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# First Record for the Acidopsid Crab, *Caecopilumnus hirsutus* (Acidopsidae: Goneplacoidea: Brachyura) from the Egyptian Red Sea Coasts

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## ABSTRACT

*Caecopilumnus hirsutus* Borradaile, 1902 (family Acidopsidae Števčić, 2005; subfamily Raouliinae Števčić, 2005; superfamily Goneplacoidea) is recorded for the first time from the Egyptian Red Sea coast, representing a new addition to the goneplacid fauna of the Red Sea. The examined specimen was identified and described based on its diagnostic morphological features, coloration, habitat preferences, and global geographical distribution. Comparative remarks are provided on distinguishing this species from other congeneric taxa and morphologically similar species previously reported from the Red Sea and Indo-Pacific regions. The findings contribute to the expanding knowledge of the regional biodiversity and distributional range of *Caecopilumnus hirsutus*.

## INTRODUCTION

The genus *Caecopilumnus* was established by Borradaile in 1903, with *Caecopilumnus hirsutus* Borradaile, 1902 designated as the type species and defined as a monotypic genus of masculine gender (Borradaile, 1902, 1903). According to **Ng (1987)**, members of the genera *Typhlocarcinops* and *Typhlocarcinus* share several morphological features with *Caecopilumnus*, particularly the broad first male abdominal segment, which extends markedly between the last pair of ambulatory legs, as well as a highly reduced cornea, visible only as a small dot on the ventral surface. Due to these similarities, **Ng (1987)** grouped *Caecopilumnus* with the closely related genera *Typhlocarcinodes*, *Typhlocarcinus*, and *Typhlocarcinops*, along with 16 additional genera, under the subfamily **Rhizopinae** within the family **Pilumnidae** (superfamily *Pilumnoidea*).

Based on these revisions, **Ng (1987)** recognized three species within *Caecopilumnus*: *C. hirsutus* Borradaile, 1903; *C. piroculatus* (Rathbun, 1911); and *C. crassipes* (Tesch, 1918), all primarily distributed in the Indo-West Pacific, particularly in the Indian and western Pacific Oceans **(Barnard, 1956; Ng, 1987; Ng *et al.*, 2008)**. A fourth species, *C. integrifrons* (Miers, 1881), is distributed in the Atlantic Ocean **(Holthuis & Manning, 1981)**. Notably, *C. piroculatus* was previously classified by Serène (1963) as *Typhlocarcinodes piroculatus* under the family *Goneplacidae*, and later

reported across a wide Indo-West Pacific range, from Mayotte and Seychelles to the Philippines and Kiribati **(Ng, 1987)**.

However, **Števčić (2005)** reclassified *Caecopilumnus* under the newly established family Acidopsidae (fam. nov.), within the superfamily Acidopsoidea. In contrast, **Ng and Rahayu (2014)** revised the family Acidopsidae and concluded that the four families previously recognized by Števčić—Caecopilumnidae, Parapilumnidae, Raouliidae, and Typhlocarcinodidae—are junior synonyms of Acidopsidae, with all members grouped under a single family. This classification was supported by **Ng *et al.* (2008)** and **Guinot *et al.* (2013)**, who noted that Acidopsidae has nomenclatural priority over *Parapilumnidae* when treated as synonyms. Accordingly, Acidopsidae is now placed within the superfamily Goneplacoidea **(Ng & Rahayu, 2014)**.

Currently, Acidopsidae is divided into two subfamilies:

1. Acidopsinae, which includes the genera *Acidops*, *Parapilumnus*, and *Crinitocinus* (gen. nov.), all possessing coxal male openings;
2. Raouliinae (subfam. nov.), which includes *Typhlocarcinodes*, *Caecopilumnus*, *Raoulia*, and *Thecaplax* (gen. nov.), all characterized by coxo-sternal male openings.

Within the genus *Caecopilumnus*, three species are currently recognized: *C. hirsutus*, *C. crassipes*, and *C. loculatus* sp. **(Ng & Rahayu, 2014)**.

To date, no species of *Caecopilumnus* have been recorded from the Red Sea, Gulf of Aden, or the eastern African coastline. However, closely related species from the genera *Typhlocarcinus* and *Typhlocarcinops* (subfamily *Rhizopinae*, family *Pilumnidae*) are represented in the western Pacific by approximately seven species each. Among these, *Typhlocarcinus villosus*, *T. rubidus*, and *T. serenei* have been recorded in the Red Sea, including the Gulfs of Suez and Aqaba **(Monod, 1938; Guinot, 1967; Vine, 1986; Türkay, 1986a, b)**. In the southern Red Sea, Gulf of Aden, and the western Arabian Sea (including the Socotra Archipelago), **Al-Hindi (2019)** documented brachyuran crabs along the Yemeni coast, but found no species belonging to *Caecopilumnus*, *Typhlocarcinus*, or *Typhlocarcinops*. Similarly, **Simões *et al.* (2001)** did not report *C. hirsutus* in their study of decapod crustaceans from Socotra Island. In the Persian Gulf, **Naderloo (2017)** recorded *Typhlocarcinops stephenseni*, *T. dentatus*, and *T. rubidus* in his revision of *Pilumnidae*, but again, *Caecopilumnus hirsutus* was not reported.

Between 1994 and 1999, the first author (El-Sayed, A.A.M.) conducted regular surveys of the Egyptian Red Sea coastline targeting pilumnid crabs. During this period, a specimen closely resembling the genus *Caecopilumnus* was collected but remained unidentified and required further taxonomic investigation.

The current study therefore aimed to re-examine this unidentified specimen using classical morphological methods, to determine its taxonomic placement and confirm its identity, potentially marking the first record of *Caecopilumnus hirsutus* in the Red Sea.

## MATERIALS AND METHODS

Only a single male specimen of *Caecopilumnus hirsutus* was collected from the Egyptian Red Sea coast in March 1998. The specimen was obtained during low tide from intertidal shallow waters (depth 0.5–1 m) within a mixed sandy and sandy gravel habitat at Abu El Mahkhadeg Bay (Makady Bay), located approximately 36 km south of Hurghada City. The exact coordinates of the collection site lie between 26°59′40.8″N and 26°59′19.6″N, and 33°59′5.5″E and 33°54′14.2″E (Fig. 1).

Following collection, the specimen was deposited in the Reference Collection of Al-Azhar University, Egypt (catalogue number: RCAZUE-Crus-Br.10601-1), housed in the Laboratory of Marine Invertebrates, Zoology Department, Faculty of Science, Al-Azhar University, Cairo. Identification was carried out using diagnostic keys and taxonomic references provided by **Ng and Rahayu (2014)**.

Morphometric measurements taken included: carapace length (CL), carapace width (CW), chelae length (ChL), chelae height (ChH), fronto-orbital breadth (FOB), orbital breadth (OB), greatest abdominal breadth (AB), and eyestalk length (EsL). Measurements were recorded using a Vernier caliper with a precision of 0.01 mm.

Terminology used throughout the description and analysis follows standard references, including **Barnard (1950, 1956)**, **Ng (1987)**, **Ng *et al.* (2008)**, and **Ng and Rahayu (2014, 2020)**.

High-resolution examination of morphological characters and imaging of the specimen were performed using a binocular stereomicroscope (OPTICA SZM-1) equipped with a PHD-5 MP Micro-cam, in addition to a portable Samsung HD1080 digital camera. Images were processed and edited using Adobe Photoshop for Windows to enhance clarity and detail for publication.

## RESULTS

### Systematic account

Phyluum: Crustacea
Class: Malacostratca
Order: Decapoda
Infraorder: Brachyura
Superfamily: Goneplacoidea **MacLeay, 1838**
Family: Acidopsidae **Števčić, 2005**
Subfamily: Raouliinae **Števčic, 2005**
Genus: *Caecopilumnus* **Borradaile, 1903**
*Caecopilumnus hirsutus* **Borradaile, 1902**
**(Plates 1 & II)**

**Synonyms:**

- ***Caecopilumnus hirsutus*** Borradaile, 1902: 269, fig. 59; **Ng, 1987**: 91; **Ng *et al.*, 2008**: 143; **Ng and Rahayu, 2014**: 38–41, figs. 5h, 24–27.
- ***Typhlocarcinodes hirsutus*** – **Tesch, 1918**: 228, pl. 15, fig. 3; **Yokoya, 1933**: 200; **Sakai, 1935**: 72; **Sakai, 1936**: 192, pl. 55, fig. 1; **Sakai, 1939**: 574, pl. 68, fig. 1;

**Sakai, 1965**: 170, pl. 84, fig. 4; **Takeda, 1973**: 52; **Sakai, 1976**: 550, pl. 194, fig. 3; **Miyake, 1983**: 150, pl. 50, fig. 6; **Takeda, 1997**: 247; **Naiyanetr, 2007**: list, 92.

**Material examined:** Only one male specimen.
**Localities:** Red Sea: Abu Almakhadeg Bay (now known as Makady Bay) 36 km South Hurghada City, Egypt: RCAZUE-Crus-Br.10601-1, 1♂, 6.5×8.0 mm (CLxCW), 25/3/1998.

**Diagnostic characters**

The carapace is subquadrate to transversely oval, moderately convex laterally, and slightly broader than long, with a CW/CL ratio of 1.23. Most regions of the carapace are well defined and delineated by fine, deep grooves, including two distinct grooves separating the last two lateral lobes. The surface is densely pubescent and covered with fine granules, especially laterally, except for the anterolateral margins which bear coarser granules (Plate I: A, C, D).

The anterolateral margins are strongly arched, each bearing three dentate lobes without an exorbital angle. Each lobe features several granules, most prominent on the central lobe. There is no distinct separation between anterolateral and posterolateral margins; the posterolateral margins run almost parallel posteriorly (Plate I: A–C).

The frontal margin is deflexed strongly downward with inward-sloping sides. It measures 2.0 mm in breadth at the base, constituting 0.25 of the CW. The margin narrows anteriorly and is granulated, fringed with short hairs and scattered long setae (Plate I: D).

The orbits are very small (1.4 mm wide), lacking an orbital tooth, spine, or notches. The eyestalks are relatively large, fixed, and completely fill the orbit, bearing long hairs and granules. The fronto-orbital breadth measures 4.5 mm, representing 0.56 of the CW. The cornea is very small and slightly distinct, appearing as a dark dot on the ventral surface of the eyestalk (Plate I: D).

The third maxilliped ischium has a produced anterolateral angle, adorned with fine granules and hairs. The merus is rounded and not distinctly produced. The exognath is narrow. Both inner margins of the ischium and merus bear fine granules and hairs (Plate I: B, G). The basal antennal article is rectangular and broader than long (Plate I: E).

The epistome is sunken into the buccal region and indistinct. The antennules meet the upper margins of the third maxillipeds (Plate I: B, G).

The chelipeds are subequal, robust, and bear granules, short hairs, and pubescence. The left chela is 4.0 mm long and 2.0 mm high (50% of CL). The external surface of the palm is granular and hairy, while the inner surface is smooth. The fingers and thumbs possess sharp, toothed cutting margins, granules, pubescence, and crossing tips (Plate II: E, F).

The walking legs (pereopods) are relatively long, with the second and third legs being stout. The second pereopod is the longest, with a merus measuring 3.9 × 2.0 mm (L × Br), a short carpus (2.1 mm), a flattened propodus (2.4 mm), and a spiniform dactylus (2.2 mm). Both upper and lower margins are hairy (Plates I & II: B).

The abdomen of the examined male consists of seven segments. Segments 3 to 5 are clearly sutured but not tightly fused, possibly due to long-term preservation (Plates I: F, II: D). The first abdominal segment is extremely broad and subrectangular with nearly straight lateral margins, measuring 5.4 mm in breadth and 1.0 mm in length. It fully covers the abdominal sternum and fits between the bases of the fifth coxae (Plate II: A).

The third segment is trapezoidal (3.7 mm wide, 1.0 mm long), making up 69% of the first segment's breadth, and extends between the visible 7th and 8th sternites. The sixth segment is subquadrate, as broad as long (1.2 × 1.2 mm), with parallel sides. The seventh segment is triangular with a rounded apex (Plate I: F, Plate II: D).

The seventh and eighth thoracic sternites are evident. The eighth sternite is visible when the abdomen is closed and appears as a rectangular or subrectangular (rhomboid) plate (Plate I: F).

Pleopods are fine and soft, but were unfortunately lost during the investigation.

**Color:** Carapace, dorsal and ventral surfaces of the walking legs and chelipeds of the preserved specimen have light brown to faint grayish or dirty white color. The carapace has 16 brownish spots, being darker than the general carapace color, arranged in specific patterns across different carapace regions (Plates II: C).

**Habitat:** The shallow intertidal rocky habitat between 0-1 m depth. It was found on the reef flat covered with coral rubbles, gravel and rock fragments.

**Status:** Very rare.

**Distribution:**

**Local:** This is the first record from the Egyptian coasts and the entire Red Sea.

**World:** This species recorded from the Indo-west Pacific regions, extends from Maldives and Laccadives Islands **(Borradaile, 1902)** to Japan through Indonesia **(Tesch, 1918; Yokoya, 1933; Sakai, 1935, 1936; 1939; 1965, 1976; Serene, 1968; Takeda, 1973, 1997; Miyake, 1983; Ng, 1987; Naiyaner, 2007; Ng *et al*., 2008; Ng & Rahayu, 2014)**.

**Remarks:** The diagnostic characters of the examined specimen agree well with those reported by **Borradaile (1902, 1903)** and **Sakai (1939**) as well as in full agreement with those reported by **Ng and Rahayu (2014)**. The 6$^{th}$ abdominal segment is broad as long, with semi parallel lateral borders, but not convex and broader than long as in *C. loculatus* or parallel as in *C. crassipes* as indicated by **Ng and Rahayu (2014)**. The carapace color pattern of the present species is in full agreement with that provided by **Sakai (1976)** which indicated to cream-colored carapace with several regularly arranged brown spots.

## DISCUSSION

The present study reports the first occurrence and record of the soft-bottom-dwelling acidopsid crab, *Caecopilumnus hirsutus* Borradaile, 1902, from both the Egyptian Red Sea coast and the entire Red Sea. This species belongs to the family Acidopsidae and the superfamily Goneplacoidea, which comprise numerous species

globally **distributed across various habitats (Števčić, 2005; Ng *et al.*, 2008; Ng & Rahayu, 2014**).

The family *Acidopsidae* was established by **Števčić (2005)** as a new family, characterized by a pilumnoid-shaped carapace that is wider than long, dorsally areolated, and densely covered with short pubescence. The front is bilobed and slightly convex, with short, tridentate anterolateral margins and a broad posterior margin. The basal antennal segment fills the orbital hiatus, and a distinct endostomial ridge is present. Sternal sutures 4/5 to 7/8 are entire, with upturned 8th sternites. In males, the abdomen is narrow, and the third segment laterally extends to contact the coxae of the last pair of legs. The pereopods are also densely pubescent.

The family currently includes seven genera, divided into two subfamilies:

- Acidopsinae Števčić, 2005, comprising *Acidops*, *Crinitocinus*, and *Parapilumnus*
- Raouliinae, including *Caecopilumnus*, *Raoulia*, *Thecaplax*, and *Typhlocarcinodes* **(Ng & Rahayu, 2014**)

The genus *Caecopilumnus* (formerly *Typhlocarcinodes* Alcock, 1900) was previously placed under Goneplacoidea. **Ng (1987)** revised *Typhlocarcinodes* within *Pilumnidae* and removed it from subfamily *Rhizopinae*. These characters now define *Caecopilumnus*, leading to the reclassification of all former *Typhlocarcinodes* species into *Caecopilumnus* (**Ng *et al.*, 2008**). According to **Ng (1987)**, *Caecopilumnus* includes:

- *C. hirsutus* (Borradaile, 1903)
- *C. crassipes* (Tesch, 1918)
- *C. piroculatus* (Rathbun, 1911)
- *C. integrifrons* (Miers, 1881)

However, **Holthuis and Manning (1981)** indicated that *C. integrifrons* is restricted to the Atlantic Ocean and should remain in *Typhlocarcinodes* based on its characteristics. Consequently, after the revision by **Ng and Rahayu (2014)**, the valid species of *Caecopilumnus* are:

- *C. hirsutus*
- *C. crassipes*
- *C. loculatus* (sp. nov.)

These species are confined to the Indo-West Pacific, from Japan to Indonesia, and westward to the Maldives, Laccadive Islands, and Thailand **(Ng & Rahayu, 2014)**.

**Ng and Rahayu (2014)** noted that all *Caecopilumnus* species share key characteristics with other Raouliinae genera: a rounded merus of the third maxillipeds, convex anterolateral margins, and a rectangular basal antennal article. The penis is coxo-sternal, exiting on the fifth coxa and partially exposed between the seventh and eighth sternites, not protected by the abdomen or sternites. The eighth sternite is visible even when the abdomen is closed.

*Caecopilumnus* can be distinguished from other Raouliinae by having a relatively narrower thoracic sternum, a subrectangular first abdominal segment with nearly straight margins, and a partially exposed penis situated on a short groove near the fifth coxa.

The present study's specimen shares key diagnostic features with *C. hirsutus* as originally described by **Borradaile (1902, 1903)** from the Maldives and Laccadive Islands. Notably, the sunken posterior margin of the epistome, which merges with the upper margin of the third maxillipeds, matches the diagnosis of *C. hirsutus* given by **Ng (1987)** and **Ng and Rahayu (2014)**.

Morphologically, *C. hirsutus* can be distinguished from:

- ***C. loculatus***: which has shorter last ambulatory propodus and a broader sixth abdominal segment, and a more sinuous G1
- ***C. crassipes***: which shows a shallower, less distinct carapace groove pattern and more ovate ambulatory propodi; the cheliped and carapace shapes are also more rounded
- ***Typhlocarcinodes integrifrons***: which has only a partially sunken epistome and a distinct, mobile calcified plate between the 7th and 8th sternites

According to **Ng (1987)**, *C. hirsutus* shares some overlapping traits with *Typhlocarcinops* and *Typhlocarcinus* (subfamily Rhizopinae, family Pilumnidae). All these genera exhibit:

1. A very broad first abdominal somite in males
2. A slightly distinct cornea, appearing only as a dot

However, *Caecopilumnus* is differentiated by:

- A sunken epistome into the buccal cavity (vs. prominent in *Typhlocarcinops*)
- Antennules meeting the upper margin of the third maxillipeds (vs. not meeting in *Typhlocarcinops*)
- First abdominal somite in males completely filling the space between the fifth pereopods (vs. not in *Typhlocarcinus*)

The deflexed frontal margin and the dentition of the anterolateral margin also differentiate *C. hirsutus* from all known *Typhlocarcinus* and *Typhlocarcinops* species from the Indian and Western Pacific Oceans, including:

- *T. rubidus*
- *T. villosus*
- *T. serenei* **(Monod, 1938; Guinot, 1967;Turkay, 1986a, b; Vine, 1986)**

Moreover, *C. hirsutus* is not among the species reported by **Naderloo (2017)** in the Persian Gulf, where only *Typhlocarcinus dentatus*, *T. rubidus*, and *Typhlocarcinops stephenseni* were identified.

## CONCLUSION

This study confirms that *Caecopilumnus hirsutus* is a new record for the Egyptian Red Sea coast and the entire Red Sea region. Its presence raises the number of Goneplacoidea species reported from the area to 10, based on prior lists by **Vine (1986)** and **Turkay (1986a, b)**, and enhances our understanding of Indo-West Pacific

brachyuran diversity **(Ng & Rahayu, 2014)**. These findings underscore the urgent need for continued exploration and systematic revision of Red Sea brachyuran fauna, particularly along under-sampled Egyptian coasts.

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**Authors' contributions**

AAME collected the present specimens from the field; AAME and AMAA examined and help in identification of the specimen and prepared all photos; all authors reviewed and finalized the manuscript, as well as read and approved the manuscript.

**Conflict of interest**

The authors declare that no financial conflict of interest exists in relation to the work described. The Egyptian Environmental Affairs Agency (EEAA), the General Authority for Tourism Development, and Red Sea Governorate had been provided all facilities through the research project (Red Sea Coastal Management Project) funded by "Global Environmental Fund" during the period from 1994- 1998).

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## أول تسجيل لنوع سيكوبيلومنس هيرسيوتس ( أسيدوبسيدي: جونيبلاسيدى- القشريات عشرية الأرجل) من السرطانات قصيرة الذنب بالشواطيء المصرية للبحر الأحمر

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تم خلال هذه الدراسة تسجيل نوع سيكوبيلومنس هيرسيوتس (Borradaile، 1902) الذي ينتمي إلى عائلة أسيدوبوسيدي (Števčić ، 2005) وفوق عائلة جونيبلاسيدي من السرطانات عشرية الأرجل قصيرة الذنب التابعة لشعبة القشريات) لأول مرة من شواطئ البحر الأحمر المصرية، مما يزيد من أعداد أنواع الجونيبلاسيدي في البحر الأحمر. ولقد تم التعرف على هذا النوع بالفحص الدقيق ومطابقة الصفات التشخيصية (المورفولوجية) لهذا النوع ومطابقتها بما ورد في المراجع الحديثة لتصنيف هذا النوع. كما تم ذكر المرادفات والصفات التشخيصية واللون ومكان وطبيعة التواجد في الموائل الفطرية مع توضيح المدى الجغرافي لانتشار هذا النوع وكذلك توضيح الفروق الفاصلة بينه وبين الأنواع التابعة لهذا الجنس وكذلك الأنواع الشبيهة والتي كان يصنف معها سابقا في عائلة البلمونيدي والمنتشرة في منطقة غرب المحيط الهندي والبحر الأحمر والخليج العربي. ويعد هذا التسجيل الأول لهذا النوع ليس من الشواطئ المصرية فحسب بل من البحر الأحمر قاطبة.

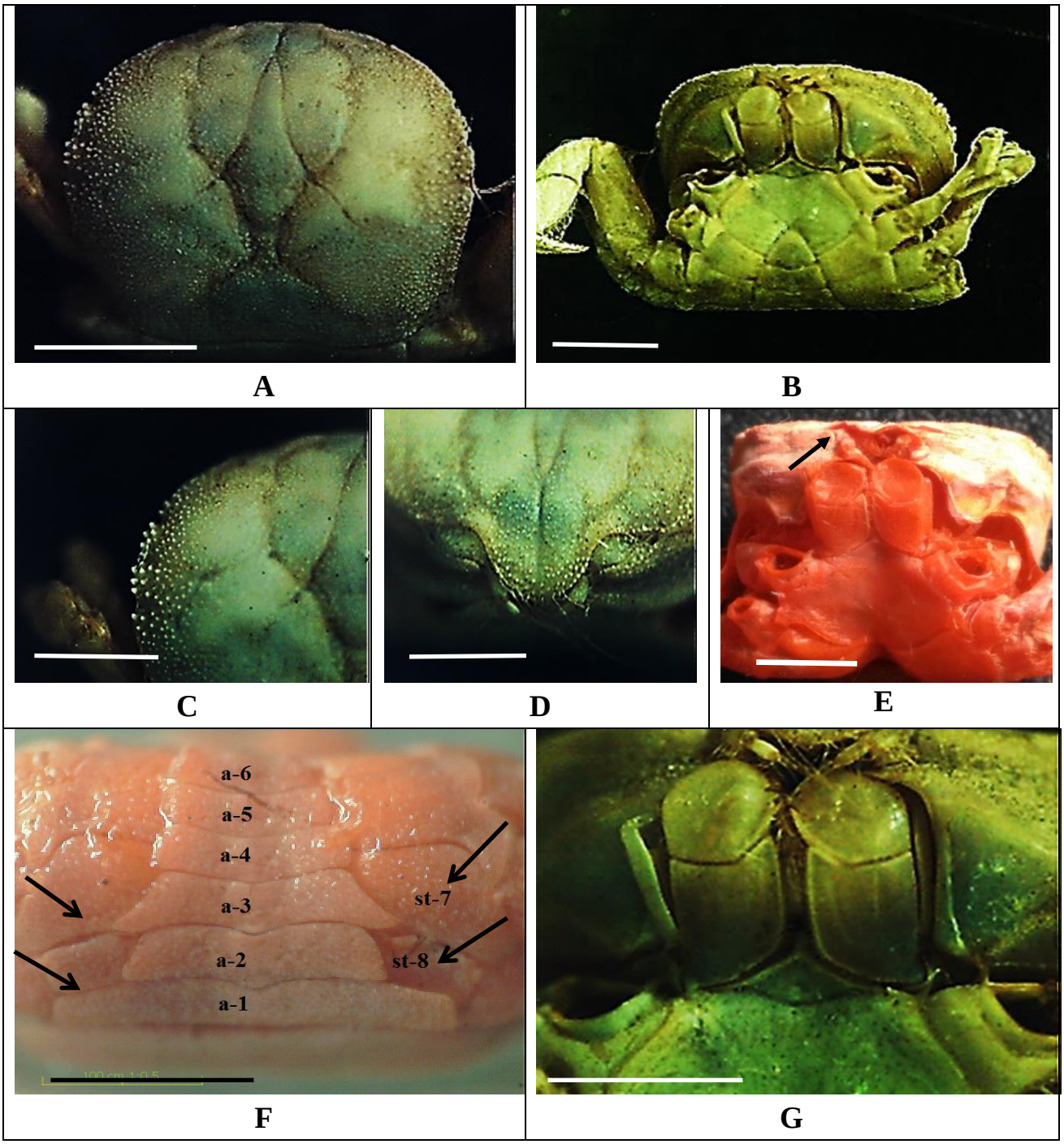



**Plate 1.** The morphometric characters of *Caecopilumnus hirsutus* (male, 6.5x8.0 mm, CLx CW) comprised: dorsal and ventral view (A &B); anterolateral margins of carapace showing it lobes and tubercles (C); frontal margin showing, orbit, eyestalk and eye ball (D); ventral view showing the basal antennal article (arrowed) with complete antenna (E); ventral view showing abdominal segments from a1 to a7; arrows denote to the 7$^{th}$ and 8$^{th}$ sternites at both sides (F); the third maxilleped meeting with antennae and sunken epistome (G). Scale bar = 3mm)

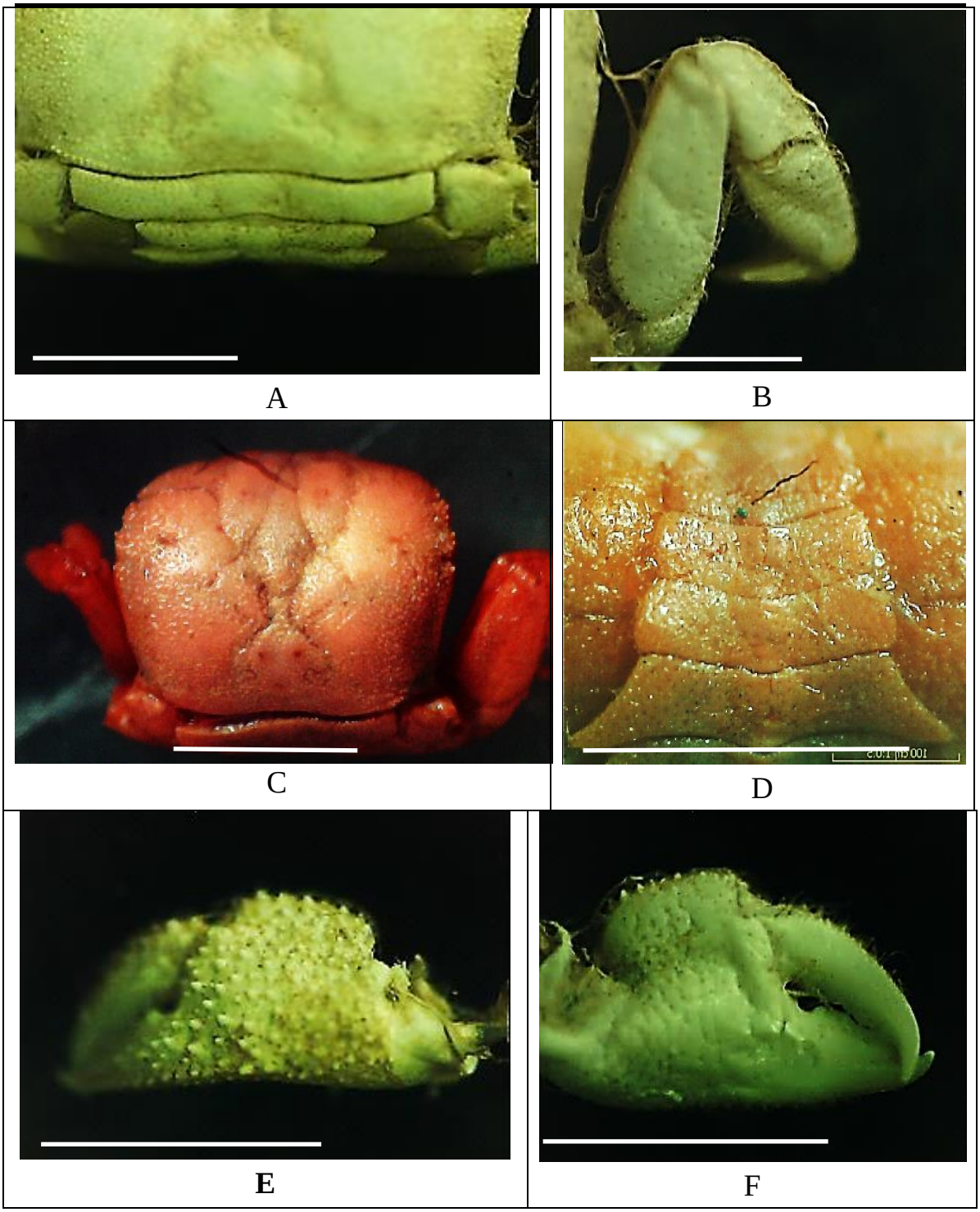
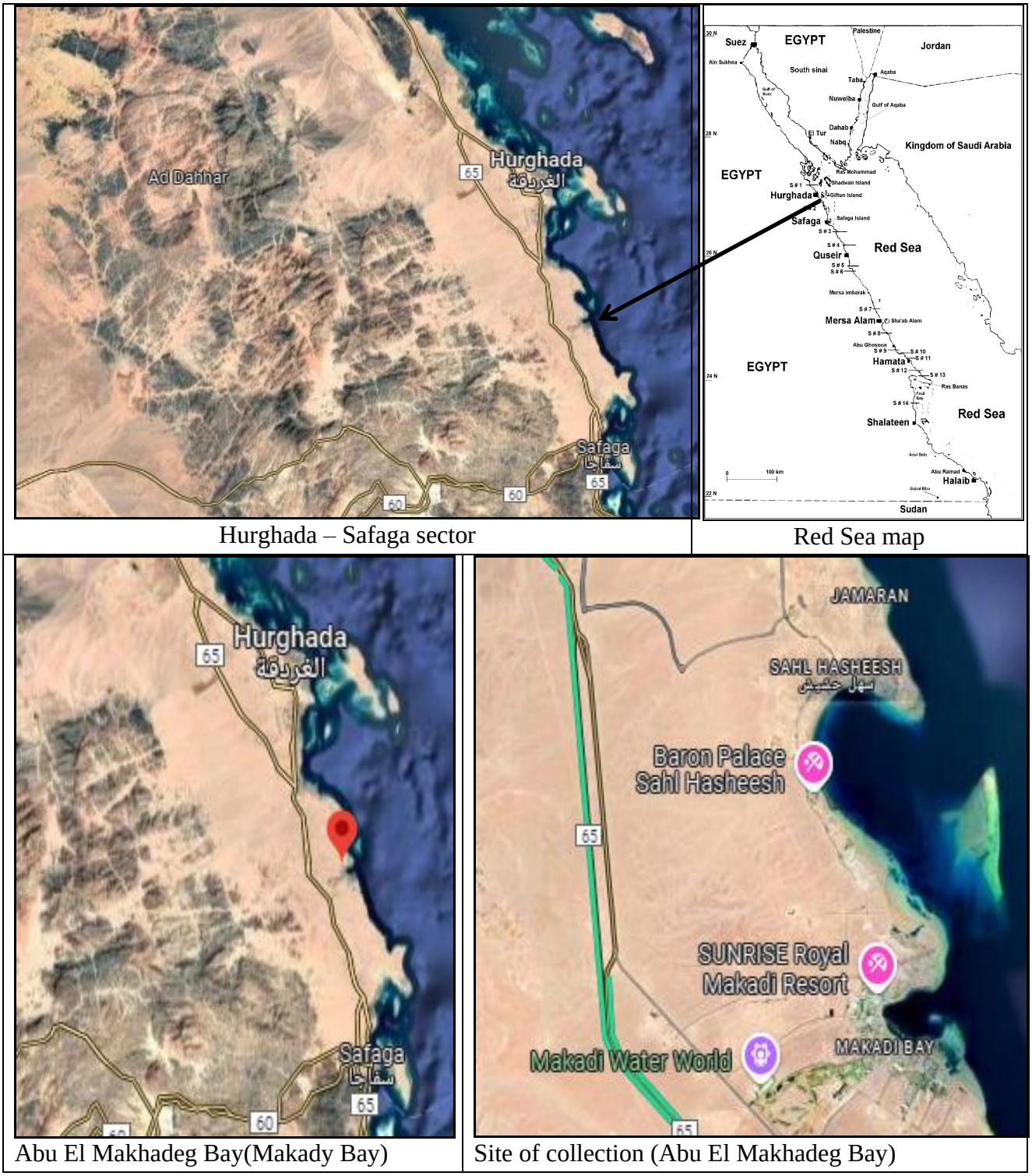



**Plate I1.** The morphometric characters of *Caecopilumnus hirsutus* (male, 6.5x8.0 mm) comprised: dorsal view showing the frits 3 segments of abdomen, 5th coxa, and posterior margin of carapace (A); second ambulatory leg (B); carapace with pattern of dark brownish pigments (C); abdominal segments in male from a2-a6 (D); outer and inner surface of left chela (E &F); Scale bar = 3mm)




Hurghada – Safaga sector | Red Sea map

Abu El Makhadeg Bay(Makady Bay) | Site of collection (Abu El Makhadeg Bay)

**Fig. 1.** The collection site of *Caecopilumnus hirsutus* from the Egyptian coasts of the Red Sea