

## Taxonomy of the Mangrove-associated Brachyuran Crabs of Jazan Province, Saudi Arabia

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**Abstract.** Taxonomical works on the mangrove-associated brachyuran crabs from the Saudi coast are limited. The present paper deals with the taxonomy of eight species of brachyuran crabs from two of the mangroves of Southern Red Sea, Jazan Province, Jazan and Sumariat. All the species are morphologically described. Figures with diagnostic values are provided. The cutting edges of the major chelae of *Austruca albimana* and *Cranuca inversa* have variations, and those which are also described and illustrated.

**Keywords:** Brachyuran crabs, Checklist, Mangroves, Taxonomy, Red Sea.

### 1. Introduction

Mangroves are highly productive and provide nursery grounds for many invertebrates and vertebrates and in general, the brachyurans of Ocypodidae and Grapsoidea dominate mangroves (Lee, 1998). The ecological roles of brachyuran in mangroves are many. They feed soil bacteria, microalgae and decaying leaves (Dye and Lasiak 1986, 1987; Rodelli *et al.*, 1984, France, 1998; Twilley *et al.*, 1997). They are part of the food chain and aid pneumatophores to obtain oxygen, and their faeces and decaying bodies enrich the soil with nitrogen, carbon, phosphorus and trace metals (Kuraeuter, 1976; Khan *et al.*, 2005).

Mangroves are discontinuously distributed along the 1,700 km long coast of Saudi Arabia (Saifullah, 1996). The mangrove brachyuran crabs of Saudi Arabia were check listed by several authors (Hogarth *et al.*, 1986; Mandura *et al.*, 1987; Por and Dor 1975; Vine,

1986). Several taxonomic amendments have been made since then. The old brachyuran names enlisted in their works along with the corresponding current names in parenthesis are as follows: *Uca inversa inversa* (= *Cranuca inversa*), *U. lacteal albimana* (= *Austruca albimana*), *U. urvielli* (= *Tubuca urvillei*), *Macrophthalmus depressus*, *M. graeffei*, *M. grandidieri*, *M. inversa*, *M. lacteal*, *M. telescopius*, *Dotilla sulcata*, *Metapograpsus messor*, *M. thukuhar*, *Sesarma guttatum* (= *Perisesarma guttatum*), *Sarmatium crassum*, *Scylla serrata*, *Portunus segnis*, *Ocypode saraten* (= *Ocypode saratan*), *Paracleistosoma leachii*.

Only general accounts on the mangrove crabs of Saudi coast are available (Vine, 1986; Mandura *et al.* 1987; Saifullah, 1996) and taxonomic works are absent. The present work details the taxonomy of mangrove-associated crabs from the mangroves of the southern coast of Saudi Arabia.

## 2. Material and Methods

Brachyuran crabs were collected from two mangroves of Jazan (16°39'18.6"N, 42°45'03.9"E) and Sumariat (17°29'15.3312"N, 42°15'9.7452"E). The mangrove crabs of Ocypodidae and Grapsidae were caught by hand picking. Portunids were caught by hand nets. The crabs were preserved in 70% alcohol. The crabs were identified using standard keys (Crane 1975; Sakai 1976; Naderloo *et al.*, 2010).

## 3. Result and Discussion

Eight species of brachyuran crabs were collected from the mangroves of Jazan and Sumariat. A checklist of the brachyuran crabs from the mangroves of Jazan and Sumariat mangroves is as follows.

### Grapsidae Macleay, 1838

*Metapograpsus thukuhar* Owen, 1839

### Portunidae Rafinesque, 1815

*Portunus segnis* Forskål, 1775

*Thalamita crenata* Rüppell, 1830

### Macrophthalmidae Dana, 1851

*Macrophthalmus depressus* Rüppell, 1830

*M. grandidieri* A. Milne Edwards, 1867

### Ocypodidae Rafinesque, 1815

*Austruca albimana* (Kossmann, 1877)

*Cranuca inversa* (Hoffmann, 1874)

*Tubuca urvillei* (H. Milne Edwards, 1852)

### *Metapograpsus thukuhar* Owen, 1839

(Fig. 1 (a&b))

*Grapsus thukuhar* Owen 1839 *Zool. Capt. Beechey's Voy.* "Blossom", p. 80, pl. 24, fig. 3

*Metapograpsus thukuhar* Tesch, 1918: 80; Crosnier, 1965: 25, figs. 20-22, 27; Sakai, 1976: 634

Materials examined: Jazan, Trees of *Rhizophora mucronata*, boulders, 03-05-2016, leg. A.A.J. Kumar, 12 ♀♀ (cl. 1.1-3.2 cm; cw. 1.6-3.2 cm), 7 ♂ (cl. 1.2-2.3, cw. 1.8-3.1 cm).

Sumariat, Jazan Province, southern Red Sea, Trees of *Rhizophora mucronata*, 23-04-2017, leg. A.A.J. Kumar, 12 ♀♀ (cl. 1.2-1.6 cm; cw. 1.8-2.2 cm), 8 ♂ (cl. 1.1-2.2, cw. 1.8-2.9 cm). Sumariat, Jazan Province.

Diagnosis: Carapace squarish; front deflexed, four lobed, more than half the extreme width of carapace; lateral borders of carapace entire, slightly arched behind external orbital angle, not markedly convergent posteriorly, external orbital angle sharp; inner infra-orbital lobe is not in contact with frontal lobe, thus the flagellum of the antenna is excluded from the orbit; external maxillipeds slender, leave a rhomboidal gape between them; merus of external maxilliped broader than long; third and fourth pereopods without hair; tip of male gonopods with a slender process.

Remarks: The other closely related species living in the Red Sea is *M. messor*. These two species can easily be differentiated. Lateral borders of carapace slightly arched behind the external orbital angle and not markedly convergent posteriorly in *M. thukuhar*. In *M. messor* lateral borders of carapace almost straight and markedly convergent posteriorly. Inner orbital angle is not in contact with frontal lobe in *M. thukuhar* contrary to *M. messor*. Tip of the male gonopod is with a slender process in *M. thukuhar* and such a process is absent in *M. messor*.

Geographical distribution: Throughout the Indo-Pacific (Sakai 1976).

### *Portunus segnis* Forskål, 1775

(Fig. 1 (c-e))

*Cancer segnis* Forskål, 1775, p. 18, 91.

*Portunus pelagicus* Crosnier, 1962: 43-45, figs. 58, 61, 67; Apel and Spiridonov, 1998:279, 300-303, pls. 10,11.

*Portunus segnis* Lai et al. 2010: 215-218, figs. 12-14.

Materials examined: Jazan, lagoon enclosed by mangroves, 20-03-2016, leg. A.A.J. Kumar, 2 ♀♀ (cl. 1.1-3.8 cm; cw. 2.3-6.8 cm), 1 ♂ (cl. 7.8, cw. 16 cm). Sumariat, Jazan Province.

Diagnosis: Carapace broader than long, regions not well defined, granulated; front with four teeth median pair being smaller; anterolateral border arcuate with nine anterolateral teeth including the external orbital angle; chelipeds narrow long, fingers red-tipped; size of ambulatories decreases from anterior to posterior.

Remarks: This species is one of the species of *P. pelagicus* species complex and is distributed from Pakistan to the east coast of South Africa (Lai et al., 2010). While comparing with *P. pelagicus* sensu lato, in this species, regions of the carapace not well marked and branchial region is not prominent and its median frontal teeth are very small. Identification of this species from the other species of *P. pelagicus* sensu lato is not difficult as only this species is found in the Western Indian Ocean.

Geographical distribution: Western Indian Ocean (Lai et al., 2010).

### ***Thalamita crenata*. Rüppell, 1830**

(Fig. 1 (f-h))

*Thalamita crenata* Rüppell, 1830: 6, pl. 1, fig. 1; Crosnier, 1962: 130, figs. 220, 226-227, 232-233; Stephenson, 1972: 46; Wee and Ng, 1995: 69-72, figs 34A, 35A,B, 36A-H.

Materials examined: Jazan, lagoon enclosed by mangroves, 21-03-2016, leg. A.A.J. Kumar, 3 ♀♀ (cl. 4.0-4.1 cm; cw. 5.8-5.9 cm), 2 ♂ (cl. 3.0-3.3, cw. 5.0- 5.3 cm).

Carapace smooth, tomentose, frontal, progastric ridges present, mesogastric ridge continuous, epibranchial ridge interrupted at the middle; mesobranchial and cardiac ridges absent. Front with six teeth excluding the inner orbital angle, median lobe subequal to submedian. Anterolateral border cut into five teeth including the external orbital angle, the last anterolateral teeth not smaller than others, fourth teeth not extremely smaller. Basal antennal segment with granulated ridge. Outer surface of manus of chelipeds smooth with a single ridge reaching up to the tip of pollex.

Geographical distribution: From Hawaii to the Red Sea and east coast of Africa (Sakai, 1976).

Remarks: The other closely related species found in the Red Sea is *T. danae* (Sakai, 1976; Wee and Ng 1995). Both the species can easily be differentiated. The fourth anterolateral tooth is not extremely smaller in *T. crenata* unlike *T. danae*. The outer surface of the manus of cheliped is smooth with a single ridge in *T. crenata*, whereas this surface is granular with three coxae in *T. danae*.

### ***Macrophthalmus depressus* Rüppell, 1830**

(Fig. 2)

*Macrophthalmus depressus* Rüppell, 1830: 19, pl. 4, fig. 6; Guinot, 1967: 282 (in list); Hogarth, 1989: 117; Apel, 1994: 42-45, pl. 2; 1996: 331, 337, figs. 1-3; Naderloo et al. 2011, 11-15, figs 6 a-e, 7a-d, 10 c, d.

Materials examined : Jazan, Mangroves, 10-04-2016, leg. A.A.J. Kumar, 9 ♀♀ (cl. 0.7-1.3 cm; cw. 1.1-2.2 cm), 7 ♂ (cl. 1.2-2.3, cw. 1.8-3.1 cm).

Sumariat, Jazan Province, southern Red Sea, Trees of *Rhizophora mucronata*, 23-04-2017, leg. A.A.J. Kumar, 6 ♀♀ (cl. 0.6-1.3 cm; cw. 1.4-2.1 cm), 8 ♂ (cl. 1.1-2.2, cw. 1.8-2.9 cm).

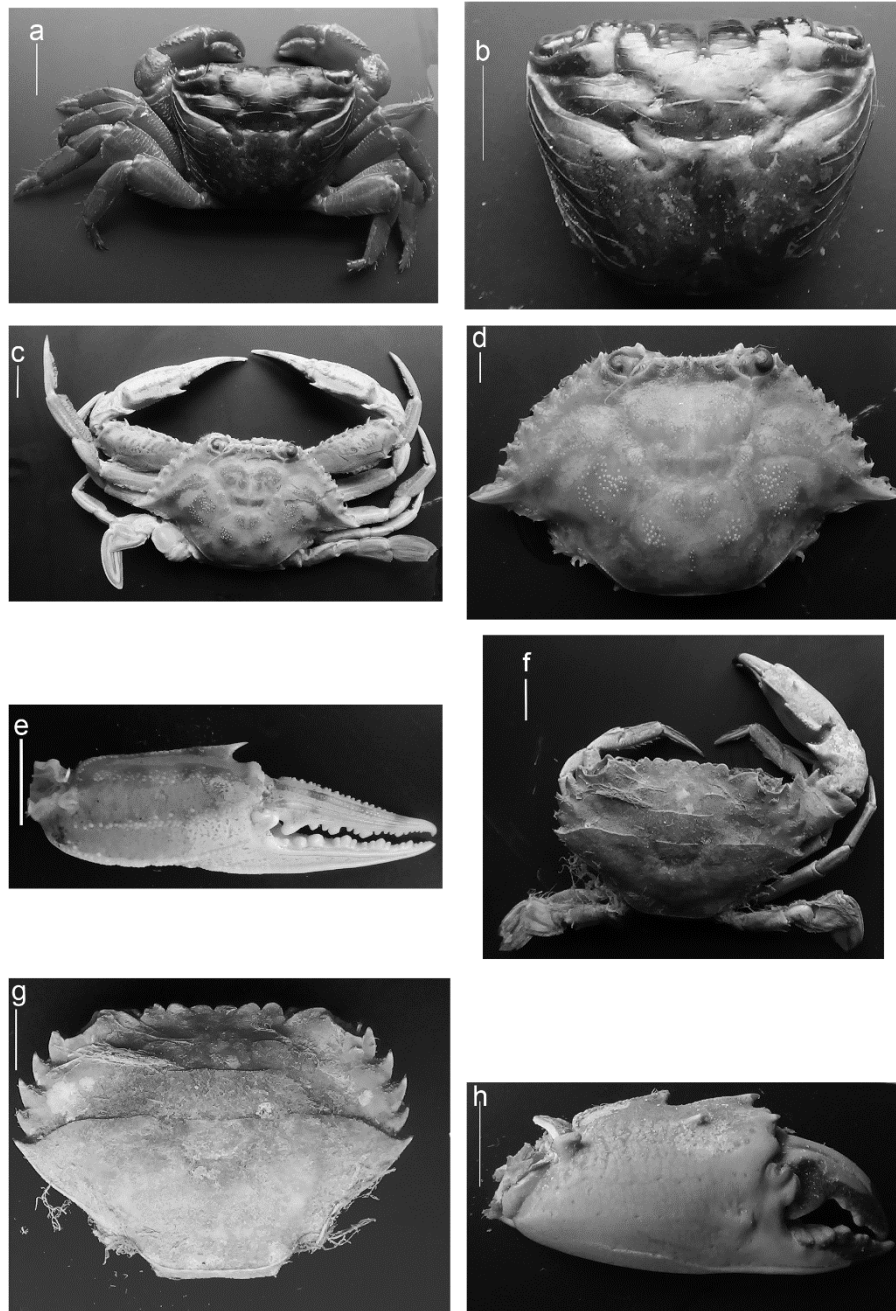


Fig. 1. *Metapograpsus thukuhar* Owen, 1839; a) entire ♂; b) carapace; *Portunus segnis* Forskål, 1775; c) entire; d) carapace; e) major chela; *Thalamita crenata* Rüppell, 1830; f) entire; g) carapace; h) major chelae. Unit: a-h = 1cm.

Diagnosis: Carapace transversely rectangular with small granules; front narrow, deflexed; anterolateral margin slightly converging

posteriorly, three teeth including the external orbital angle, external orbital angle not larger than second orbital tooth; ischium of external

maxilliped markedly longer than merus; eyestalks not projecting beyond external orbital angle; no plectrum was present on the upper surface of merus of chelipeds; cutting edge of movable finger with well-developed subproximal tooth; ambulatories with dense setae.

Geographical distribution: South Africa, Madagascar, East Africa, Gulf of Aden, Red Sea, Gulf of Oman, Persian Gulf, Pakistan, west coast of India.

Remarks: Several specimens of this species were collected from the intertidal muddy areas and mangroves of Al Jubail Marine Wildlife Sanctuary, Saudi Arabia (Naderloo et al. 2011).

***Macrophthalmus grandidieri* A. Milne-Edwards, 1867**

(Fig. 2 (d-f))

*Macrophthalmus grandidieri* A. Milne-Edwards, 1867: 285.

*Macrophthalmus brevis* Nobili, 1906: 318.

*Macrophthalmus grandidieri* Apel, 2001: 108, 109; Naderloo et al. 2011: 15-19, figs 8-10.

Materials examined: Jazan, Mangroves, 11-04-2016, leg. A.A.J. Kumar, 1 ♂ (cl. 1.1, cw. 2.3 cm).

Diagnosis: Carapace transversely rectangular, granulated; front narrow, deflexed; anterolateral margin with three teeth including the external orbital angle, first tooth conspicuously smaller than the second; ischium of third maxilliped markedly longer than merus; eyestalks not projecting beyond external orbital angle; no plectrum was present on the upper surface of merus of chelipeds; cutting edge of fixed finger with well-developed subproximal tooth.

Geographical distribution: Western Indian Ocean: South Africa, East Africa, Red Sea,

Persian Gulf, Gulf of Oman (Naderloo et al., 2011).

Remarks: *Macrophthalmus depressus* and *M. grandidieri* were found together in the muddy areas and mangroves of Sumariat and Jazan. Based on the colouration of chelipeds, both the species can be easily distinguished at a glance: blue for *M. depressus* and dirty brown for *M. grandidieri*. Prominent subproximal tooth is found in the moving finger of the chelipeds of *M. depressus* and in the fixed finger of *M. grandidieri*. Contrary to *M. depressus*, in *M. grandidieri*, the external orbital angle is much smaller than the second anterolateral tooth. Along with these species *M. telescopicus*, *M. graeffei* and *M. boscii* are also recorded from the Red Sea (Vine, 1986). Unlike *M. depressus* and *M. grandidieri*, the eye stalk of *M. telescopicus* and *M. graeffei* project beyond the external orbital angle (Komai et al., 1995; Naderloo et al., 2011).

***Austruca albimana* (Kossmann, 1877)**

(Fig. 2 (g-i) ; Fig. 3 (a-d))

*Gelasimus annulipes* var. *albimana* Kossmann, 1877: 53-54.

*Uca (Celuca) lactea annulipes* Crane, 1975: 299, 301, 611.

*Uca lactea* Hogarth 1989: 114-115.

*Uca annulipes albimana* Apel & Türkay, 1999: 133.

*Uca albimana* Shih et al. 2016: 377; Naderloo et al. 2010: 4-7, figs.1a-l

Material examined: Jazan, Mangroves, 10-04-2016, leg. A.A.J. Kumar, 2 ♀♀ (cl. 0.8-0.9 cm; cw. 1.3-1.5 cm), 4 ♂ (cl. 0.8-1.1, cw. 1.4-1.8 cm).

Sumariat, Jazan Province, southern Red Sea, Trees of *Rhizophora mucronata*, 27-04-2017, leg. A.A.J. Kumar, 3 ♀♀ (cl. 0.7-0.8 cm; cw. 1.1-1.2 cm), 9 ♂ (cl. 0.6-1.2, cw. 1.1-1.9 cm).

Diagnosis: Carapace broader than long, dorsal surface smooth, outer orbital angle triangular, projecting anteriorly; lateral margin slightly converging posteriorly; front broad; eye stalks slender; inner margin of orbital floor without granules; outer surface of manus of major chelipeds smooth, no depression near the base of pollex, supramarginal groove of dactylus absent. Merus of ambulatories with granulated transverse ridges.

Distribution: Red Sea, Gulf of Eden, Socotra, Arabian Sea, Gulf of Oman, south-eastern Arabian Gulf (Naderloo *et al.*, 2010).

***Cranuca inversa* (Hoffmann, 1874)**

(Fig. 2 (j) ; Fig. 3 (e-g))

*Gelasimus inversus* Hoffmann, 1874: p. 1, 19, 40, pl.4. figs. 23-26.

*Uca (Amphiuca) inversa inversa* Hogarth, 1986: p. 222-223.

*Cranuca inversa* Shih *et al.* 2016: 142, 153, 155-156, 169, fig. 9A.

Jazan, Mangroves, 10-04-2016, leg. A.A.J. Kumar, 9 ♀♀ (cl. 0.7-1.3 cm; cw. 1.1-2.2 cm), 7 ♂ (cl. 1.2-2.3, cw. 1.8-3.1 cm).

Sumariat, Jazan Province, southern Red Sea, Trees of *Rhizophora mucronata*, 23-04-2017, leg. A.A.J. Kumar, 6 ♀♀ (cl. 0.6-1.3 cm; cw. 1.4-2.1 cm), 8 ♂ (cl. 1.1-2.2, cw. 1.8-3.1 cm).

Diagnosis: Carapace broader than long, smooth; front broad; anterolateral margin moderately converges posteriorly, dorsolateral margin not well developed; anterodistal margin of merus of chelipeds crested, outer surface of the upper half of palm of chelipeds with larger granules; large triangular depression near the base of pollex; a large subdistal tooth present on dactyl; merus of ambulatories moderately broad.

Distribution: Indo-West Pacific: Western Indian Ocean: Madagascar, South Africa to Red Sea, Gulf of Aden, southern Oman (Dhofar), Persian Gulf, Gulf of Oman (Crane, 1975)

***Tubuca urvillei* (H. Milne Edwards, 1852)**

*Gelasimus Urvillei* (H. Milne Edwards, 1852): 148, plate 3: figure 10; Alcock (1900), 353, 363-364.

*Uca urvillei* Akash and Chowdhury, 2017: 199; Poupin, 2010: 75

*Tubuca urvillei* Shih *et al.* 2018: 41-46, 51, 53-57, figs. 1-1, 4b, 5e-h, 7B, 7d, 7f, 7h

Material examined: Jazan, Mangroves, 10-04-2016, leg. A.A.J. Kumar, 3 ♂ (cl. 0.9-1.2, cw. 1.4-1.9 cm).

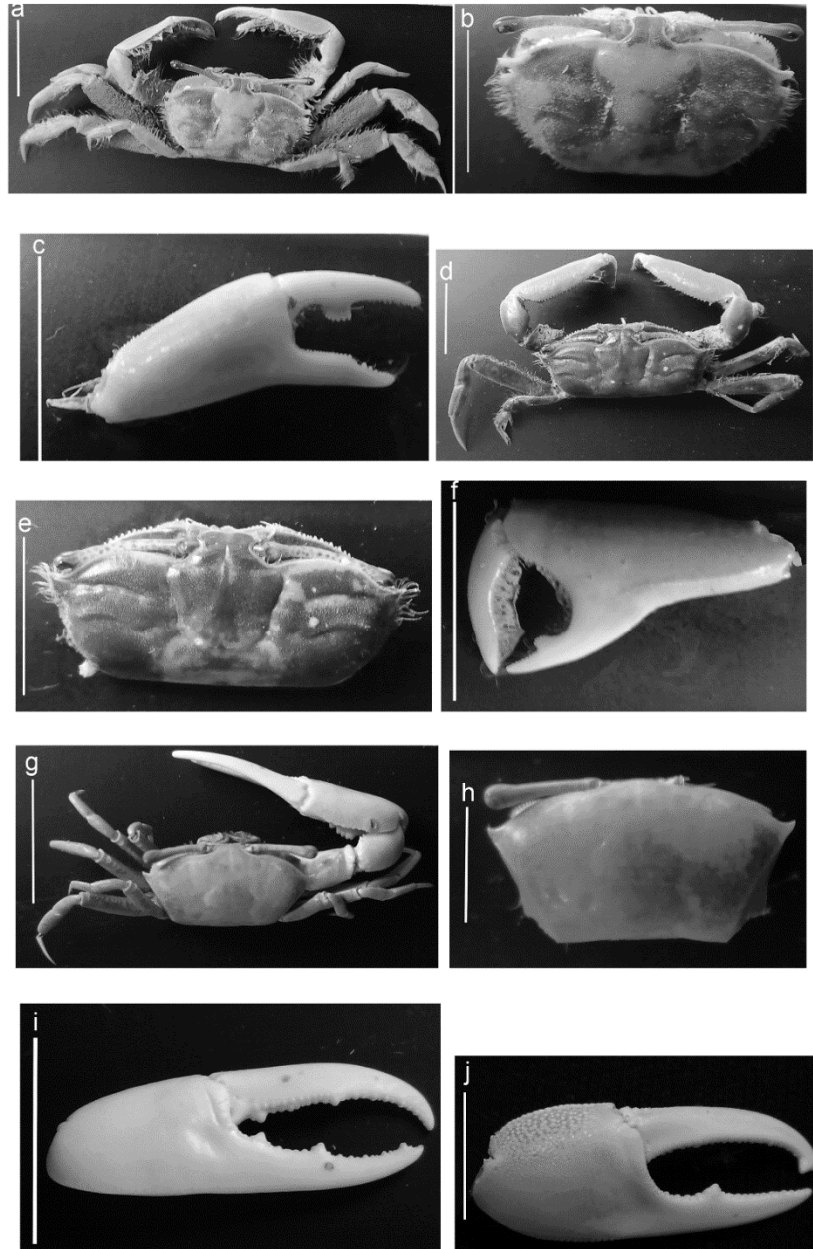
Diagnosis: Carapace longer than broad, external orbital angle strongly produced, acute, posterolateral margin markedly convergent posteriorly; narrow front, granulated ridge present on the eyebrow; merus of chelipeds with a row of tubercles on anterior margin; anterodorsal; margin of carpus flattened; outer margin of palm of chelipeds granulated, forceps-shaped finger, cutting edge of pollex with a submedian tooth.

Distribution: Indo-West Pacific: South Africa to Tanzania, Saudi Arabia (Red Sea), Western India, Thailand (Crane, 1975)

Remarks: *Tubuca urvillei* is having narrow front *A. albimana* and the other two species, *A. albimana* and *C. inversa* have wide front. Distinct granulated ridge is present on the eyebrow of *T. urvillei* contrary to the other two species. The wide front *A. albimana* and *C. inversa* can be distinguished based on the position on a large tooth in the fingers of major chelipeds. In *A. albimana* a subdistal tooth is present in the pollex of major chelipeds and in *C. inversa* a subdistal tooth is present in the dactyl of major chelipeds. Teeth of the cutting edges of the dactyl and pollex of

the major chelipeds exhibit conspecific variations that are illustrated in Fig. 3 (a-g). *Tubuca urvillei*, *A. albimana* and *C. inversa*

were collected from the mangroves of Jazan and only *A. albimana* and *C. inversa* from Sumariat.



**Fig. 2.** *Macrophthalmus depressus* Rüppell, 1830; a) entire ♂; b) carapace; c) major chela; *M. grandidieri* A. Milne Edwards, 1867; d) entire; e) carapace; f) major chela; 1830; *Austruca albimana* (Kossmann, 1877); g) entire; h) carapace; i) major chelae; *Cranuca inversa* (Hoffmann, 1874); j) major chelae. Unit: a-g, i, j = 1 cm, h = 0.5 cm.

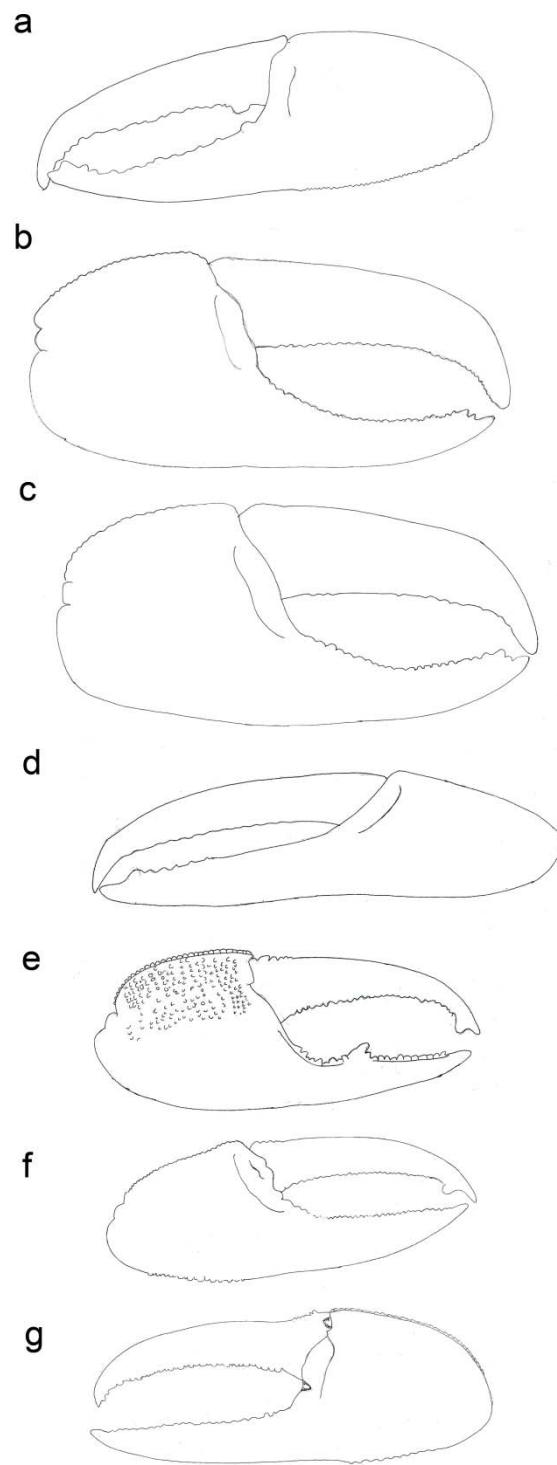


Fig. 3. *Austruca albimana* (Kossmann, 1877); major chelae; a-d; *Cranuca inversa* (Hoffmann, 1874); j) major chelae, e-g.



#### 4. Conclusions

In the Jazan mangrove eight species are collected against six species from Sumariat as *T. crenata* and *M. grandidieri* were not collected. The Jazan mangrove is comparatively larger. It is easy to identify the brachyurans of these mangroves as only a limited number of species are there. The mangroves are usually dominated by the crabs of Grapsidoidea and fiddler crabs (Kristensen, 2008). *Metopograpsus messor*, *M. thukuhar*, *Sesarma guttatum* (= *Perisesarma guttatum*), *Sarmatium crissum* were recorded from the mangroves of the Red Sea (Hogarth *et al.*, 1986; Mandura *et al.*, 1987; Por and Dor 1975; Vine, 1986). However, only *M. thukuhar* was recorded from these two mangroves. Similarly, *M. graeffei*, *M. inversa*, *M. lacteal*, *M. telescopius*, *D. sulcata*, *S. serrata*, *O. saraten* (= *Ocypode saratan*) and *P. leachii* were also not collected.

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#### References

- Akash, M. and Chowdhury, G.W. (2017) First record of the Bengal Fiddler Crab *Uca (Austruca) bengali* Crane, 1975 (Brachyura: Ocypodidae) from Kuakata National Park, Bangladesh, *Dhaka University Journal of Biological Sciences*, **26**(2):199–203.
- Alcock, A.W. (1900) Materials for a Carcinological Fauna of India No. 6. The Brachyura Catometopa, or Grapsoidea, *Journal of the Asiatic Society of Bengal*, **64**(3, Part 2): 279–456
- Apel, M. (1994) Effects of the 1991 Oil Spill on the Crab Fauna (Crustacea: Decapoda: Brachyura) of Intertidal Mudflats in the Western Persian Gulf, *Courier Forschungsinstitut Senckenberg*, **166**:40–46.
- Apel, M. (2001) Taxonomie und Zoogeographie der Brachyura, Paguridea und Porcellanidae (Crustacea: Decapoda) des Persisch- Arabischen Golfes unpublished Ph.D. Thesis, Johann Wolfgang Goethe-Universität, Frankfurt am Main 268 pp.
- Apel, M. and Spiridonov, V. (1998) Taxonomy and zoogeography of the portunid crabs (Crustacea: Decapoda: Brachyura: Portunidae) of the Arabian Gulf and adjacent waters, *Fauna Arabia*, **17**: 159–331
- Apel, M. and Türkay, M. (1999) Taxonomic Composition, Distribution and Zoogeographic Relationships of the Grapsid and Ocypodid Crab Fauna of Intertidal Soft Bottoms in the Arabian Gulf, *Estuarine Coastal and Shelf Science*, **49** (suppl. A): 131–142.
- Crane, J. (1975) *Fiddler Crabs of the World*. Ocypodidae: Genus *Uca*. Princeton University Press, Princeton, New Jersey, i–xxiii + 736 pp.
- Crosnier, A. (1962) Crustacés Décapodes Portunidae. *Faune de Madagascar*, **16**: 1-154, figs 1-256, pls 1-13
- Dye, A. H. and Lasiak, T. A. (1986) Microbenthos, Meiobenthos and Fiddler Crabs: Trophic Interactions in a Tropical Mangrove Sediment, *Marine Ecology Progress Series*, **32**: 259–267.
- Dye, A. H. and Lasiak, T. A. (1987) Assimilation Efficiencies of Fiddler Crabs and Deposit-feeding Gastropods from Tropical Mangrove Sediments, *Comparative Biochemistry and Physiology*, **87**(A): 341–344.
- France, R. L. (1998) Estimation of the Assimilation of Mangrove Detritus by Fiddler Crabs in Laguna Joyuda, Puerto Rico, Using Dual Stable Isotopes. *Journal of Tropical Ecology*, **14** : 413–425.
- Guinot, D. (1967) La faune carcinologique (Crustacea, Brachyura) de l’Océan Indien occidental et de la Mer Rouge. Catalogue Remarques Biogéographiques et Bibliographie. *Mémoires de l’Institut fondamental d’Afrique noire*, **77**: 235–352.
- Hoffmann, C.K. (1874) *Crustacea*, Volume Part 5, livr. 2. Leyden.
- Hogarth, P.J. (1986) Occurrence of *Uca (Deltuca) urvillei* (H. Milne Edwards, 1852) in the Saudi Red Sea (Decapoda, Ocypodidae), *Crustaceana*, **51**(2): 222–223.
- Hogarth, P.J. (1989) The Marine Crustacea of Dhofar, Southern Oman. *Journal of Oman Studies*, **10**: 99–124.
- Khan, A.S., Raffi, S.M. and Lyla, P.S. (2005) Brachyuran Crab Diversity in Natural (Pitchavaram) and Artificially Developed Mangroves (Vellar estuary), *Current Science*, **88** (25): 1316–1324.
- Komai, T., Goshima, S. and Murai, M. (1995). Crabs of the genus *Macrophthalmus* of Phuket, Thailand (Crustacea: Decapoda: Ocypodidae), *Bulletin of Marine Science*, **56**(1): 103–149.
- Kossmann, R. (1877) Malacostraca (1. Teil: Brachyura). *Zoologische Ergebnisse einer im Auftrage der Königlichen Akademie der Wissenschaften u Berlin ausgeführten Reise in die Küstengebiete des Roten Meeres*, **3** (1): 66, pls 1–3.
- Kristensen, E. (2008) Mangrove crabs as ecosystem engineers; with emphasis on sediment processes, *Journal of Sea Research*, **59**:30–43
- Kuraeuter, J.N. (1976) Biodeposition by Salt Marsh Invertebrates, *Marine Biology*, **35**: 215–223.

- Lai, J.C.Y., Ng, P.K.L. and Davie, P.J.F.** (2010) A revision of the *Portunus pelagicus* (Linnaeus, 1758) species complex (Crustacea: Brachyura: Portunidae), with the recognition of four species. *Raffles Bulletin of Zoology*, **58**(2): 199-237.
- Lee, S. Y.** (1998) Ecological Role of Grapsid Crabs in Mangrove Ecosystems: a Review. *Marine and Freshwater Research*, **49**: 335-343.
- Mandura, A.S., Saifullah, S.M. and Khafaji, A.K.** (1987) Mangrove Ecosystem of Southern Red Sea Coast of Saudi Arabia, *Saudi Biological Society*, **10**: 165-193.
- Milne Edwards, H.** (1852) Observations Sur les Affinités Zoologiques et la Classification Naturelle des Crustacés. *Annales des Sciences Naturelles. Zoologie (Série 3)*, **18**:109-166.
- Milne-Edwards, A.** (1867) Descriptions de Quelques Espèces nouvelles de Crustacés Brachyures. *Annales de la Société entomologique de France*, (4) **7**: 263-288.
- Naderloo, R., Türkay, M. and Chen H-L.** (2010) Taxonomic Revision of the Wide-front Fiddler Crabs of the *Uca lacteal* group (Crustacea: Decapoda: Brachyura: Ocypodidae) in the Indo-West Pacific, *Zootaxa*, **2500**:1-38.
- Naderloo, R., Türkay, M. and Apel, M.** (2011) Brachyuran crabs of the family Macrophthalmidae Dana, 1851 (Decapoda: Brachyura: Macrophthalmidae) of the Persian Gulf, *Zootaxa*, **2911**:1-42.
- Nobili, G.** (1906) Faune carcinologique de la Mer Rouge. Décapodes et Stomatopodes. *Annales des Sciences naturelles*, (Zoologie), **9**(4): 1-347, figs. 1-12, pls. 1-11.
- Por, F.D. and Dor, I.** (1975). The Hard Bottom Mangroves of Sinai, Red Sea. *Rapp. Commn. Int. Medit*, **23** (27): 145-147.
- Rodelli, M. R., Gearing, J. N., Gearing, P. J., Marshall, N. and Sasekumar, A.** (1984) Stable Isotope Ratios as a Tracer of Mangrove Carbon in Malaysian Ecosystems. *Oecologia*, **61**: 326-333.
- Rüppell, E.** (1830) *Beschreibung und Abbildung von 24 kurzschwänzigen Krabben als Beitrag zur Naturgeschichte des Rotheres Meeres*, 1-28, pls. 1-6
- Saifullah, S .M.** (1996) Mangrove Ecosystem of Saudi Arabian Red Sea Coast - An Overview. *Journal of King Abdulaziz University Marine Science*, Special Issue on Red Sea environment, 263-270.
- Sakai, (1976).** *Crabs of Japan and the adjacent Seas*, Tokyo, Kodansha.
- Shih, H.-T., Chan, B.K.K. and Ng, P.K.L.** (2018) *Tubuca alcocki*, a new pseudocryptic species of fiddler crab from the Indian Ocean, sister to the southeastern African *T. urvillei* (H. Milne Edwards, 1852) (Crustacea, Decapoda, Brachyura, Ocypodidae), *ZooKeys*, **747**: 41-62.
- Shih, H.-T., Ng, P.K.L., Davie, P.J.F., Schubart, C.D., Türkay, M., Naderloo, R., Jones, D.S. and Liu, M.-Y.** (2016) Systematics of the family Ocypodidae Rafinesque, 1815 (Crustacea: Brachyura), based on phylogenetic relationships, with a reorganization of subfamily rankings and a review of the taxonomic status of *Uca* Leach, 1814, sensu lato and its subgenera. *Raffles Bulletin of Zoology*, **64**: 139-175.
- Twilley, R. R., Poro, M., Garcia, V. H., Rivera-Monroy, V. H., Zambrano, R. and Boderio, A.** (1997) Litter Dynamics in riverine Mangrove Forests in the Guayas River Estuary, Ecuador, *Oecologia*, **111**: 109-122.
- Vine, P.** (1986) *Red Sea Invertebrates*, Immel Publishing, London. 224 pp.
- Wee, D.P.C. and Ng, P.K.L.** (1995) Swimming Crabs of the Genera *Charybdis* De Haan, 1833 and *Thalamita* Latreille, 1829 (Crustacea: Decapoda: Brachyura: Portunidae) from Peninsular Malaysia and Singapore, *Raffles Bulletin of Zoology*, Supplement **1**: 1-128, figs. 1-66.

## تصنيف سلطعون البراكيوران المرتبط بأشجار المنجروف في منطقة جازان، المملكة العربية السعودية

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المستخلص. الأعمال التصنيفية على السرطانات البراكيوران المرتبطة بأشجار المنجروف من الساحل السعودي محدودة. وتتناول هذه الورقة تصنيف ثمانية أنواع من السرطانات البراكيورانية من نوعين من أشجار المنجروف في جنوب البحر الأحمر، منطقة جازان، جازان وسوماريات. وتم وصف جميع الأنواع شكليًا. وتم توفير الأرقام ذات القيم التشخيصية. حواف التقطيع للكلاب الرئيسية في *Austruca albimana* و *Cranuca inversa* لها اختلافات، وقد تم وصفها وتوضيحها أيضًا.

الكلمات المفتاحية: سلطعون البراكيوران، قائمة التحقق، المنجروف، التصنيف، البحر الأحمر.

