

THREE NEW FINDINGS OF “SEA SLUGS” (GASTROPODA, HETEROBRANCHIA) FOR THE ALGERIAN PROVINCES OF ALGIERS AND TIPAZA (ALGERIA, SOUTH-WESTERN MEDITERRANEAN)

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Abstract. Knowledge of the “sea slug” fauna along the Algerian coast has always been scarce and fragmented, mainly due to the lack of experts on this group in the region. Nevertheless, recent collaboration with local marine life enthusiasts has made it possible to compile the first faunal inventory of Algerian sea slugs. Building on this collaborative effort, the present study reports the first observation from the Algerian coast of *Phyllidia flava*, *Berthellina* cf. *edwardsii*, and *Haminoea* cf. *hydatis*, recorded in the provinces of Algiers and Tipaza. Species identification was based on external morphological characters visible in photographs and comparison with relevant literature. Further studies based on detailed morphological and molecular analyses will be necessary to confirm the identification of the latter two records. These findings further contribute to knowledge of sea slug diversity along the Algerian coast and highlight the importance of continued surveys and collaboration with local observers.

Key words: *Berthellina* cf. *edwardsii*; *Haminoea* cf. *hydatis*; heterobranch sea slugs; marine heterobranchs; opisthobranchs; *Phyllidia flava*

1. INTRODUCTION

The “sea slugs” are an informal complex of 13 taxa (i.e., Rhodopoidea, Acteonoidea, Ringiculimorpha, Pleurobranchida, Nudibranchia, Doridida, Cephalaspidea, Runcinida, Aplysiida, Pteropoda, Umbraculida, Sacoglossa, and Acochlidimorpha) of gastropods molluscs famous for their flamboyant body shapes and unique biological adaptations (Trainito & Doneddu, 2014; Lombardo & Marletta, in press). As regards the Algerian coast, the first faunal inventory of sea slug species has only recently been compiled. (Lombardo *et al.*, 2026).

The examination of the historical and scattered records together with more recent data highlighted the presence of 71 sea slug species along the Algerian coast, subdivided into

ten taxa (19 Nudibranchia, 18 Doridida, 10 Cephalaspidea, 10 Aplysida, 7 Sacoglossa, 2 Umbraculida, 2 Ringiculimorpha, 1 Acteonida, 1 Pleurobranchida, and 1 Pteropoda) (Lombardo *et al.*, 2026). Nevertheless, despite this recent increase in knowledge, the available data on Algerian sea slugs remain limited when compared with the high overall biodiversity of the region (CAR/ASP-PLUE/PAM, 2015; Grimes *et al.*, 2016; MEER & SPA/RAC-ONU Environment/PAM, 2018).

This knowledge gap is mainly because of the lack of long-term research on Algerian sea slugs in Algeria. Indeed, the limited faunal information available in the literature on these animals derives mainly from studies of general marine fauna (Derbal & Kara, 2005; Bakalem, 2008; Refes *et al.*, 2010; CAR/ASP-PLUE/PAM, 2015; Brahimi & Bensaou, 2018; Bensari *et al.*, 2020; Meziane *et al.*, 2020) or from rare single records

(Dieuzeide, 1951; Pruvot-Fol, 1954; Camacho-García & Gosliner, 2008; Eleftheriou *et al.*, 2011; Tamsouri *et al.*, 2018).

In this regard, in recent years a key contribution to our understanding of the sea slug fauna along the Algerian coast has come from Algerian enthusiasts of marine organisms (*e.g.*, sea lovers, fishermen, snorkelers and divers). Their activities have generated a considerable photographic documentation, enabling the recording of 54 of the 71 sea slug species currently documented from this coastline (Lombardo *et al.*, 2026).

In this context, the present study documents, for the first time, three species of sea slugs along the Algerian coast that have not yet been recorded in the area: *Phyllidia flava* Aradas, 1847; *Berthellina cf. edwardsii* (Vayssière, 1897) and *Haminoea cf. ydatis* (Linnaeus, 1758).

2. MATERIAL AND METHODS

The species reported in the present study were observed in the central coast of Algeria (Fig. 1a), specifically within the province of Algiers and Tipaza (Fig 1b). The finding sites were Agueli Island ($36^{\circ}47'40.13''\text{N}$ $3^{\circ}21'08.44''\text{E}$) and Cap Caxine beach ($36^{\circ}48'55.26''\text{N}$ $2^{\circ}57'05.67''\text{E}$) for the province of Algiers (Fig. 1c); while, for that of Tipaza, the finding site was the Port of Tipaza ($36^{\circ}35'37.33''\text{N}$ $2^{\circ}27'03.96''\text{E}$) (Fig. 1d).

For the areas located within the province of Algiers, the finds were made during two dives carried out in June 2014 and 2017 by Mr. N. Kouaci. As for the province of Tipaza, the find was made during a manual inspection of a mooring line carried out by one of the authors (J.C.).

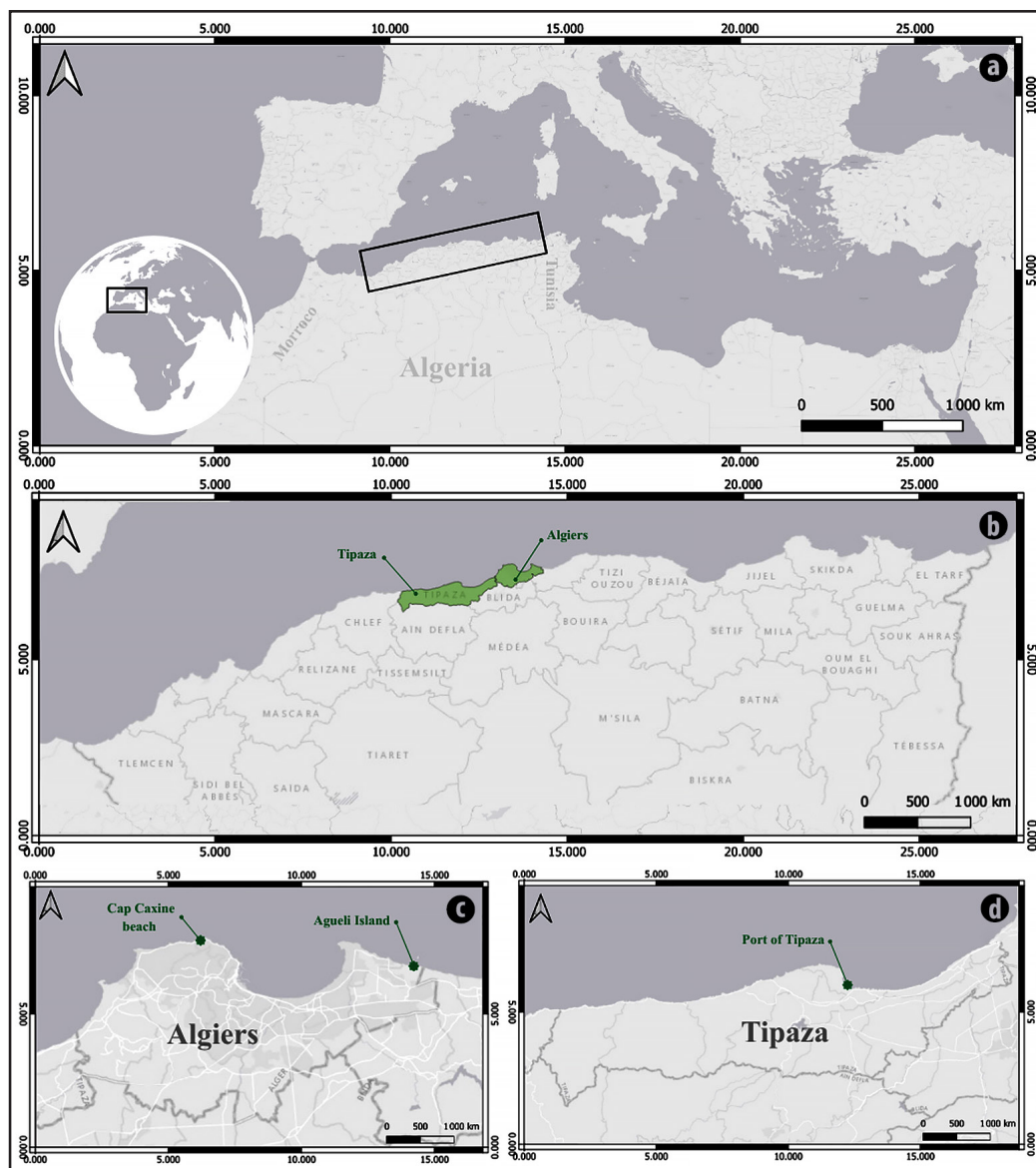


Fig. 1. (a) Location of the Algerian coastline in the Mediterranean basin; (b) location of the provinces covered in this note; (c) location of the sites within the province of Algiers; (d) location of the site in the province of Tipaza.

The specific identification was carried out by examining the external morphological characteristics visible in the photographs and comparing these with the information found in the relevant literature (Tchang Si, 1931; Trainito & Doneddu, 2014; Oskars *et al.*, 2019; Rufrey *et al.*, 2021; Wigham, 2022; Lombardo & Marletta, in press) and online sources (Cervera, 2002; Rudman, 2002). Of the three specimens documented in this study, only the one identified as *Haminoea cf. hydatis* is held in the private collection of one of the authors (J.C.). For the other two specimens (*Phyllidia flava* and *Berthellina cf. edwardsii*), only photographic material was available.

3. RESULTS

On the 7th of June 2014, one specimen of *Phyllidia flava* was found and photographed on Agueli Island (province of Algiers), at a depth of 15 m. The specimen, of which only the dorsal part of the notum was visible, had a yellowish-orange colouration, with white tubercles of varying sizes. It was observed on a substrate characterised by the presence of Dictyotales, encrusting calcareous red algae, sponges and tunicates, strongly covered in detritus (Fig. 2a).

On 1 June 2017, one specimen of *Berthellina cf. edwardsii* was discovered and photographed at Cap Caxine beach (province of Algiers), at a depth of 10 m. The animal was

orange and had a slightly wrinkled notum. As the animal was active (crawling), it was possible to observe its trapezoidal oral veil and the pair of rolled rhinophores. The substrate on which the animal was found consisted mainly of Dictyotales (also covered by detritus, sand and filamentous algae/cyanobacteria), accompanied by encrusting calcareous red algae and sand (Fig. 2b).

On 25 July 2026, one specimen of *Haminoea cf. hydatis* (Fig. 2c-f) was found just below the surface of the water in port of Tipaza area. The specimen's body was characterised by brown-grey patches of varying sizes. Its cephalic shield was trapezoidal, with a small central indentation on the anterior margin and a deeper central indentation on the posterior margin. The posterior indentation divided the posterior portion of the cephalic shield into two small, non-overlapping lobes, whose prominence varied depending on the degree of body elongation/contraction. The cephalic shield featured three dark brown areas: one (the largest) in the front-central region and one (slightly smaller) in each of the rear-lateral areas of the shield. The remaining areas of the cephalic shield were colourless and/or pigmented with light brown patches. The eyes were located on the lateral edge of the anterior-central dark patch. When extended, the parapodia, reached only the anterior/medial part of the shell.

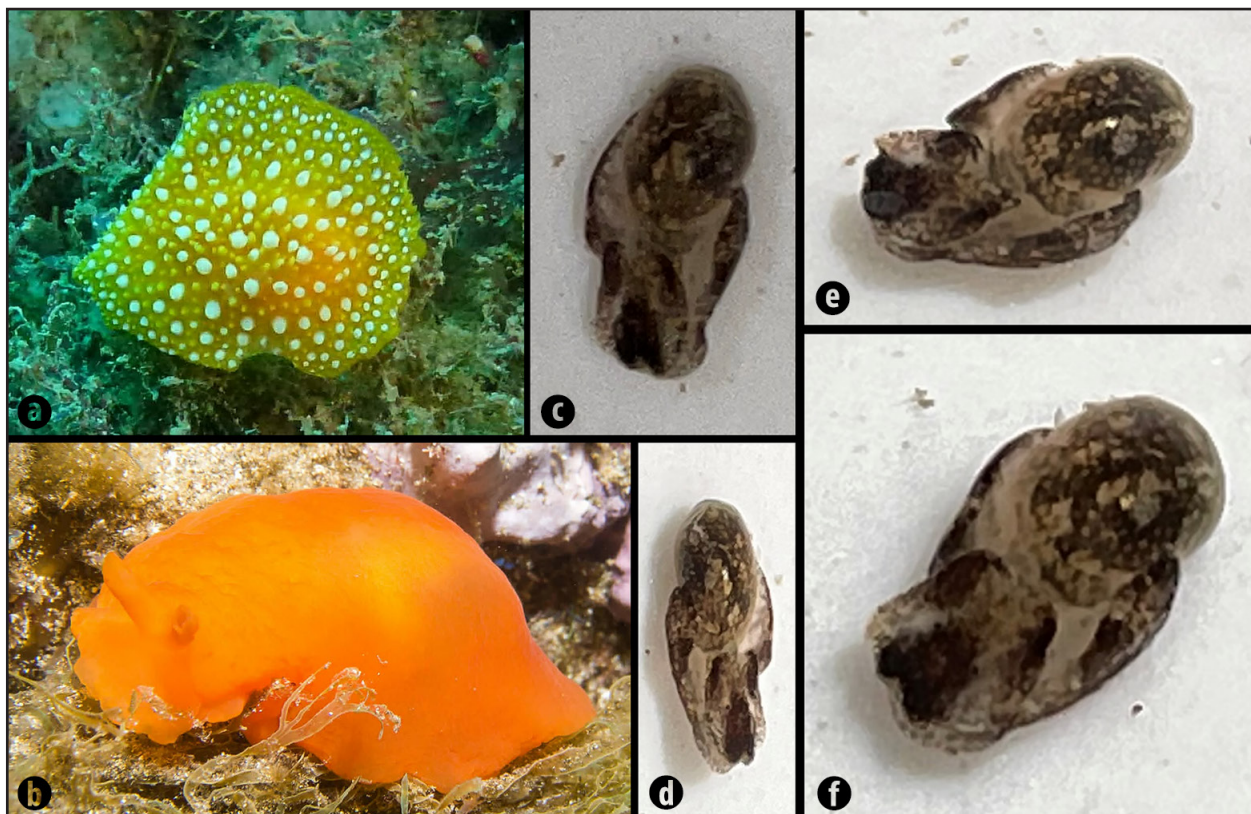


Fig. 2. (a) *Phyllidia flava* specimen in dorsal view (N. Kouaci's photo); (b) *Berthellina cf. edwardsii* individual in left dorso-lateral view (N. Kouaci's photo); (c) *Haminoea cf. hydatis* specimen (8 mm in length) (slightly elongated antero-posteriorly) in dorsal view; (d) the same in a more elongate aspect; (e) the individual in dorsal view; (f) dorsal view of the specimen, the trapezoidal shape of the cephalic shield can be noted (J. Chabane's photos).

Their outer surface showed an irregular pattern of brown patches and colourless areas, whereas the inner surface was colourless. The mantle, visible through the transparency of the shell, exhibited almost the same colour pattern as the outer surface of the parapodia. However, several greyish areas stood out amongst the mottled area. The animal was found on top of a mooring rope heavily colonised by algae, tunicates, sponges and other sessile fouling organisms.

4. DISCUSSIONS

The specimens documented in the present study belong to species that are generally well known within the Mediterranean basin and which, in addition to a Mediterranean-Atlantic distribution, are found in typical habitats with geographically variable frequencies.

Specifically, *Phyllidia flava*, the most recognisable of the three species, has a primary Mediterranean distribution (Cattaneo-Vietti *et al.*, 1990; Brunkhorst, 1993; Trainito & Doneddu, 2014) that extends to the Atlantic region of Macaronesia (Debelius & Kuitert, 2007; Hart & Wirtz, 2013). This species is typically associated with pre-coraligenous (Cattaneo-Vietti *et al.*, 1990) and coraligenous (Salvador, 2020) environments, and is characterised by a highly variable frequency of occurrence; depending on whether large areas are considered [where it is regarded as relatively/fairly common (Cattaneo-Vietti *et al.*, 1990; Salvador, 2020; Girard & Girard, 2024)] or more localised areas [where it is rare (Lombardo & Marletta, in press) or very rare (Lipej *et al.*, 2018)]. *Berthellina edwardsii* has a geographical distribution ranging from the Atlantic coasts (from France to Angola) to the entire Mediterranean basin (Lipej *et al.*, 2018). Nevertheless, it is thought that this species is also present in the Macaronesia region (Cervera *et al.*, 2004) and in the United Kingdom (Picton & Morrow, 2023). Other authors even consider this species to be cosmopolitan (Trainito & Doneddu, 2014). It is typically nocturnal species that can be found during the day in sheltered habitats, including caves, crevices, fissures, and beneath rocks (Calado & Silva, 2012; Lipej *et al.*, 2018; Salvador, 2020; Lombardo & Marletta, 2024). The abundance of this species varies considerably depending on the area in question [from uncommon (Lombardo & Marletta, 2024) to rare (Girard & Girard, 2024) or very rare (Lipej *et al.*, 2018; Lombardo & Marletta, in press)]. *Haminoea hydatis* occurs from Norway to the Mediterranean (including the Macaronesian islands) (Tchang Si, 1931; Nordsieck, 1972; Lipej *et al.*, 2018; Wigham, 2022). It is a nocturnal species (Lipej *et al.*, 2018; Rufrey *et al.*, 2021; Wigham, 2022) typical of shallow environments with abundant algal cover (it lives amongst algae) (Tchang Si, 1931; Salvador, 2020), although it can also be found in sandy/muddy habitats (always with algae) (Bielecki *et al.*, 2011; Lipej *et al.*, 2018; Wigham, 2022). This species exhibits varying abundances depending on the area in question; for example, it is considered common in the Mediterranean whilst rare along the Atlantic coasts (Tchang Si, 1931). It appears to be abundant in favourable habitats

amongst algae in shallow areas (Tchang Si, 1931; Salvador, 2020), harbours (Tchang Si, 1931) and lagoons (Girard & Girard, 2024), and rare elsewhere (Girard & Girard, 2024).

The findings reported here, considering the relative abundance of the three species in the Mediterranean basin and the taxonomic difficulty associated with two of them (i.e., *Berthellina edwardsii* and *Haminoea hydatis*), further highlight the limited knowledge of sea slug diversity along the Algerian coast. Indeed, this first record of three species that are relatively common in the Mediterranean basin and typical of habitats also found in the area under consideration highlights the clear historical lack of research dedicated to sea slugs along the Algerian coast. This also underscores the fact that only underwater photography enthusiasts have shown an interest in these molluscs. On the other hand, the discovery of cryptic species by enthusiasts and documented solely through photographs makes their identification considerably more complex than it ought to be, unless properly guided by experts. An example of this can be seen in the case of the specimen identified here as *B. cf. edwardsii*, a species whose external morphology is virtually identical to that of another Pleurobranchida, *Berthella aurantiaca* (Risso, 1818). This striking similarity in the external morphology of these two species makes their identification particularly difficult unless the animals are dissected (Cervera, 2002; Bielecki *et al.*, 2011; Trainito & Doneddu, 2014; Lipej *et al.*, 2018; Salvador, 2020). Nevertheless, an empirical method has been proposed that would allow the two species to be distinguished when examination of the internal parts is not possible (Cervera, 2002; Rudman, 2002). However, this method (which can be easily carried out underwater by the person who finds the specimen) must be known to those who search for or document sea slugs underwater, and it is precisely at this point that the expertise of a specialist comes into play, as they can guide the enthusiast in applying these methods. However, this ideal scenario did not occur in the case of the specimen presented here, which could therefore only be tentatively identified visually, without the aid of either the aforementioned empirical method or morphological (dissection) and/or molecular analyses. A very similar case concerns the third of the specimens reported here, identified as *Haminoea cf. hydatis*. In this case too, the species bears a strong resemblance to another member of the family Haminoeidae Pilsbry, 1895, *Haloe japonica* (Pilsbry, 1895) (Rufrey *et al.*, 2020), which, however, is not native to the Mediterranean (Hanson *et al.*, 2013). Nevertheless, unlike the previous example, there are external morphological characters (e.g., the length and overlap of the posterior processes of the cephalic shield) that allow the two genera of the species in question to be distinguished with a certain degree of accuracy (Oskars *et al.*, 2019). Consequently, by examining the various photographs in our possession (not just one, as in the case of *B. cf. edwardsii*) and reviewing the relevant literature, it has been possible to carry out the identification with a certain degree of accuracy.

Taking into account what has been highlighted so far, together with the historical and bibliographical analysis concerning the informal group of sea slugs along the Algerian coast presented by Lombardo *et al.* (2026), it is clear that there is a huge knowledge gap regarding this area. The 2,148 km length of the Algerian coastline (El Watan, 2023), the high marine biodiversity in this area (CAR/ASP-PLUE/PAM, 2015; MEER & SPA/RAC-UN Environment/PAM, 2018) and the fact that one of the Mediterranean's most important surface currents (the Algerian Current) flows along it (Millot & Taupier-Letage, 2005), make this knowledge gap regarding the area's sea slug fauna all the more serious, given the coast's high biogeographical importance. Nevertheless, the recently initiated research, which has involved collaboration between

Algerian marine life enthusiasts and sea slug experts (Lombardo *et al.*, 2026), offers hope that this knowledge gap will be narrowed and that data on these marine organisms will increase. The findings presented here therefore represent, in their own small way, a continuation and confirmation of this special collaboration, which we hope will continue and grow in the years to come.

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