

Description of the megalopa of *Lissocarcinus orbicularis* Dana, 1852 (Decapoda: Portunidae: Caphyrinae), a crab associated with tropical holothurians

Описание мегалопы *Lissocarcinus orbicularis* Dana, 1852 (Decapoda: Portunidae: Caphyrinae), краба—симбионта тропических голотурий

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КЛЮЧЕВЫЕ СЛОВА: мегалопы, Caphyrinae, оседание, симбиоз.

РЕЗЮМЕ: Проводится описание мегалопы симбиотического краба *Lissocarcinus orbicularis* Dana, 1852. Это первое описание личиночной стадии у представителя подсемейства Caphyrinae. Сравнение мегалопы этого вида и мегалоп других подсемейств Portunidae позволяет дать предварительный диагноз подсемейства Caphyrinae: рострум направлен вперед, коксальных игл на переоподах нет, имеется вырост стернума, количество щетинок на плеоподах — в районе 20, на уроподах — несколько больше 10, нет длинных постерио-латеральных игл на пятом абдоминальном сомите. Все мегалопы были собраны с голотурий *Holothuria leucospilota* (Brandt). Это свидетельствует о том, что оседание личинок из планктона происходит непосредственно на хозяев.

ABSTRACT: The megalopa of symbiotic crab *Lissocarcinus orbicularis* Dana, 1852 is described. This is the first report on larval stage in the subfamily Caphyrinae. The finding of megalopae on bodies of holothurians indicates on the settlement of symbionts directly on their hosts.

Introduction

The family Portunidae Rafinesque, 1815 consists of the 6 subfamilies: Carcininae, Polybiinae, Portuninae, Catoptrinae, Caphyrinae and Podophthalminae [Stephenson, Campbell, 1960]. The larval development of the portunids has been studied in many representatives of this family [reviews: Rice, Ingle, 1975b; Rice, 1980]. Zoeal stages and megalopae have been described at least in 3 subfamilies: Carcininae, Polybiinae and Portuninae [for example: Rice, Ingle, 1975a; Rice, Ingle, 1975b; Fielder et al., 1984; Ingle, 1985; Paula, 1988; Stuck, Truesdale, 1988].

Nevertheless any information on the larval development of the subfamily Caphyrinae is absent up to now. This article provides the first description of *Lissocarcinus orbicularis* Dana, 1852 (Portunidae, Caphyrinae) megalopa, with a brief discussion on peculiarities of the symbiotic associations formation among crabs associated with holothurians.

Material and methods

The holothurian hosts and their crab symbionts were collected in Vietnam (Nhatrang city area) in different seasons from 1985 to 1990. Seven species of holothurians (*Actinopyga echinites* (Jaeger), *Bohadschia graeffi* (Semper), *Bohadschia tenuissima* (Semper), *Holothuria atra* Jaeger, *Holothuria leucospilota* (Brandt), *Stichopus chloronotus* Brandt and *Stichopus variegatus* Semper) were examined. The crabs *Lissocarcinus orbicularis* were found associated with all these species excepting *Actinopyga echinites* [Britayev, Lyskin, unpubl. observations]. Three specimens of megalopae stage were found on *Holothuria leucospilota* in March 1990 only.

The holothurians were collected by SCUBA diving, placed into the plastic bags and transported to the shore. The megalopae, juvenile and adult crabs were taken away from the holothurians and preserved in 70% ethanol. Drawing were made with the aid of the *camera lucida* (LOMO RA-7). As megalopae, juvenile and adult crabs were found all together on *H. leucospilota* and the sample of juvenile and adult crabs was quite big (21 specimens) the smallest young crab was considered and described as first crab stage.

Some setae and spines were broken off during the preservation and storage of the material. Loss of setae or spines were defined everywhere, where it was possible



Fig. 1. *Lissocarcinus orbicularis* Dana, 1852: megalopa. a — dorsal view of megalopa; b — lateral view of carapace; c — antennule (circles indicate places where spines or setae were attached); d — antenna; e — mandible; f — maxillule; g — maxilla; h — maxilliped 1; i — maxilliped 2; j — maxilliped 3.

Рис. 1. *Lissocarcinus orbicularis* Dana, 1852: мегалопа. а — вид мегалопы со спинной стороны; б — вид карапакса сбоку; с — 1-я антенна (кружки указывают на места, где были прикреплены щетинки или иглы); д — 2-я антенна; е — мандибула; ф — 1-я максилла; г — 2-я максилла; h — 1-я ногочелюсть; i — 2-я ногочелюсть; j — 3-я ногочелюсть.

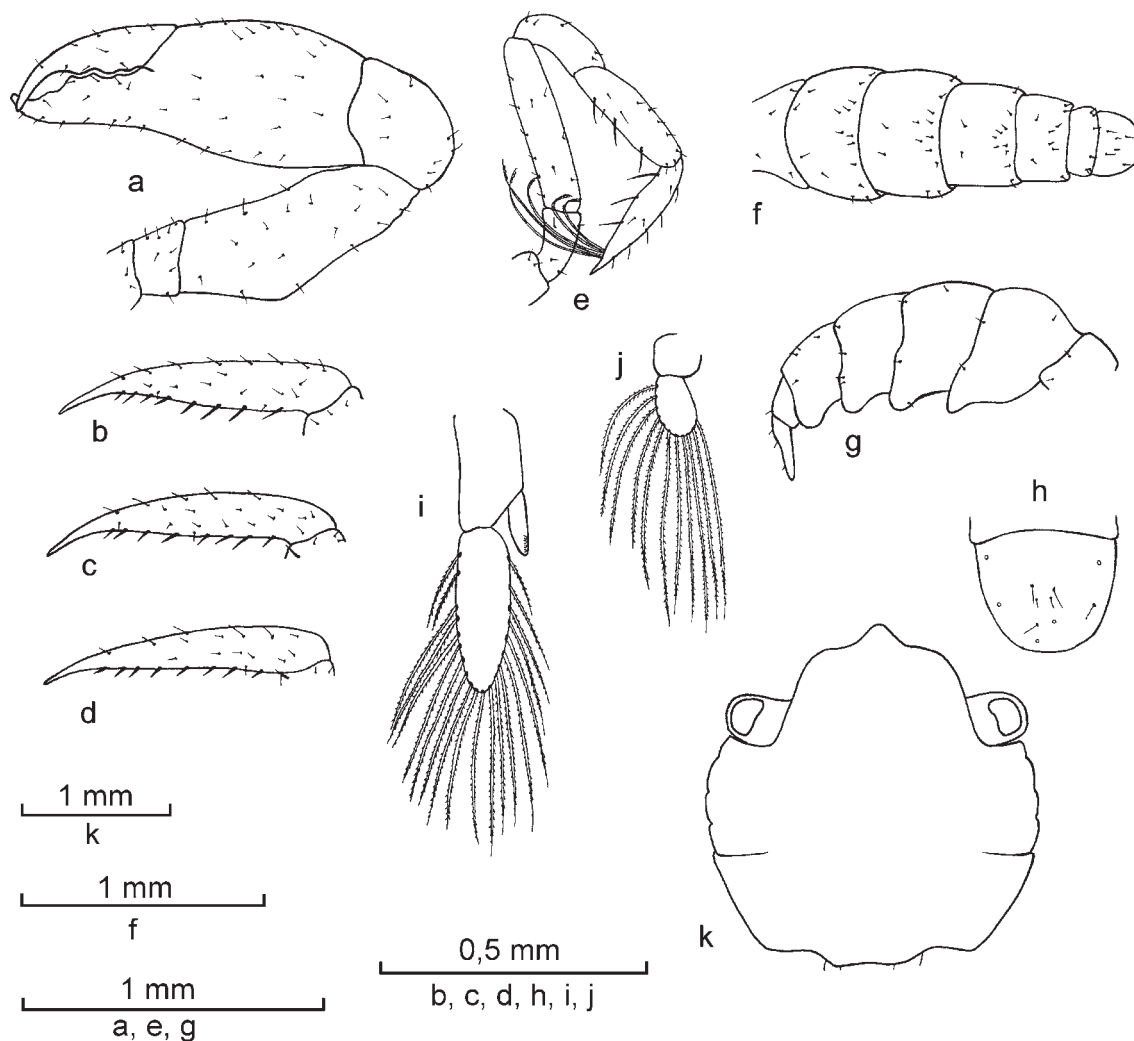


Fig. 2. *Lissocarcinus orbicularis* Dana, 1852: a-j — megalopa, k — first crab stage. a — cheliped; b-d — dactylus of pereopods 2-4 respectively; e — pereopod 5; f — dorsal view of abdomen; g — lateral view of abdomen; h — ventral view of telson; i — pleopod 1; j — uropod; k — dorsal view of carapace.

Рис. 2. *Lissocarcinus orbicularis* Dana, 1852: а-ј — мегалопа, к — 1-я послеличиночная стадия. а — 1-й переопод; б-д — дактилюсы переоподов со 2-го по 4-й; е — 5-й переопод; ф — вид живота со спинной стороны; г — вид живота сбоку; h — вид тельсона с брюшной стороны; i — плеопод; j — уropод; k — вид карапакса со спинной стороны.

(by a presence of cuticular rings, formed at the places of attaching of setae or spines). Nevertheless, the number of setae and spines, given in the description, is probably less than in fact.

Results

Megalopa. Carapace (Figs 1a, b): Length 2.33–2.37 mm (from the tip of rostral spine to posterior margin), width 1.20–1.22 mm (maximum width of the carapace). Rostral spine long, directed forwards, slightly downwards, with acute apex. 9–11 setae on the rostral spine and rostral plate. Antero-lateral angles smoothed. Cardiac and gastric regions slightly elevated. Epibranchial region isolated from dorsal surface of the carapace. Postero-lateral edges with spinelets.

Antennule (Fig. 1c): Peduncle 3-segmented. Segment 1 with setae, segments 2 and 3 with 3–4 and 3 setae respectively. Exopod 5-segmented, with 0, 0, 1, 1–2, 2 setae and 0, 10–11, 9–10, 7–8, 5 aesthetascs (not shown) respectively, aesthetascs long, reaching the middle of terminal setae of endopod. Endopod with 3–4 terminal setae and 2 subterminal ones.

Antenna (Fig. 1d): Peduncle 3-segmented, with 4–5, 3 and 2 setae respectively. Flagellum 8-segmented, with (from proximal to distal) 0, 0, 3–4, 2, 3, 2, 3–4 and 4–5 setae respectively, segment 5 is the longest.

Mandible (Fig. 1e): Mandibular palp 2-segmented, distal segment with 11–12 setae / spines.

Maxillule (Fig. 1f): Coxal endite with 13–14 setae / spines. Basal endite with 23–25 setae / spines. Endopod unsegmented, with 5 setae.

Table 1. The comparison of megalopae of the different subfamilies of the Portunidae with the megalopa of *Lissocarcinus orbicularis*.Таблица 1. Сравнение мегалоп различных подсемейств Portunidae с мегалопой *Lissocarcinus orbicularis*.

	Carcininae	Polybiinae	Portuninae	<i>Lissocarcinus orbicularis</i> (Caphyrinae)
Direction of rostrum	Forwards or downwards	Forwards or downwards	Forwards	Forwards
Coxal spines on pereopods	No	Present	Sometimes present	No
Sternal cornua	No	No	Present	Present
Number of setae on pleopods	9–13	13–20 or 31–40	17–26	18–23
Number of setae on uropods	4–10	8–10 or ca. 22	11–14	11–12
Prominent postero-lateral spines on abdominal somite 5	No	No	Present	No

Maxilla (Fig. 1g): Coxal endite with 4 setae on each lobe. Basal endite with 7–8 setae on inner and 9 on outer lobe. Endopod unsegmented, with 1–2 setae. Scaphognathite with 62–64 marginal setae and 3–6 setae on the surface.

Maxilliped 1 (Fig. 1h): Coxal endite with 8 setae / spines on distal margin and 3–5 setae on the surface. Basal endite with 20–22 marginal setae / spines and 1 seta on the surface. Endopod unsegmented, with 3 short stout terminal spines and 1 basal seta. Exopod 2-segmented, proximal segment with 1 subterminal seta, distal segment with 4–5 long setae. Epipod large, with 15–19 long setae.

Maxilliped 2 (Fig. 1i): Endopod 4-segmented, with 4–6, 2, 8–9 and 10–11 setae / spines. Exopod 2-segmented, proximal segment with 1 short thick spine, distal segment with 4–5 long setae.

Maxilliped 3 (Fig. 1j): Coxa + basis with 14–15 setae. Endopod 5-segmented, segment 1 with 9–10 denticles and 17–19 setae / spines, segments 2–5 with 14–15, 13–15, 12–13 and 9–10 setae / spines respectively. Exopod 2-segmented, proximal segment with 2–3 setae, distal segment with 2–3 subterminal setae and 4–5 long ones. Epipod long, with 18–21 setae.

Pereopods (Figs 2a–e): Chelipeds (Fig. 2a) setosed as shown, propodal inner margin with 4 teeth, dactilar inner margin with 3 teeth. Dactilus of pereopods 2–4 (Figs 2b–d) long, with acute apex, setosed as shown. Large cornua extend from the sternum near to the base of pereopods 4 and reach segment 3 of abdomen. Pereopods 5 (Fig. 2e) shorter than pereopods 2–4, with 5 long setae on dactilus, setosed as shown.

Abdomen (Figs 2f–j): with 6 segments + telson, setosed as shown, with 5 pairs of pleopods. Postero-lateral margins of segments 2–5 form semicircular lobes, the one on segment 5 is the biggest. Telson (Fig. 2h) slightly broader than long, with 2 pairs of lateral, 3 pairs of submedian setae and one unpaired submedian seta. Segments 2–6 with pleopods (Figs 2i, j). Pleopods 1–4 with 18–20, 21–23, 20–22 and 17–19 long setae respectively on exopods. Endopods of pleopods 1–4 with 3–4

coupling hooks. Uropods (pleopods 5) with 11–12 long setae on distal segment of exopods and without endopods.

First crab stage. Carapace (Fig. 2k) slightly longer than broad (2,30 * 2,21 mm). Front with blunt triangular lobe in the middle. Anterolateral border with 5 lobes / teeth. Epibranchial ridge starts at the level of the fifth lobe / tooth. Posterior margin of carapace with setae.

Discussion

Sub-familial characters of megalopae within the Portunidae

Rice and Ingle [1975b] reviewed the literature available up to that time and provided larval diagnoses for the subfamilies Carcininae (studied species: *Carcinus maenas*, *C. mediterraneus*, *Portunus biguttatus*, *P. latipes*, *Xavia biguttata*), Polybiinae (*Macropipus holsatus*, *M. marmoreus*, *M. puber*, *Ovalipes ocellatus*, *O. punctatus*) and Portuninae (*Callinectes sapidus*, *Scylla serata*, *Charybdis acuta*, *C. japonica*, *C. bimaculata*, *Portunus pelagicus*, *Thalamita sima*). Table 1 contains the comparison of megalopae of these subfamilies with the megalopa of *Lissocarcinus orbicularis*. According to this comparison one can conclude some preliminary features of the subfamily Caphyrinae: rostrum directed forwards; no coxal spines on pereopods; sternal cornua present; pleopods with about 20 setae; uropods with a little more than 10 setae; no prominent postero-lateral spines on abdominal segment 5. It's interesting to point out that sternal cornua were indicated by Rice and Ingle [1975b] as a feature at once distinguishing the portunins, not only from the carcinins and polybiins, but also from other brachyuran megalopae described up to that time. So one can suppose that subfamily Caphyrinae is more closely related to the subfamily Portuninae (in broad sense, including genera *Callinectes*, *Scylla*, *Charybdis*, *Portunus* and *Thalamita*) than to all other subfamilies of the family Portunidae.

Formation of symbiotic associations

Until recently, the peculiarities of formation of symbiotic associations have been described only in two species of crabs, associated with holothurians: *Hapalonotus reticulatus* and *Pinnixa tumida* [Vandenspiegel et al., 1992; Takeda et al., 1997]. In both cases hosts have been infested by the adult crabs. Recently, the settlement of megalopae of *Pinnotheres halingi*, directly on its holothurian host has been demonstrated in experiments [Hamel et al., 1999].

Thus, there can be two ways of forming of associations. 1) The hosts infestation by adult crabs. 2) The hosts infestation by megalopae, settling from the plankton. The finding of megalopae of *Lissocarcinus orbicularis* on *Holothuria leucospilota* indicates on the second way of formation of associations in this species.

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