Morphological description of pre-zoeas and first zoeas of *Trapezia tigrina* and *Trapezia lutea* (Brachyura: Trapeziidae) from Obhur Creek Jeddah, Saudi Arabia

Indra Effendy, A A J Kumar and M M El-Shirbeny

Marine Biology Department, Faculty of Marine Science, King Abdulaziz University, Jeddah, Saudi Arabia

Email: indraeffendy1984@gmail.com

**Abstract.** Ovigerous female crabs of *Trapezia tigrina* and *T. lutea* were collected from Obhur Creek Jeddah, Saudi Arabia. The eggs hatched into pre-zoea and metamorphosed into first zoeas. All the larvae failed to moult into second zoeas. In the present study, both the pre-zoeas and the zoeas of *T. tigrina* and *T. lutea* are morphologically described. The pre-zoeas of *T. tigrina* and *T. lutea* and the first zoea of *T. lutea* are morphologically described herein for the first time. The pre-zoeas of both *T. tigrina* and *T. lutea* are also morphologically compared with each other and also with their respective first zoeas. The pre-zoeas of both *T. tigrina* and *T. lutea* are not morphologically compared with the other pre-zoeas as morphological descriptions of the pre-zoeas of *Trapezia* spp. are meagre. The first zoeas of different *Trapezia* spp. are morphologically compared in this paper.

1. **Introduction**

The species of Trapeziidae are host-specific and mostly they prefer hosts from Acroporidae and Pocilloporidae [1]. The coral crabs feed the high nutrient mucus produced by the coral without harming the corals. In turn, the trapeziid very aggressively guard corals from predators. The crab cuts the tube feet of *Acanthaster planci* using its pincer. *T. cymodoce* also reduces the predation of *Pocillopora acuta* by *Drupella rugosa* Born, 1778 [2].

The eggs may hatch into pre-zoeas in some species, probably due to unfavorable biotic and abiotic factors. The cuticle of during pre-zoea is retained by the larva for several minutes into hours. Later, this cuticle changes into some appendages of the body: aesthetascs, antenna, antennule and telson [3,4]. The pre-zoea then metamorphose into first zoeal stage once the cuticle is removed.

TAXONOMICAL WORKS ON TRAPEZIID LARVAE ARE SCANTY. PRE-ZOEAS OF TRAPEZIID CRABS HAVE NOT BEEN DESCRIBED YET. RECENTLY, ONLY FIRST AND SECOND STAGE ZOEAS OF A FEW TRAPEZIID SPECIES HAVE BEEN DESCRIBED. THE FIRST ZOEAL MORPHOLOGICAL DESCRIPTIONS HAVE BEEN DONE FOR *Trapezia cymodoce* Herbst, 1801 [5–8], *Trapezia bidentata* Forskål, 1775 [7], *Trapezia digitalis* Latreille, 1828 [7,8], *Trapezia ferruginea* Latreille, 1828 [7,8], T.n. *Trapezia rufopunctata* Herbst, 1799 [7,9], *Trapezia septata* Dana, 1852 [7], T.n. *Trapezia tigrina* Eydoux and Souleyet, 1842 [8] and *Trapezia richtersi* Galil and Lewinsohn, 1983 [10]. Zoa I and II zoeas of *Trapezia guttata* Rüppell, 1830 also have been described [5].
2. Materials and methods

An ovigerous female of *Trapezia tigrina* (CL = 0.8 cm, CW = 0.9 cm) was collected on September 22nd, 2019 and another ovigerous female of *T. lutea* (CL = 1.20 cm, CW = 1.35 cm) was on October 22nd, 2019 from Obhur creek, KAU boat jetty (21°42'30"N 39° 5'45.44"E) by snorkelling at a depth of 2 to 4 m. The crabs were found in *Acropora sp.* coral head. The crab was maintained in walk-in type environmental chamber (Company: ESPEC CORP, Japan) at the Faculty of Marine Sciences, King Abdulaziz University, at 28°C under a 12-h dark and light photoperiod. The carapace length and width of the crabs were measured. Carapace width (CW) is the length between the widest part of carapace and carapace length (CL) is the distance between the frontal margin and posterior border. The larvae of *T. tigrina* hatched on 2-11-2019 and *T. lutea* on 8-11-2019. For each species, five batches of 50 larvae were reared in 1 L containers each with 800 mL seawater with a salinity of 35 psu at 28°C. Several eggs hatched into pre-zoas for both the species. Zoas were fed with rotifers. Water was changed every other day. Ten larvae from each stage were preserved in 70% ethanol and dissected using a Leica M80 microscope in polyvinyl lactophenol. Drawings were made using a Leica 6000B phase contrast stereomicroscope equipped with a camera lucida (5–40X objective lenses). Setal counts were determined using a Leica 6000B phase contrast stereomicroscope. Measurements and descriptions were usually made from 10 larvae from each stage. The carapace length (CL) and width (CW) of prezoas and zoas were taken. The carapace width (CW) of the first zoas is the distance between the tips of the lateral spines and for prezoas it is the thickness of carapace which is devoid of lateral spines. The carapace length (CL) of first zoas is the distance from the base of the rostral spine to the posterior margin of the carapace and for prezoas it is the distance between the anterior and posterior borders. Setal counts were made from proximal to distal portions; setal numbers were represented for appendages from basis to endopod [11].

3. Results and Discussion

3.1. Pre Zoa description *Trapezia tigrina*

*Carapace* (Figure. 1a). Carapace length 0.45-0.46 mm, carapace width 0.346-0.354 mm, all spines absent. Well-developed eyes. *Antennule* (Figure. 1c). Uniramous with 2 terminal aesthetascs and 2 terminal simple setae. *Antenna* (Figure. 2a). Protopod bilaterally spinulated, two small spines on disal margin; exopod with 3 unequal setae. *Maxillule* (Figure. 2c). Endopod unsegmented, proximal part with 1 simple seta and distal part with 4 simple setae. Basal endite has 4 simple and 1 plumoserrulated setae, some hairs on submedial margin. Coxal endite has 9 simple terminal setae. *Maxilla* (Figure. 3a). Endopod bilobed with 2 plumose, 1 simple terminal + 2 plumose setae, basal endite bilobed with 4 terminal plumose + 3 terminal plumose and 1 subterminal simple setae, coxal endite bilobed with 5 + 2 plumose setae. Scaphognathite bearing 4 plumose setae and apical parts with inner side hairs.
Figure 1. *Trapezia tigrina*, A) Pre-zoea, B) Zoea I, C) antennule of pre-zoea, D) antennule

Figure 2. *Trapezia tigrina*, A) antenna of pre-zoea, B) antenna of zoea I. C) Maxillule of pre-zoea, D) Maxillule of zoea I
**Figure 3.** *Trapezia tigrina* A) Maxilla of pre-zoea, B) Maxilla of zoea I, C) Maxilliped I of pre-zoea, D) Maxilliped of zoea I

**Figure 4.** *Trapezia tigrina* A) Maxilliped II of pre-zoea, B) Maxilliped II of zoea I, C) Abdomen of pre-zoea, D) Abdomen of zoea I

*First maxilliped* (Figure 3c). Basis with 1,1,2,2 (7) setation. Endopod 5-segmented with 2 plumose, 2 plumose, 0, 1 simple, 5 setae. Exopod 2-segmented with 4 plumose + 1 simple natatory setae. *Second maxilliped* (Figure 4a). Basis without seta. Endopod 2-segmented with 0, 2 setation. Exopod 2-segmented with 0, 4 natatory setae. *Abdomen* (Figure 4c). Consists of 5 somites. All somite without setae. First to third somite have rounded dorsolateral margins; fourth and fifth somites with a pair of dorsolateral knob directed ventrally. *Telson*. A pair of latera spines present. Posterior margin with 3 pairs of plumose setae.
3.2. Zoea I description Trapezia tigrina

Carapace (Figure. 1b). Carapace length 0.47-0.48 mm, carapace width 0.387-0.396 mm, dorsal spine smooth, rostrum and lateral spines with small spines. Well-developed eyes. Antennule (Figure. 1d). Uniramous with 3 terminal aesthetascs, terminal simple setae. Antenna (Figure. 2b). Protopod bilaterally spinulate. Exopod with 1 long and 2 unequal terminal setae Maxillule (Figure. 2d). Endopod 2-segmented, proximal segment with 1 simple seta and distal segment with 5 terminal plumose setae. Basal endite has 5 serrated setae and 2 small knobs on tip. Coxal endite has 7 plumose terminal setae. Maxilla (Figure. 3b). Endopod bilobed with 2 + 3 terminal plumose setae; basal endite bilobed with 4 terminal + 3 terminal and 1 subterminal plumose setae, coxal endite bilobed with 5 + 3 plumose setae. Scaphognathite bearing 4 plumose setae and apical parts with hairs. First maxilliped (Figure. 3d). Basis arrangement with 2,2,3,2 (9) setae. Endopod 5-segmented with 2,2,1,2,4 terminal + subterminal seta. Endopod 2-segmented with 4 natatory setae. Second maxilliped (Figure. 4b). Basis with 3 ventral plumose setae. Endopod 3-segmented with 0,1,4 setation. Exopod 2-segmented with 0,4 plumose natatory setae Abdomen (Figure. 4d). Consists of 5 somites. First somite without setae, second to fifth somite with a pair of small setae on postero-dorsal margins. Second somite has a pair of dorsolateral knob directed anteriorly while third to fifth somites each has a pair of dorsolateral knob directed ventrally Telson. Bifurcated and each fork has two pairs of lateral spines: 1 large and 1 small; posterior margin with 3 pairs of plumose setae.

3.3. Pre Zoea description Trapezia lutea

Carapace (Figure. 5a). Carapace length 0.37-0.38 mm, carapace width 0.260-0.289 mm, without any spines. Well-developed eyes. Antennule (Figure. 5c). Uniramous with 3 terminal aesthetascs. Antenna (Figure. 6a). Protopod bilaterally spinulate. Exopod with 3 unequal setae. Maxillule (Figure. 6c). Endopod unsegmented with 3 simple setae. Basal endite with 3 plumose and 2 plumoserrulated setae. Coxal endite with 5 plumose setae. Maxilla (Figure. 7a). Endopod bilobed with 2 plumose + 2 plumose setae, some hairs in lateral side; basal endite bilobed with 3 terminal + 4 terminal simple setae, all terminal; coxal endite bilobed with 3 terminal, 2 subterminal + 2 simple setae. Scaphognathite bearing 4 plumose setae and apical parts with hairs. First maxilliped (Figure. 7c). Basis arrangement without seta. Endopod 5-segmented with 0,0,0,1 simple, 3 terminal + 1 subterminal setae. Exopod unsegmented with 4 simple natatory setae. Second maxilliped (Figure. 8a). Basis without seta. Endopod 3-segmented with 0,1,2 (1 terminal and 1 subterminal). Exopod 2-segmented with 0, 4 plumose natatory setae. Abdomen (Figure. 8c). Consists of 5 somites; all somite without setae. First to third somite with rounded dorsolateral margin, fourth and fifth somites each with a pair of dorsolateral knob directed ventrally Telson. Bifurcated and each fork has a lateral spine, tip truncated with two spines; posterior margin with 3 pairs of plumose setae.

3.4. Zoea I description Trapezia lutea (Figure. 5 to 8)

Carapace (Figure. 5b). Carapace length 0.37 - 0.39 mm, carapace width 0.316 - 0.325 mm dorsal spine smooth, rostrum and lateral spines have small spines; well-developed eyes. Antennule (Figure. 5d). Uniramous with 3 terminal aesthetascs, 1 terminal simple seta. Antenna (Figure. 6b). Protopod bilaterally spinulate. Exopod with 1 long subterminal and 2 unequal terminal setae Maxillule (Figure. 6d). Endopod 2-segmented, proximal segment with 1 simple seta and distal with 1 subterminal simple setae and 4 terminal simple setae. Basal endite has 5 serrated setae and 2 small knobs on distal margin. Coxal endite with 7 plumose terminal setae.

Maxilla (Figure. 7b). Endopod bilobed with 3 +4 terminal setae; basal endite bilobed with 4 (an additional subterminal knob present) + 4 setation; coxal endite bilobed with 5 (an additional subterminal knob present) +3 setae. Scaphognathite bearing 4 plumose setae and apical parts with hairs. First maxilliped (Figure. 7d). Basis arrangement with 2,2,3,2 (9) ventral setae. Endopod 5-segmented with 2,2,1,2,4 terminal + 1 subterminal setae. Endopod 2-segmented with 0, 4 setation. Second maxilliped (Figure. 8b). Basis without...
setae. Endopod 3-segmented with 0,1,3 setae (2 terminal and 1 subterminal). Exopod 2-segmented with 0, 4 plumose natatory setae Abdomen (Figure. 8d). Five somites present. First somite without setae, second to fifth somite have a pair of small setae on postero-dorsal margins. Second somite has a pair of dorsolateral knob directed anteriorly while third to fifth somites each has a pair of dorsolateral knob directed ventrally Telson. Bifurcated and each fork has two pairs of lateral spines: 1 large and 1 small; one pair of dorsal spines present; posterior margin with 3 pairs of stout plumose setae.

Several similarities are found between the pre-zoeas of T. lutea and T. tigrina: absence of carapacial spines; number of endopodal lobes of maxillules (2); coxal setations maxilla (5+2), number of the exopod and endopod segments of maxillipes I and II (Table 1). In the meantime, several morphological differences are also found between the pre-zoeas of trapeziid crabs (present study). The antennule has 2 setae and two aesthetasc for T. tigrina and whereas T. lutea has three aesthetasc. Similarly, the coxal setations and basial setations of maxillule differ. Although the number of the segments of the endopods of maxillule are similar (2), their setations vary. The basis of T. tigrina has hair, this feature is unique and not found in the other species. The basial setations of maxilla vary (4+4 for T. tigrina and 3+3 for T. lutea). Similarly, the endopodal setations of the same appendage vary. In the endopod of T. lutea there are hairs on endopod, this is a unique feature. The endopod and exopod setations of maxillipeds I exhibit variations. Likewise, the endopodal setations of maxillipeds II also vary. By these variations the pre-zoeas of T. lutea and T. tigrina can be well differentiated.

The pre-zoeas and first-zoeas of trapeziid crabs (present study) have several morphological variations. In T. lutea the antennule of pre-zoea has three aesthetasc. However, one additional seta was present in the first zoea of this species. In the coxa of maxillule coxa five setae are present in pre-zoea and in the first zoea one additional seta is present. The endopod of these appendages unsegmented with three undeveloped setae in pre-zoea and in the first zoea the endopod is bisegmented and in both of the segment’s numbers of setae have increased. In the maxillule also, in this species the setae are undeveloped in pre-zoeas. In the ischium of the first maxilliped, there are no setae in pre-zoea, contrary to first zoea. Unlike the endopod of the first zoea of this appendage (maxilliped I), in pre-zoea setae are absent in the first three segments. In the second maxilliped also, no setae are present in the ischium of pre-zoea. In the telson of abdomen dorsal spines are absent in the pre-zoeas.

Several morphological similarities are also found between the pre-zoeas and first zoeas of T. lutea. In both of the stages the endopod of antenna are bispinnulate and the exopod has three setae. The outer lobes of the endopod of maxilla have two setae each in both pre-zoeal and zoeal stages. Moreover, the distal two segments of the endopod of maxilliped I has similar setation.

Several morphological differences are found between both the pre-zoeal and first zoal stages of T. tigrina: setations of maxillule, setations of the inner lobe of the coxa of maxilla (2 for pre-zoea vs, three for zoea), and setations of maxillipeds I and II. In the telson of the abdomen of pre-zoea no dorsal spines are there, unlike the first zoeal stage.

In the pre-zoeal and zoal stages of T. tigrina the antennular (3 aesthetasc, and one seta) and antennal setations (bispinnulate endopod, and exopod with three setae) are similar. The distal segments of the endopod of the maxillule of either pre-zoeal or zoal stage have four setae. Similarly, the endopod of the maxilla of both the pre-zoeal and zoal stages have similar setation.

No prezoeas of Trapezziid crabs are morphologically described thus far. Therefore, the prezoeas of the present study could not be compared with the prezoeas of other species of Trapezziid crabs. However, several brachyuran larval taxonomists believe that prezoeas are not a valid larval stage and owing to this reason information with regard to trapeziid prezoeas is inadequate. Most examples of prezoeae are from brachyurans, but there are also several examples from anomurans, thalassinids, stenopodids, carideans, and palinurids. The prezoea is the final embryonic form that precedes the first zoeal[12]. The spines and setae are invaginated or folded, allowing development within the “rounded” egg case capsule. The processes
evaginate or become erect upon hatching. The first zoea might still be active but its ability to survive is limited if this procedure is unsuccessful. Most of the prezoeas generally die without complete development as first zoea. If rearing is continued in the laboratory, however, the malformed zoeae are unable to complete development through to megalopa. Furthermore, during hatching of first stage, only an embryonic membrane/egg case is discarded and moults (exuviae) of prezoeae are not found. The prezoeae are not here considered a stage but an initial form (duration from seconds to a few minutes) of the hatched first zoea [11,13].

The first zoea of *T. lutea* is described herein for the first time. No unique character differentiates the prezoeas of this species from its congeners as all the morphological features of this species is found in its congeners (Table 1 to 4). The morphological similarities are very high amongst the first zoeas of trapeziid crabs. There are two dorsal carapacial setae for all trapeziid first zoeas (*T. lutea, T.cymodoce, T. tigrina, T.digitalis, T. septata, T. rufopunctata and T. ferruginea*). The dorsal spine is smooth for most of the species, excepting *T. cymodoce* described by Shikatani & Shokita [7]. The surfaces of lateral spines are not smooth for all species of trapeziid zoeas. The coxa of maxillule has 7 setae for all the species of Trapeziidae. The basis of maxillule has two knobs like projections in all the species together with 5 setae. The endopod of the same appendage (maxillule) is bisegmented and the proximal segment has 1 seta and the distal 5 setae. The coxal setal pattern of maxilla is 5+3 for all species zoeas and excepting *T. rufopunctata*. Basial setal patter of maxilla is common for most of the species (4+4). Similarly, the endopodal setal pattern 3+2 is common for all the zoeas of all the species. In the basis of maxilliped I, either 9 (in *T. tigrina* of present study, *T. lutea* of present study, *T. richtersi*[10], *T. ferruginea* of Shikatani and Shokita [7], *T. rufopunctata* of Shikatani and Shokita [7], and *Trapezia* sp. of Shikatani and Shokita[7]) or 10 (~*T. ferruginea* of Al-Aidaroos [8], *T.cymodoce* of Al-Aidaroos[8], *T. tigrina* of Al-Aidaroos[8], *T. digitalis* of Al-Aidaroos[8], *T. septata* of Shikatani and Shokita [7], *T. cymodoce* of Shikatani and Shokita[7], *T. digitalis* of Shikatani and Shokita [7] setae are present. In all the first zoea of trapeziid crabs 5 endopodal segments are there with the setation of 2S,2S, 1S,2S,5S. The exopod of the maxilliped I are bisegmented in the zoeas of all species with a setation 0, 4. In all first zoeas of the trapeziid crabs, the endopod of maxilliped II has three segments. The setal pattern of these segments are common for all the species of trapeziid crabs in that the first segment is devoid of any seta, the second segment possessed a single seta and the third four seta. The exopod of this appendage (maxilliped II) is bisegmented in all the first zoeas of trapeziid crabs with a setation 0, 4. The morphological features of this species and *T. ferruginea* and another *Trapezia* sp. described by Shikatani & Shokita[7] are exactly the same (Table 1 to table 4). High degrees of morphological similarities are found between the zoeas.
**Figure 5.** *Trapezia lutea*, A) Pre-zoea, B) Zoea I, C) antennule of pre-zoea, D) antennule of zoea I

**Figure 6.** *Trapezia lutea*, A) antenna of pre-zoea, B) antenna of zoea I. C) Maxillule of pre-zoea, D) Maxillule of zoea I
Figure 7. *Trapezia lutea* A) Maxilla of pre-zoea, B) Maxilla of zoea I, C) Maxilliped I of pre-zoea, D) Maxilliped of zoea I

Figure 8. *Trapezia tigrine* A) Maxilliped II of pre-zoea, B) Maxilliped II of zoea I, C) Abdomen of pre-zoea, D) Abdomen of zoea I

of trapeziid crabs. This similarity is posing an important taxonomical issue. Existence of morphological similarities of congeners is one of the taxonomical issues as a larva of species cannot be distinguished from their congeners. In general, setations of antennule, antenna and basis of maxilliped II exhibit slight morphological variations.
Table 1. Morphological features of the Zoea of Trapeziid crabs.

| Characters       | Trapezia tigrina (Pre-zoea) | Trapezia lutea (Pre-zoea) | Trapezia tigrina (Z1) | Trapezia lutea (Z1) | T. richtersi |
|------------------|-----------------------------|---------------------------|-----------------------|---------------------|--------------|
| Carapace setae   | 2S                          | 2S                        | Smooth                | Smooth              | 2S           |
| dorsal spine     | smooth                      | smooth                    | spines                | spines              |              |
| rostral spine    | 1 pair+spines               | 1 pair+spines             | 1 pair+spines         | 1 pair+spines       |              |
| lateral spine    | 1 pair+spines               | 1 pair+spines             | 1 pair+spines         | 1 pair+spines       |              |
| Antennule Ae+S   | 2A2S                        | 2A2S                      | 3A                    | 3A1S                | 2A2S         |
| Antenna Exopod   | 3+2 spines                  | 3S                        | 3S                    | 1A2S                |              |
| Maxillule Coxa   | 9S                          | 5S                        | 7S                    | 7S                  |              |
| Basis 5S+hairs   | 5S                          | 5S + 2K                   | 5S + 2K               | 5S + 2K             |              |
| Endopod 2(1S,4S) | 2(0,3S)                     | 2(1S,5S)                  | 2(1S,5S)              | 2(1S,5S)            |              |
| Maxilla Coxa     | (5+2)S                      | (5+2)S                    | (5+3)S with spine     | (5+3)S              | (5+3)S       |
| Basis (4+4)S     | (3+3)S                      | (4+4) S                   | (4+4) S               | (4+4) S             | (4+4) S      |
| Endopod (2+3)S   | (2+2)+hairs                 | (3+2)S                    | (3+2)S                | (3+2)S              | (3+2)S       |
| Sch 4S           | 4S                          | 4S                        | 4S                    | 4S                  |              |
| Lss              | 4S                          | 4S                        | 4S                    | 4S                  |              |
| Maxilliped I Coxa| 7S                          | 9S                        | 9S                    | 9S                  | 9S           |
| Basis 5(2S,2S,0,1S,5S) | 5(0,0,0,1S,4S)  | 5(2S,2S,1S,2S,5S)        | 5(2S,2S,1S,2S,5S)    | 5(2S,2S,1S,2S,5S)  |
| Endopod 2(0,5S)  | 2(0,4S)                     | 2(0,4S)                   | 2(0,4S)               | 2(0,4S)             | 2(0,4S)      |
| Exopod Epipod   |                             |                           |                       |                     |              |
| Maxilliped II Coxa| 3(0,1S,3S)                  | 3(0,1S,2S)                | 3(0,1S,4S)            | 3(0,1S,4S)          | 3(0,1S,4S)  |
| Basis 3(0,1S,3S) | 3(0,1S,2S)                  | 3(0,1S,4S)                | 3(0,1S,4S)            | 3(0,1S,4S)          |              |
| Endopod 2(0,4S)  | 2(0,4S)                     | 2(0,4S)                   | 2(0,4S)               | 2(0,4S)             |              |
| Exopod Epipod   |                             |                           |                       |                     |              |
### Table 2. Morphological features of the Zoea of Trapeziid crabs.

| Characters | T. ferruginea² | T. cymodoce² | T. tigrina² | T. digitalis² | T. ferruginea² |
|------------|----------------|--------------|-------------|---------------|---------------|
| Carapace   |                |              |             |               |               |
| setae      | 2S             | 2S           | 2S          | 2S            | 2S            |
| dorsal spine | Smooth       | Smooth       | smooth      | Smooth        | smooth        |
| rostral spine | Spines       | Spines       | Spines      | Spines        | Spines        |
| lateral spines | 1 pair+spines | 1 pair+spines | 1 pair+spines | 1 pair+spines | 1 pair+spines |
| Antennule  |                |              |             |               |               |
| Antenna |                |              |             |               |               |
| Exopod     | 5A             | 5A           | 5A          | 5A            | 3A1S          |
| Coxa       | 7S             | 7S           | 7S          | 7S            | 7S            |
| Maxillule  |                |              |             |               |               |
| Basis      | 5S + 2K        | 5S + 2K      | 5S + 2K     | 5S + 2K       | 5S + 2K       |
| Endopod    | 2(1S,5S)       | 2(1S,5S)     | 2(1S,5S)    | 2(1S,5S)      | 2(1S,5S)      |
| Maxilla    |                |              |             |               |               |
| Coxa       | (5+3)S         | (5+3)S       | (5+3)S      | (5+3)S        | (5+3)S        |
| Basis      | (4+4) S        | (4+4) S      | (4+4) S     | (4+4) S       | (4+4) S       |
| Endopod    | (3+2)S         | (3+2)S       | (3+2)S      | (3+2)S        | (3+2)S        |
| Sch        | 4S             | 4S           | 4S          | 4S            | 4S            |
| Lss        |                |              |             |               |               |
| Maxilliped I | Coxa         |              |             |               |               |
| Basis      | 10S            | 10S          | 10S         | 10S           | 9S            |
| Endopod    | 5(2S,2S,1S,2S,5S) | 5(2S,2S,1S,2S,5S) | 5(2S,2S,1S,2S,5S) | 5(2S,2S,1S,2S,5S) | 5(2S,2S,1S,2S,5S) |
| Exopod     | 2(0,4S)        | 2(0,4S)      | 2(0,4S)     | 2(0,4S)       | 2(0,4S)       |
| Epipod     |                |              |             |               |               |
| Maxilliped II | Coxa        |              |             |               |               |
| Basis      | 3S             | 3S           | 3S          | 3S            | 3S            |
| Endopod    | 3(0,1S,4S)     | 3(0,1S,4S)   | 3(0,1S,4S)  | 3(0,1S,4S)    | 3(0,1S,4S)    |
| Exopod     | 2(0,4S)        | 2(0,4S)      | 2(0,4S)     | 2(0,4S)       | 2(0,4S)       |
| Epipod     |                |              |             |               |               |
Table 3. Morphological features of the Zoea of Trapeziid crabs.

| Characters          | T. septata<sup>7</sup> | T. cymodoce<sup>7</sup> | T. rufopunctata<sup>7</sup> | T. digitalis<sup>7</sup> | T. sp<sup>7</sup> |
|---------------------|------------------------|-------------------------|-----------------------------|-------------------------|-----------------|
| Carapace            |                        |                         |                             |                         |                 |
| setae               | 2S                     |                         | 2S                          | 2S                      |                 |
| dorsal spine        | Smooth                 | granules                | smooth                      | Smooth                  | smooth          |
| rostral spine       | Spines                 | spines                  | Spines                      | Spines                  |                 |
| lateral spines      | 1 pair+spines          | 1 pair+spines           | 1 pair+spines               | 1 pair+spines           |                 |
| Antennule           |                        |                         |                             |                         |                 |
| Ae+S                | 2A2S                   | 2A2S                    | 2A3S                        | 2A3S                    |                 |
| Antenna             |                        |                         |                             |                         |                 |
| Maxillule           |                        |                         |                             |                         |                 |
| Exopod              | 3S                     | 3S                      | 3S                          | 3S                      | 3S              |
| Coxa                | 7S                     | 7S                      | 7S                          | 7S                      | 7S              |
| Basis               | 5S + 2K                | 5S + 2K                 | 5S + 2K                     | 5S + 2K                 | 5S + 2K         |
| Endopod             | 2(1S,5S)               | 2(1S,5S)                | 2(1S,5S)                    | 2(1S,5S)                | 2(1S,5S)        |
| Maxilla             |                        |                         |                             |                         |                 |
| Coxa                | (5+3)S                 | (5+3)S                  | (5+3)S                      | (5+3)S                  | (5+3)S          |
| Basis               | (4+4) S                | (4+4) S                 | (4+4) S                     | (4+4) S                 | (4+4) S         |
| Endopod             | (3+2)S                 | (3+2)S                  | (3+2)S                      | (3+2)S                  | (3+2)S          |
| Sch                 | 4S                     | 4S                      | 4S                          | 4S                      | 4S              |
| Lss                 |                        |                         |                             |                         |                 |
| Maxillipede I       |                        |                         |                             |                         |                 |
| Coxa                | 10S                    | 10S                     | 9S                          | 10S                     | 9S              |
| Basis               | 5(2S,2S,1S,2S,5S)      | 5(2S,2S,1S,2S,5S)       | 5(2S,2S,1S,2S,5S)           | 5(2S,2S,1S,2S,5S)       | 5(2S,2S,1S,2S,5S) |
| Endopod             | 2(0,4S)                | 2(0,4S)                 | 2(0,4S)                     | 2(0,4S)                 | 2(0,4S)         |
| Exopod              |                        |                         |                             |                         |                 |
| Epipod              |                        |                         |                             |                         |                 |
| Maxillipede II      |                        |                         |                             |                         |                 |
| Coxa                | 4S                     | 4S                      | 3S                          | 3S                      | 3S              |
| Basis               | 3(0,1S,4S)             | 3(0,1S,4S)              | 3(0,1S,4S)                  | 3(0,1S,4S)              | 3(0,1S,4S)      |
| Endopod             | 2(0,4S)                | 2(0,4S)                 | 2(0,4S)                     | 2(0,4S)                 | 2(0,4S)         |
| Exopod              |                        |                         |                             |                         |                 |
| Epipod              |                        |                         |                             |                         |                 |
Table 4. Morphological features of the Zoea of Trapeziid crabs.

| Characters   | Tetralia glaberrima | Tetralia rubridactyla | Quadrella maculosa | Quadrella serenei |
|--------------|---------------------|-----------------------|--------------------|-------------------|
| Carapace     |                     |                       |                    |                   |
| setae        | 2S                  | 2S                    | 2S                 | 2S                |
| dorsal spine | Granules            | granules              | granules           | Smooth            |
| rostral spine| Spines              | spines                | spines             | Spines            |
| lateral spine| 1 pair+spines       | 2 pairs+spines        | 2 pairs+spines     | 2 pairs+spines    |
| Antennule    | Ae+S                | 2A2S                  | 4A1S               | 4A1S              |
| Antenna      | Exopod              | 3S                    | 3S                 | 3S                |
| Maxillule    | Coxa                | 7S                    | 7S                 | 7S                |
| Basis        | 5S + 2K             | 5S + 2K               | 5S + 2K            | 5S + 2K           |
| Endopod      | 2(1S,5S)            | 2(1S,5S)              | 2(1S,6S)           | 2(1S,6S)          |
| Maxilla      | Coxa                | (4+3)S                | (5+3)S             | (5+3)S            |
| Basis        | (4+4) S             | ((4+spine)+4) S       | (5+4) S            | (5+4) S           |
| Endopod      | (2+3)S              | (2+3)S                | (3+5)S             | (3+5)S            |
| Sch          | 4S                  | 4S                    | 4S                 | 4S                |
| Lss          |                     |                       |                    |                   |
| Maxilliped I | Coxa                | 10S                   | 10S                | 10S               | 10S               |
| Basis        | 5(2S,2S,1S,2S,5S)   | 5(3S,2S,1S,2S,5S)     | 5(3S,2S,1S,2S,5S)  | 5(3S,2S,1S,2S,5S)  |
| Endopod      | 2(0,4S)             | 2(0,4S)               | 2(0,4S)            | 2(0,4S)           |
| Maxilliped II| Coxa                | 4S                    | 4S                 | 4S                |
| Basis        | 3(1S,1S,4S)         | 3(1S,1S,4S)           | 3(1S,1S,4S)        | 3(1S,1S,4S)       |
| Endopod      | 2(0,4S)             | 2(0,4S)               | 2(0,4S)            | 2(0,4S)           |
Some intraspecific variations are also observed in the present study. In *T. tigrina*, present study there are 2 aesthetascs and 2 setae on antennule. The same species is morphologically described by Al-Aidaroos from the same location, and in his description, there were 5 aesthetascs in the same appendage. The carapacial dorsal spine is smooth in the first zoea of *T. cymodoce* described by Al-Aidaroos. The same spine of the same species described by Shikatani and Shokita was granulated. Similarly, the antennule setations and the basial setations of maxilliped II of these conspecifics exhibited variations.

The zoeas of *Trapeia* and *Tetralia* have several morphological variations. The zoeas of *Tetralia* spp. have two lateral spines and their surfaces rough. In the zoeas of *Trapezia* spp. there is only one pair of lateral spines and their surfaces are mostly smooth. The coxae of the maxilla of *Tetralia* spp. zoeas have 4+3 setal pattern and in *Trapezia* spp. larvae this setal pattern is 5+3. The endopodal setal patterns of the maxilla of the zoeas of *Tetralia* and *Trapezia* exhibit variations (3+2 vs 2+3). The morphological feature of having granules on the dorsal spine in *Quadrella* spp. larvae is inconsistent as in *Q. maculosa* this spine is granulated and not granulated in *Q. serenei*. In the endopod of maxillule, in *Quadrella* spp. larvae, the setation in 1S, 6S and this setation in *Trapezia* spp. larvae is 1S, 5S. The endopodal setations of maxilla are showing variations between *Quadrella* and *Trapezia* spp. larvae (Table 1 to 4).

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