



The First Record of *Amathina tricarinata* (Gastropoda, Amathinidae) from Coral Reef in Iraqi Marine Waters

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Abstract: The Arabian Gulf is a semi-enclosed shallow sea that is located in a subtropical climate. It is considered part of the Indo-Pacific Ocean. Despite the harshest environment of the Arabian Gulf, it hosts diverse communities of coral reef organisms, vertebrates, and invertebrates, which have adapted to survive in harsh climatic conditions. This study reveals, for the first time, updated information on the distribution range of the parasitic gastropod, *Amathina tricarinata* (Linnaeus, 1767), in the Iraqi marine waters of the northwestern Arabian Gulf. Mollusca specimens were manually collected using scientific diving techniques at Palinurus Rock area near Basrah Oil Terminal during the first week of June 2015. Environmental factors were recorded at the site: water temperature 32.2 °C, salinity 40.2 psu, turbidity 30 mg/L, and pH 8.07. The specimen was found attached to pen shell *Pinna bicolor* (Gmelin, 1791), at a depth of 10 meters and have been preserved in laboratory ever since. The shell morphology was described, and all necessary measurements were taken.

Keywords: *Amathina tricarinata*; Arabian Gulf; first record; *Pinna bicolor*.

Introduction

In general, the Arabian Gulf region is characterized by harsh climatic conditions, making it one of the most extreme marine environments. Surface temperatures can reach 40–42°C (Burt *et al.*, 2020; Seraphim *et al.*, 2024), with high evaporation rates and salinity levels that can exceed 43 psu, which producing a special biotic factor which encourages an endemic species to occurring as a euryhaline species. Therefore, marine organisms in the

Arabian Gulf live close to their ecological tolerance limits, and most marine species are stenohaline, meaning they cannot tolerate changes in salinity, except for those that inhabit estuaries (Naser, 2014).

The first Mollusca collected in the Arabian Gulf with a description of the new species were collected by Townsend during 1893 to 1900 (Melvill & Standen, 2010), whereas the first documented systematic study of marine

mollusks in the Arabian Gulf, especially in the Iraqi waters, was published by Ahmed (1975), whose study included 43 species of mollusks, including 25 species of marine gastropods.

Information on benthic mollusks in the shared waters of the Gulf is scarce, as most published studies rely on data from limited locations in the Arabian Gulf (Literathy *et al.*, 2002), however, Al-Kandari *et al.*, (2020) recorded a total of 271 species of Mollusca along the Kuwaiti coastal areas between 2013 and 2015, including 104 species of Gastropods; Ali *et al.*, (2024) reported a list of 28 gastropod species were identified from sandy (26 species) and about 20 species from the rocky shore of the Kuwaiti coastal areas during 2016 and 2017. Coll *et al.*, (2010) and Abbas *et al.*, (2024) found that biodiversity was generally higher in coastal areas and continental shelves, and decreases with depth,

For many years the survey of molluscs in the Arabian Gulf did not refers to the taxonomic families that belonged to Limpet-like gastropods such as Amathinidae includes five or six genera, which is an endemic group in the tropical to subtropical Indo-Pacific; it mostly consists of small and minute sea snails and their individuals are usually found in subtidal areas or under stones of marine waters in depth ranged between 20 to 30 m, this family is a marine heterobranch and ectosymbiotic ectoparasite pyramidelloid gastropod (MolluscaBase Editors, 2026).

The genus *Amathina* (pyramidal gastropod), thought to be native to the Indo-Pacific, this gastropod has not been reported from elsewhere in the world. Its distribution extends from the Red Sea westward to Japan and Australia eastward (Hori, 2000). Scapolatempo *et al.*, (2003) believed to have entered the Mediterranean basin through the

Suez Canal. In other region one specimen of *A. tricarinata* was found in Lebanon, and additional collections were recorded in Turkey (Çeviker & Albayrak, 2006). It was then recorded in Cyprus (Kletou *et al.*, 2019), where it may be considered as invasive species (Kletou *et al.*, 2019; Tan & Low, 2014). IUCN suggested that *Amathina* is: Not Evaluated (NE) and Harmless to humans (MolluscaBase Editors, 2026).

A number of investigations and observations were reported by Valarmathi (2017) that snail species have an ability to choose and to recognize their preferred food, it has diverse feeding modes, most of them are herbivores and feed by scraping off algae using the radula, some are scavengers of dead organism and others are carnivores (Nützel, 2021; Tachapuripunya *et al.*, 2021). Mooi *et al.*, (2007) reported that some oyster borers, have an extensible proboscis for drilling holes in the shells of bivalves whose soft parts may be delectable and some even have a spine for opening shells.

Amathina tricarinata considered to be an ectoparasitic snail species that make drilling holes to feed on the body fluids of host represented by large bivalves molluscs such as *Pinna atropurpurea* G. B. Sowerby I, 1825, *Chama pacifica* Broderip, 1835, *Ostrea denselamellosa* Lischke, 1869, *Atrina pectinata* (L., 1767), *Atrina vexillum* (Born, 1778), *Pinna bicolor* (Gmelin, 1791), *Pinctata radiata* (Leach, 1814), *Pteria penguin* (Röding, 1798), *Spondylus spinosus* Schreibers, 1793 (Tan & Low, 2014). Ponder (1988) presented an anatomical details and notes on biology and systematics of *A. tricarinata* and confirmed that it is an ectoparasite, meaning it lives on the outer surface of its host, usually attached to the shell

near the exhalant opening, and uses a long, slender proboscis to pierce the host's mantle tissue and suck its fluids.

The present study indicates the first record of the species *Amathina tricarinata* and the family to which it belongs in the Arabian Gulf, this study is a part of macrobenthic invertebrates' program for documenting the taxonomic groups which were collected from the unique coral reefs in an extreme environment of the Iraqi marine waters.

Material and Methods

Samples of Mollusca were collected manually by using SCUBA techniques from the coral reef at Palinurus rock near Basrah Oil Terminal of the Iraqi marine water northwest Arabian Gulf (29°37'13.65"N, 48°46'42.34"E) (**Figure 1**) at depth of 10 meters on 7th June 2015. Details of the newly discovered coral reef area

in Iraqi territorial waters can be found in the study by Pohl *et al.*, (2014). The materials isolated in plastic containers and preserved in 95% ethanol for further laboratory studies, all materials are deposit in the marine biology laboratory and museum in Marine Science Centre, University of Basrah. After washing and examining the isolated specimens, it was observed that one live limpet gastropod *A. tricarinata* was attached to the broad edge of the large bivalve *Pinna bicolor*. The gastropods were identified based on Ponder (1988), whereas, the large bivalve *P. bicolor*, identified depend on Al-Yamani *et al.*, (2012). Morphological measurements of the shell were taken by Vernier caliper to the nearest 0.01 mm; Total shell length (TL), width (TW) and height (H) were measured. Environmental factors at the collection site were measured, including sea surface temperature, salinity, turbidity, and pH.

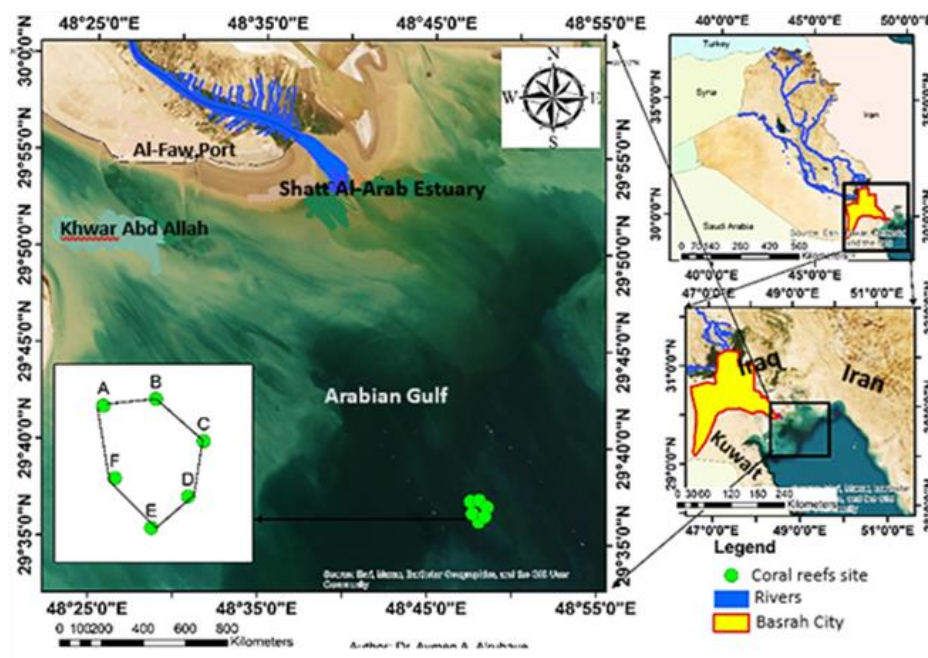


Figure 1. Map of the site sample in the Iraqi marine waters

Results and Discussion

Systematic summary

Phylum Mollusca Linnaeus, 1758

Class: Gastropoda Cuvier, 1795

Subclass: Heterobranchia

Superorder: Pylopulmonata

Family Amathinidae Ponder, 1987

Genus *Amathina* Gray, 1842

Species *Amathina tricarinata* (L., 1767)

Material: Voucher specimens, (MSC. 211),
Palinurus Rock, Iraqi marine waters.
Collector: T. Pohl, 07 June 2015, depth: 10 m,
water temperature: 32.4 °C.

Diagnosis

Fig. (2) shows the bivalve *P. bicolor* Gmelin, 1791 (total length 21cm) with the attached *A. tricarinata*. (Figure 3) shows the external feature of *A. tricarinata* shell, it is thick and solid, yellowish-brown oval, hat-like 26.99 mm long, 18.77 mm wide, and 10.46 mm high, the top is bent from the inside and 3 prominent radial protruding ribs emerge strong in the form of round lines that go beyond the edge of the front shell in the form of claw-like protrusions, ventral of the shell is white smooth soft covered with straw to brown periostracum, and has fossa, with 16.82 mm long, 10.19mm wide, and 7.72 mm depth.

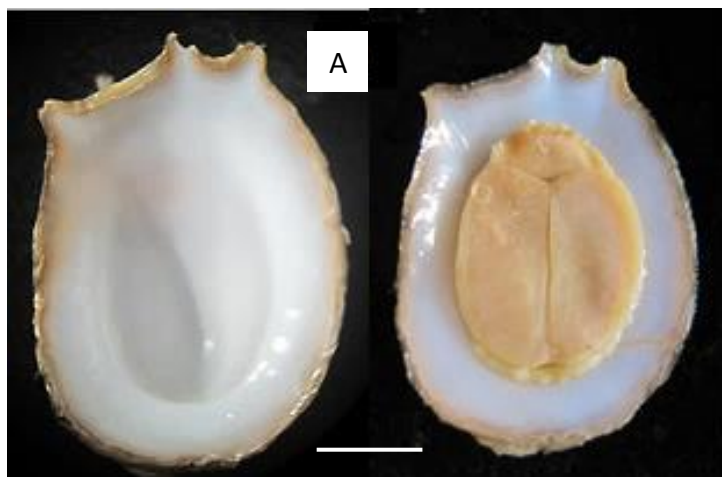


Figure 2. *Amathina tricarinata* attached on *Pinna bicolor* (TL: 21cm.) was collected from the Iraqi marine waters of the Arabian Gulf.

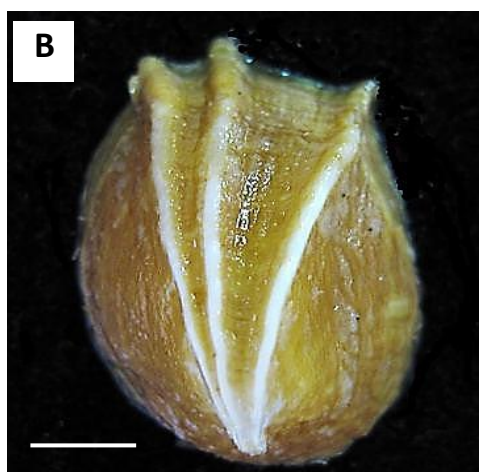
A. tricarinata, as an ectoparasite on large bivalve shells mainly *Pinna bicolor* that settled close the mantle edge of the host.

It was found attached near the edge of the host's mantle; a slit or furrow (not exceeding 1.5 mm) was also observed on the edge of the host's shell extending from the anterior end of the *A. tricarinata* when removed from the

bivalve shell. This indicates that the ectoparasite *A. tricarinata* is drilling holes to feed on the body fluids of *P. bicolor*. It is probably *A. tricarinata* feeds on encrusting sponges found on the host's shell, due to the area under the parasite was completely devoid of the sponges that had surrounded it and spread throughout the other parts of the host's shell (Figure 4).



A. Shell ventral view (left), and a live specimen (right) from the Iraqi marine waters, northwest Arabian Gulf.



B. Dorsal view: highlighting three distinct carinae



C. Lateral view

Figure 3. Refined morphological study of *Amathina tricarinata* with enhanced focus on key identifying features. **A:** Internal and live animal views. **B:** Clarified dorsal perspective, emphasizing the diagnostic three robust external ridges (carinae) and white coloration. **C:** Detailed lateral profile. All scale bars = 9 mm.



Figure 4. Part of the *Pinna bicolor* shell, the yellow circle surrounds the furrow drilled by *Amathina. tricarinata* on the shell, while the white area shows the encrusting sponges.

Distribution

The species *A. tricarinata* has a native distribution in the Indo-Pacific region, including the Red Sea, and has been introduced

to the Mediterranean Sea naturally via the Suez Canal, then it spread to stable populations in parts of the Mediterranean such as Turkey, Lebanon, and Cyprus (Table 1).

Table 1: Geographical distribution of *Amathina tricarinata* in western Indo-Pacific Ocean and east Mediterranean Sea

	Name of Area	Shell TL mm.	Depth (m)	No. of individuals	Host species	Reference
1.	Red Sea		Subtidal zone	-	Large bivalves	Dekker & Orlin, 2000
2.	Lebanon		1	3	Free without host	Scapolatempo <i>et al.</i> , 2003
3.	SE Turkey Iskenderum Bay	8	25	7	<i>Pondylus spinosus</i> Schreibers, 1793	Çeviker & Albayrak, 2006 Delongueville & Scaillet, 2006
	Cyprus	5.6	1	1	Free, without host	Kletou <i>et al.</i> , 2019
4.	Singapore	5.9-26.5	Subtidal zone	2	<i>Pinna atropurpurea</i> G.P. Sowerby, 1825	Tan & Low, 2014
5.	Northwest Arabian Gulf	26.99	10	1	<i>Pinna bicolor</i> Gmelin, 1791	Present study

Discussion

Environmental data from the study area provide clear evidence of the harsh environmental conditions of Iraqi marine waters due to high surface water temperature (32.2 °C), high salinity levels (40.2 psu), and high turbidity (30 mg. L⁻¹) exceed the normal

ranges found in most of the world's seas. These factors collectively act as limiting factors for the spread and distribution of organisms, especially given the prolonged periods of high-water temperature and salinity in this environment (Mohammed *et al.*, 2026). Mellin *et al.*, (2016) reported that elevated

temperatures likely allow species to expand into new areas where they were previously unable to survive and reproduce. This suggests that *Amathina* has adapted to the northwestern Gulf environment by parasitizing large bivalves, attaching itself to the edge of the *P. bicolor* via a small slit through which it absorbs host fluids, and it also appears to feed on sponges growing on the host shell (Ponder, 1988).

Species in the Arabian Gulf are genetically adapted to survive the region's environmental conditions. However, the precise range of tolerance for temperature, salinity, and other factors for each species is not well understood, and further environmental and physiological experimental studies are required to determine the specific limits for each species (Leung *et al.*, 2021).

Records of *A. tricarinata* species in the northwest Arabian Gulf shows the expanding of its scope distribution and a remarkable migration, especially since it has not been previously recorded in the routes leading to the Arabian Gulf from the Red Sea, such as the Gulf of Oman, Gulf of Aden and Hormuz Strait. We think that this species has been transported in the area close to the Iraqi oil ports by many oil tankers, and here it should be noted that shipping may be a means of transporting it through ballasting water to this area of the Arabian Gulf, where some studies show the possibility of its transmission by commercial ships or oil tankers (Çeviker & Albayrak, 2006). Although the *A. tricarinata* had not been previously reported in surveys of the Arabian Gulf, it is probably capable of migration, or may be spread via free-living veliger larvae (Riquet *et al.*, 2017).

The dimensions of the shell in the current study were compared with those of *A. tricarinata*

from other regions, although it is a single specimen, but it was the largest, it exceeds the largest length category recorded by Tan and Low (2014) in Singapore (L: 26.5mm, W: 18.6mm), while smaller lengths were recorded in the Mediterranean basin, ranging from 8 mm. in Turkey to 5.6 mm. in Cyprus. This indicates that snail sizes decrease with distance from their natural habitat (Table 1), thick and the fossa is oval and narrowly defined in the mid-ventral portion of the shell, while the fossa of *A. tricarinata* of Cyprus, Turkey, and Singapore is broad and occupies almost the entire ventral portion of the shell.

In Cyprus, a living individual of this species was found at a depth of about one meter in a site affected by human activity and surrounded by three ports (Kletou *et al.*, 2019). *A. tricarinata* may be able to withstand the harshness of conditions in the northwest Arabian Gulf in addition to being described as an alien migratory species (Çeviker & Albayrak, 2006; Kletou *et al.*, 2019; Tan & Low, 2014).

A. tricarinata in the present study appears to may be restricted to the bivalve *P. bicolor*, despite that we examining all preserved specimens of bivalve genera to be parasitize by it, such as *Spondylus*, *Picndata*, and *Chama* (Çeviker & Albayrak, 2006; Ponder, 1987). While Tan and Low (2014) demonstrated that it parasitizes is only *P. atropurpurea* in Singapore specimens and also they found it under rocks at the intertidal zone, whereas, Çeviker and Albayrak, (2006) reported that the *A. tricarinata* parasitizes only spiny oyster *Spondylus spinosus* Schreibers, 1793 at a depth of 25 m in Turkey. This diversity in hosts gives the parasite high resilience, better survival chances, and wider distribution in different environments.

The current status of *A. tricarinata* and its stability and distribution in the Arabian Gulf warrant further investigation. Studies by Niamaimandi *et al.*, (2017) and Ali *et al.*, (2024), when comparing their results with previous studies dating back to the 1980s, showed that the composition of the dominant species in the Gulf remained unchanged, excluding the species *A. tricarinata*, this may indicate that it is not common species, This may be due to a lack of samples, as obtaining them would require greater and investigation efforts, especially since this species in Iraqi territorial waters was found at a depth of 10 m. and not in the intertidal zones as in Cyprus and Singapore.

Conclusion

The small limpet gastropod *A. tricarinata* was found attached to the broad edge of the large bivalve shell, *P. bicolor*, which produces pearl, from a newly discovered coral reef in the Iraqi marine waters northwest Arabian Gulf. This species appears larger than those recorded globally, especially in the Mediterranean basin, but is close to the sizes recorded in Singapore. This may indicate that the sizes of *A. tricarinata* decrease as it moves further away from its natural habitat or adopts invasive behavior It is believed that it entered the Gulf via the ballast water of cargo ships, as it was observed near Iraqi oil ports, which receive hundreds of ships annually. As an invasive species, *A. tricarinata* is able to withstand the harsh conditions of the Arabian Gulf for migration and colonization. The spread of exotic species is likely to continue with climate change conditions, so continuous monitoring is necessary to detect more of them. Extensive studies are needed to shed light on the biodiversity of Iraqi coral reefs.

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Contributions of authors

H.H.M. identify the Gastropod and the Bivalve, wrote the manuscript. **N.A.H.** Revision and proofreading. **H.K.A.** wrote and drafting of the article.

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Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article

Ethical approval

No animal studies are presented in manuscript. The project was approved by the local ethical committee at Marine Science Centre, University of Basrah, Iraq.

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اول تسجيل لبطني القدم (*Amathina tricarinata* (Mollusca, Gastropoda, Amathinidae) من منطقة الشعاب المرجانية في المياه البحرية العراقية

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المستخلص: يعد الخليج العربي بحرا ضحلا شبه مغلق يقع في مناخ شبه استوائي. يُعتبر جزءاً من المحيط الهندي-الهادئ. وعلى الرغم من بيئته القاسية، إلا أنه يحتضن مجتمعات متنوعة من كائنات الشعاب المرجانية والفقاريات واللافقاريات التي تكيفت للبقاء على قيد الحياة في ظل ظروف مناخية متطرفة. تكشف هذه الدراسة، لأول مرة، عن معلومات محدثة حول نطاق التوزيع الجديد لبطني القدم الطفيلي (*Amathina tricarinata* (Linnaeus, 1767)، في المياه البحرية العراقية شمال غرب الخليج العربي. جمعت نماذج الرخويات يدويا بواسطة تقنية الغوص العلمي عند صخرة بالينورس قرب الموانئ النفطية خلال الاسبوع الاول من شهر حزيران 2015، جرى تسجيل العوامل البيئية في الموقع، وقد بلغت درجة حرارة الماء 32.2 درجة مئوية، والملوحة 40.2 وحدة ملوحة عملية، والعكارة 30 ملغم/لتر، ودرجة الحموضة 8.07. وجد القوقع ملتصقا على الرخويات الكبيرة، *Pinna bicolor* (Gmelin, 1791)، على عمق 10 أمتار كطفيلي خارجي، وُصفت الصدفة مورفولوجيا هذا النوع، وأُخذت جميع القياسات اللازمة.

الكلمات المفتاحية: *Amathina tricarinata*؛ الخليج العربي؛ أول تسجيل؛ *Pinna bicolor*.