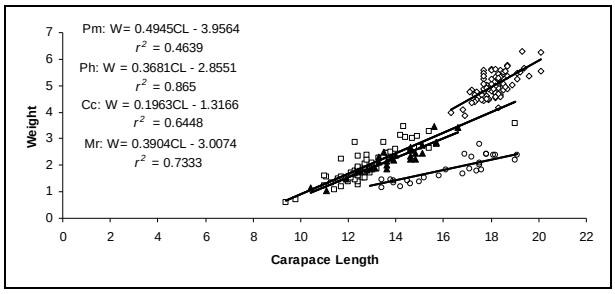

Figure 3. Length-Weight relationship of the species [*P.martia*: Pm(◊); *P.heterocarpus*: Ph(▲); *C.crassicornis*: Cc(○); *M.rutlanti*: Mr(□)].

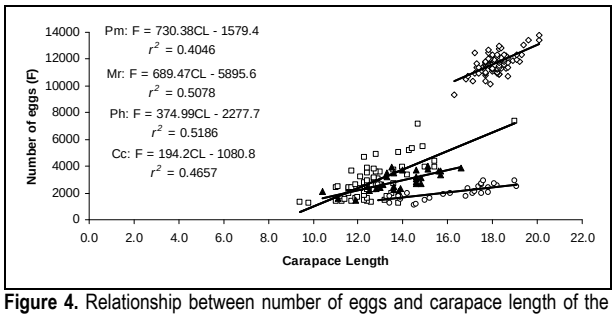

Figure 4. Relationship between number of eggs and carapace length of the species [*P.martia*: Pm(◊); *P.heterocarpus*: Ph(▲); *C.crassicornis*: Cc(○); *M.rutlanti*: Mr(□)].

Table 1. CL-BW relationships of four decapod crustaceans (CL: Carapace Length; BW: Body Width; Pm: *P.martia*; Ph: *P.heterocarpus*; Cc: *C.crassicornis*; Mr: *M.rutlanti*).

Species	Number of Specimens	CLmin-CLmax	BWmin-BWmax	*a*	*b* ± 95% C.I.	r^2
Pm	82	16.3-20.1	9.0-10.9	1.96	0.43 ± 0.05	0.44
Mr	62	9.4-19.0	7.4-13.8	1.11	0.72 ± 0.03	0.85
Ph	30	5.4-8.9	10.4-16.6	0.86	0.47 ± 0.04	0.79
Cc	28	12.9-19.1	5.3-7.8	0.57	0.37 ± 0.03	0.8

Table 2. Development stages and egg size of species (Pm: *P. martia*; Ph: *P. heterocarpus*; Cc: *C. crassicornis*; Mr: *M. rutlanti*).

Species	Stage of Eggs	Females (N)	Mean minor axis (mm)	Mean major axis (mm)
Pm	I	25	0.455	0.588
	II	45	0.473	0.623
	III	12	0.538	0.703
Mr	I	31	0.477	0.506
	II	28	0.463	0.488
	III	3	0.533	0.650
Ph	I	12	0.496	0.590
	II	8	0.494	0.616
	III	10	0.553	0.748
Cc	I	17	0.599	0.793
	II	3	0.650	0.833
	III	8	0.647	1.000

References

Ateş, A. S., (2003). Decapoda (Crustacea) species in the sublittoral zone of the Turkish Aegean Sea coasts and their ecological features. (Ph.D. Thesis, Ege University, Izmir-Turkey). 1-225.

Campisi, S. D., M. Cuccu, M. Murenu, C. Follesa, and A. Cau, 1998. Aspetti riproduttivi di *Plesionika martia* (A. Milne Edwards, 1883) nei mari sardi. Biologia Marina Mediterranea 5: 268–272.

Cartes, J. E., (1993a). Diets of deep-water pandalid shrimps on the Western Mediterranean slope. Marine Ecology Progress Series 96: 49–61.

Cartes, J. E., (1993b). Day-night feeding by decapod crustaceans in a deep-water bottom community in the western Mediterranean. Journal of the Marine Biological Association of the United Kingdom 73: 795–811.

Chilari, A., M. Thessalou-Legaki, and G. Petrakis, (2005). Population Structure And Reproduction Of The Deep-Water Shrimp *Plesionika Martia* (Decapoda: Pandalidae) From The Eastern Ionian Sea. Journal Of Crustacean Biology, 25(2): 233–241.

Company, J. B. and F. Sardà, (1997). Reproductive patterns and population characteristics in five deep-water pandalid shrimps in the western Mediterranean along a depth gradient (150–1100 m). Marine Ecology Progress Series 148: 49–58.

Company, J. B. and F. Sardà, (2000). Growth parameters of deep-water decapod crustaceans in the Northwestern Mediterranean Sea: a comparative approach. Marine Biology 136: 79–90.

Company, J. B., F. Sardà, P. Puig, J. E. Cartes, and A. Palanques, (2003). Duration and timing of reproduction in decapod crustaceans of the NW Mediterranean continental margin: is there a general pattern? Marine Ecology Progress Series 261: 201–216.

Fischer, W., M. Schneider, and M. L. Bauchot, (1987). Mediterranee et Mer Noire Zone de Peche 37. Vol I. Vegetaux et Invertebres. Organisation des Nations Unies Pour L'Alimentation et L'Agriculture, Rome.

González, J. A. and J. I. Santana, (1996). Shrimps of the family Pandalidae (Crustacea, Decapoda) off the Canary Islands, eastern Central Atlantic. South African Journal of Marine Science 17: 173–182.

Katağan, T., A. Kocataş, and H. A. Benli, (1988). Note préliminaire sur les Décapodes bathyaux de la côte Turque de la mer Egée. Rapport de la Commission Internationale pour l' Exploration Scientifique de la Mer Méditerannée 31: 1-23.

Maiorano, P., G. D'onghia, F. Capezzuto, and L. Sion, (2002). Life-history traits of *Plesionika martia* (Decapoda: Caridea) from the eastern-central Mediterranean Sea.—Marine Biology 141: 527–539.

Marsan, R., N. Ungaro, C. A. Marano, and M. C. Marzano, (2000). Remarks on distribution and fishery biology of some *Plesionika* species (Decapoda, Pandalidae) in the southern Adriatic basin (Mediterranean Sea). Pp. 763–769 in J. C. von Vaupel Klein and F. R. Schram, eds. The Biodiversity Crisis and Crustacea. Proceedings of the Fourth International Crustacean Congress. A. A. Balkema, Rotterdam.

Maynou, F., G. I. Conan, J. E. Cartes, J. B. Company, and F. Sardà, (1996), Spatial structure and seasonality of decapod crustacean populations on the northwestern Mediterranean slope, Limnology and Oceanography, 41, 113-125.

Moutopoulos, D. K. and K. I. Stergiou, (2002). Length-weight and length-length relationships of fish species from the Aegean Sea (Greece). Journal of Applied Ichthyology 18, 200-203.

Petruzzi, T., A. M. Pastorelli, and G. Marano, (1988). Notes on the distribution

of commercial crustaceans in the southern Adriatic, trawl survey 1985-86, FAO Fisheries Report, 394, 213 221.

Primavera, J. H., F. D. Parado-Estepa, and J. L. Lebata, (1998). Morphometric relationship oflength and weight of giant tiger prawn *Penaeus monodon* according to life stage, sex and source. Aquaculture, 164: 67-75.

Relini, G., A. Peirano, and L. Tunesi, (1986). Osservazioni sulle comunit/t dei fondi straseicabili del Mar Ligure Centro-Orientale, Bollettino di Musei dell'Istituto di Biologia dell' Universitgt di Genova, 52 (Supplemento), 139-161.

Sukumaran, K. K. and B. Neelakantan, (1997). Length-weight relationship in two marineportunid crabs *Portunus sanguinolentus* (Herbst) and *Portunus pelagicus* (Linnaeus) from the Karnataka Coast. Indian Journ. mar. Sci., 26: 39-42.

Tesch, F. W., (1971). Age and growth. In: Methods for Assesment of Fish Production in Fresh Waters. W.E. Ricker (Ed). Blackwell Scientific Publications, Oxford 98-130

Thessalou-Legaki, M., A. Frantzis, K. Nassiokas, and S. Hatzinikalaou, (1989). Depth zonation in a *Parapandalus narval* (Crustacea, Decapoda, Pandalidae) population from Rhodos Island, Greece, Estuarine, Coastal and Shelf Science, 29, 273 284.

Tosunoğlu, Z., O. Özaydin, and M. C. Deval, (2008). Morphometric relationshıps of length-length and length-weight in *Parapenaeus longırostris* (Lucas, 1846)(decapoda, penaeidae). Crustaceana 80: 1253-1259.

Vafidis, D., P. K. Leontarakis, T. Dailianis and A. Kallianiotis (2008). Population characteristics of four deep-water pandalid shrimps (Decapoda: Caridea) in the northern Aegean Sea (NE Mediterranean). Journal of Natural History Vol. 42, Nos. 31–32, 2079–2093.

Weatherley, A. H. and H. S. Gill, (1987). The biology of fish growth. Academic Press, London.