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A. RAMOS-ESPLA, O. OCAÑA

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A striking morphotype of *Aplidium proliferum* (Milne Edwards, 1841) (Asciidiacea: Polyclinidae) from the Strait of Gibraltar

A. A. RAMOS-ESPLA¹ and O. OCAÑA²

¹ Marine Research Centre (CIMAR), University of Alicante, 03080 Alicante, Spain

² Museo del Mar de Ceuta, Muelle España, s/n, 51001 Ceuta, Spain

Corresponding author: Alfonso.ramos@ua.es

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Abstract

An unusual colonial ascidian with 1-2m in length, belonging to the genus *Aplidium* (Asciidiacea: Polyclinidae), has been sampled from the Strait of Gibraltar (Ras Leona, Morocco). The characteristics of the colony, zooids and larvae point us to *A. proliferum*. The species seems common in the NE Atlantic from the Shetland Islands to Mediterranean Sea, but the length of colonies found in the Strait this area have not previously been observed. Probably, it is one of the longest ascidians reported worldwide.

Keywords: Keywords: Asciidiacea, Polyclinidae, *Aplidium*, colony size, Strait of Gibraltar, Mediterranean Sea.

Introduction

Aplidium is the genus with the greatest number of known species of the class Asciidiacea, with 280 spp. (Asciidiacea World Database: www.marinespecies.org/ascidiacea 2016). It is distributed worldwide from the poles to the tropics, in mainly littoral waters, although one species has been sampled at 4500m depth (*A. enigmaticum*; Monniot & Monniot, 1984). *Aplidium* colonies show high plasticity to physical (hydrodynamics and sedimentological), biological (competition) and anthropogenic environmental changes (Naranjo *et al.*, 1996).

Within the *Aplidium* genus, *A. proliferum* is one of the commonest Polyclinidae species in the NE Atlantic (Berrill, 1950; Millar, 1966), although it is subject of discussion regarding synonymy with *A. nordmanni* (Thompson, 1934; Berrill, 1950, Kott, 1952; Millar, 1970). These two species are differentiated mainly by their zooid system and colony shape of the colony: regular systems (star-shaped) and flat-topped colonies in *A. nordmanni*, vs. irregular or non-conspicuous systems and a variety of colony shapes (stalked, massive, encrusting, etc., not flat-topped) in *A. proliferum*. Pending further studies to confirm the possible synonymy or not, we consider them two different species. Up to present, its length have never exceeded 10cm (Milne-Edwards, 1841; Harant & Vernières, 1933; Millar, 1966, Fiala-Medioni, 1970), so the colonies (1-2m in length), founded at Ras Leona (Morocco), are very surprising.

Aplidium proliferum (Milne Edwards, 1841) (Figs. 1,2)

Amaroucium proliferum Milne Edwards, 1841: 283; pl. 1, figs. 3, 3a; pl. 3, fig. 2a-2d. Della Valle, 1877: 34. Lahille, 1890: 222, fig. 115 vi. Alder & Hancock, 1912: 7; figs. 90-91; pl. 52; pl. 53, figs. 1-3; pl. 56, fig. 2. Hart-

meyer, 1924: 211. Harant & Vernières, 1933: 88. Thompson, 1934: 36; pl. 35, pl. 35, figs. 6-7; chart 35. Pérès, 1956: 290, 295.

Aplidium proliferum: Berrill, 1950: 102; fig. 29. Kott, 1952: 74; fig. 2-H. Millar, 1966: 27; fig. 15; Millar, 1970: 29. Turon, 1987: 91; figs. 28, 72, 73, 99. Ramos-Esplá, 1988: 47, carta 1. Vázquez, 1993: 92; Fig. 11; Naranjo, 1995: fig. 16.

Amaroucium aureum Milne Edwards, 1841 (*sensu* Lahille, 1890: 224).

Amaroucium papillosum Alder, 1863 (*sensu* Berrill, 1950: 103):.

Amaroucium roseum Della Valle, 1877 (*sensu* Lahille 1890: 223)

Amaroucium commune + *A. torquatum* Drasche, 1883 (*sensu* Lahille, 1890: 224)

Amaroucium willi+*A. rodriguezii*+*A. fimbriatum*+*A. robustum* Heiden, 1894 (*sensu* Pérès, 1956: 290).

Amaroucium gelatinosum: Fiala-Medioni, 1970: 301; pl. VI.

? *Amaroucium simulans* Giard, 1872 (*sensu* Lahille, 1890: 222)

Material examined: The colonies were observed (03/06/2009) between 18 to 23m depth, in a coralligenous community (dominated by *Paramuricea clavata*, *Eunicella* spp., *Astroides calycularis*) by SCUBA diving at Ras Leona (N35°54'56.46"- W05°23'51.26": Strait of Gibraltar, Morocco). One colony was sampled, anaesthetised with menthol crystals and fixed with 10% formalin in seawater. Some zooids have been dissected, stained with Masson's haemalum and mounted on permanent slides. The specimen is deposited at the Marine Research Centre of the University of Alicante (code: Apl-pro-Mr-01).

Colonies: Stalked and cylindrical in shape, cord- or rope-like, very long (1-2m in length and 15-25 mm in diameter), with 3-5 colonies/stalk (Fig. 1a,c). They are normally attached to the gorgonian *Paramuricea clavata* (Fig. 1b,c). Living colonies are cream or yellowish showing the red or orange spots of the zooids (Fig. 1d). The tunic is fleshy with a gelatinous consistence, without sand. Preserved colonies are light brown to pinkish with white spots (thorax of zooids). There are not conspicuous systems, although long channels appear between zooids.

Zooids: Mature zooids are 10-12mm in length; the post-abdomen is joined to abdomen without a distinct narrow stalk (Fig. 2a,b) and greater than or equal in length to the thorax + abdomen ($T/A/P = 2/1/3-4$). The oral siphon has 6 lobes (a few zooids with 8 lobes); the atrial aperture is short and slightly denticulate, situated at the level of the 2nd row of stigmata, and surmounted by a long simple atrial languet (Fig. 2a); oral tentacles are simple, short and curved, 10-12 in number. The branchial sac presents 12-13 rows of stigmata without papillae in the transverse vessels, and 19-20 stigmata per half row in the middle of the thorax (Fig. 2a). The gut begins with a wide and short oesophagus; the stomach is cylindrical with 20-22 pronounced interrupted vertical folds (Fig. 2c,d); the post-stomach is narrow and short, and the rectum ends at the level of the 8th row of stigmata row.

The ovary is located near to the gut; and the testes are arranged in biserial row, posterior to the ovary (Fig. 2b).

Larvae: 0.7mm in trunk length (Fig. 2e). They have 3 adhesive papillae arranged vertically; 3 small epidermal conical ampullae between the papillae, surrounded by lateral epidermal vesicles with different sizes.

Distribution: Shallow-dwelling species from intertidal to 75m depth (Pérès, 1956) on different substrata (e.g. rock, gravel, macrophyta, gorgonians, solitary ascidians). The species is distributed (Fig. 3) from the NE-Atlantic Boreal (Thompson, 1934, Berrill, 1950; Millar, 1966) and Atlantic-Mediterranean regions, through the Lusitania province (Milne-Edwards, 1841; Lahille, 1890; Kott, 1952; Harant & Vernières, 1933; Saldanha, 1972; Vázquez, 1993), to the Mediterranean Sea. In the Mediterranean, the species has been reported in the Strait of Gibraltar (Pérès, 1959; Naranjo, 1995); Alborán Sea (Ramos-Esplá, 1988; Sánchez-Tocino *et al.*, 2009); Balearic Islands (Heiden, 1994; Pérès, 1959), Gulf of Lyon (Lahille, 1890; Daumézou, 1909; Harant & Vernières, 1933; Fiala-Médioni, 1970; Turon, 1987); and the Tyrrhenian (Della Valle, 1877; Salfi, 1931), Ionian (Pérès, 1956; Tursi, 1976) and Adriatic Seas (Drasche, 1883; Mastrototaro & Tursi, 2010). It has not been observed in the Aegean and Levantine Seas.

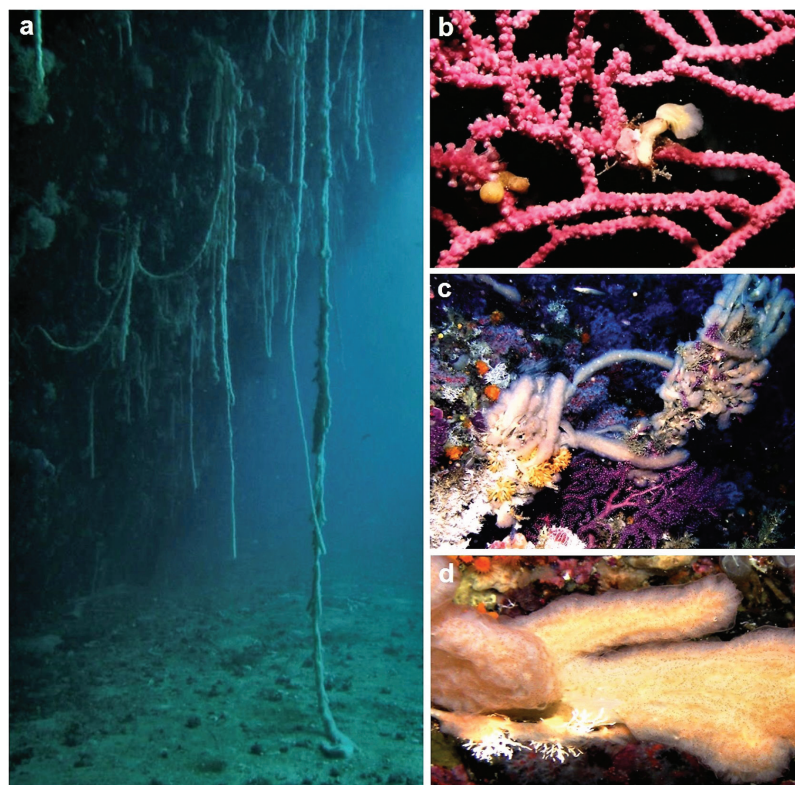


Fig. 1: Living colonies of *Aplidium proliferum* from Ras Leona (Strait of Gibraltar, Morocco) at 22-25m depth: a) long colonies in the form of strings or ropes; b) small pioneer colonies attached to *Paramuricea clavata*; c) development of colonies on *Paramuricea*; d) detail of the colony.

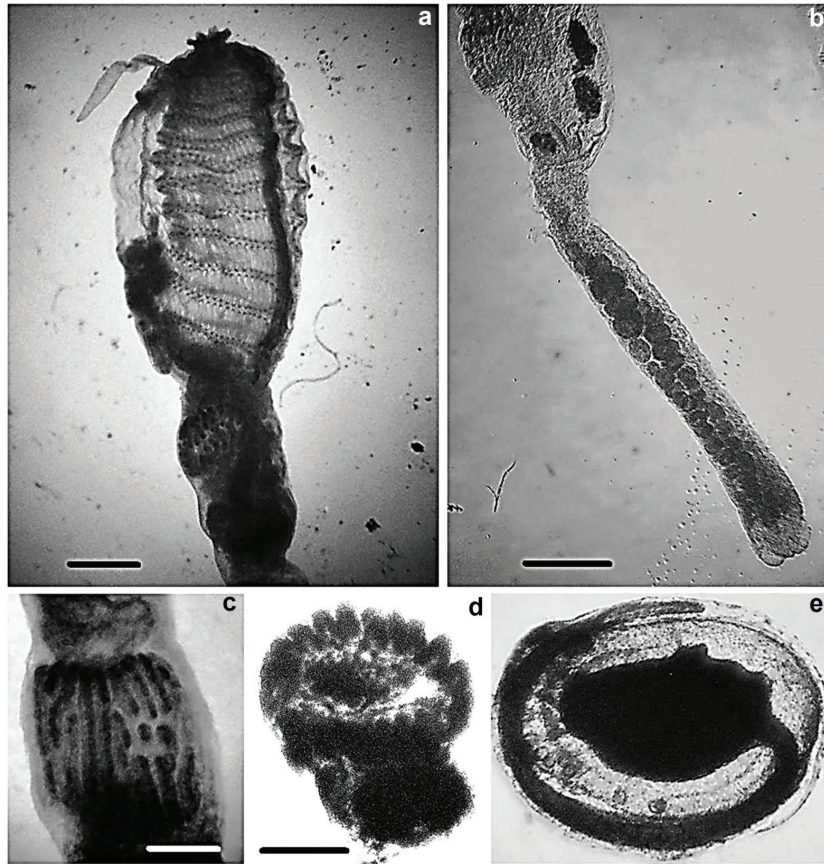


Fig. 2: Zooids and larva of *Aplidium proliferum*: a) thorax and abdomen; b) postabdomen with ovary and testes; c) stomach with interrupted folds; d) transversal dissected stomach, showing the inner wall with folds; e) young larva. Bars: a, b = 500 μm ; c,d,e = 250 μm .

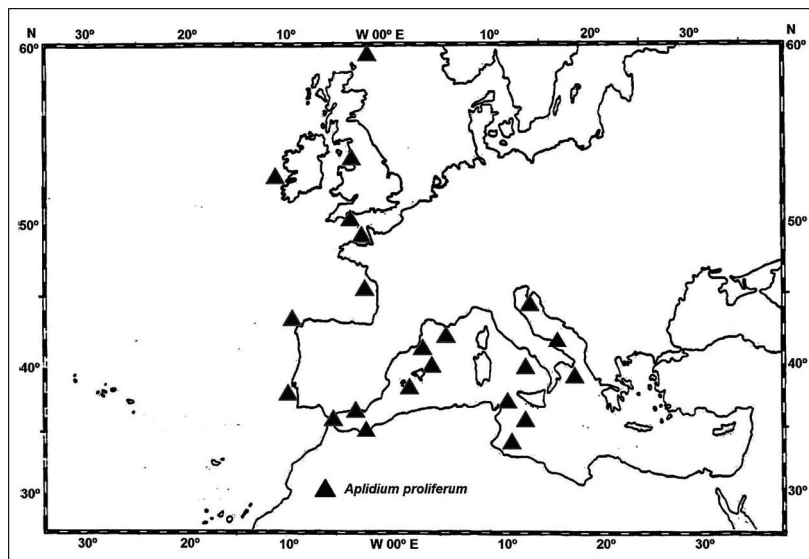


Fig. 3: Distribution of *Aplidium proliferum* (from different authors).

Remarks

A. proliferum presents a wide polymorphism in shape, colour and consistency of the colony, zooids length, number of rows of stigmata and number of stomach folds (Table 1). This is seen in the large number of

synonyms received by the species. However, they all have in common: i) irregular or non-conspicuous systems; ii) zooids with a simple pointed atrial languet; iii) numerous stomach folds, some of them interrupted or branched. Colony shape varies from encrusting to erect (cushion, pedunculated, pillow, etc) depending on their

Table 1. *Aplidium proliferum*: Maximum size of colonies and some characteristics of the zooids from some authors. (OS) oral siphon; (+) present.

Author	Max. size colonies (cm)	Lobes OS	Stigmata rows	N Stigmata/ ½ row	Stomach folds
Milne Edwards, 1841	2.5	6	10-15	-	+
Della Valle, 1877	4	6	10	-	+
Lahille, 1890	-	6	10	-	+
Drasche, 1893	-	6	-	-	+
Heiden, 1894	8	6-8	10-18	-	+
Alder & Hancock, 1912	2,5	6	14	-	+
Salfi, 1931	-	-	10-12	-	+
Thompson, 1934	5	-	12-14	-	30-40
Berrill, 1950	5	-	12-14	-	30-40
Kott, 1952	-	-	8-11	10-16.	20-25
Pérès, 1956	-	6-8	10-17	-	>20
Millar, 1966	5	-	12-14	-	30-40
Fiala-Medioni, 1970	10	6	10-18	-	>20
Turon, 1987	5	-	15-18	<30	40
Ramos-Esplá, 1988	3	6	8-9	15-17	24-28
Vázquez, 1993	2	-	9-13	16	21-24
Naranjo, 1995	4	-	10-14	18	20-28
Present work	200	6-8	12-13	19-20	20-22

physical and biological environment (hydrodynamism, sedimentation, competition, etc). However, due to this morphological diversity, *A. proliferum* could be a group of species that needs other complementary studies (such as molecular taxonomy). The morphotype of elongated cords is seen in some ascidian families such as Didemniidae and Holozoidae (Millar, 1971; Monniot et al., 1991), in which it may constitute an asexual reproduction strategy. The most striking case is *Distaplia cylindrica* from the Southern ocean, that can reach 7m in length (Kott, 1969), and whose colonies break and float away to colonise new substrates.

With regard to the development of colonies and zooids, Vázquez (1993) found developed gonads off the NW Iberian Peninsula between May to August. Pérès (1959) reported immature colonies in September in Ceuta (Strait of Gibraltar) derived from oozoids. However, immature zooids in late August (NE Iberian Peninsula) and April (Alboran Sea) were documented respectively by Turon (1987) and Ramos-Esplá (1988). In the present study, long colonies were observed in late spring (June) with mature zooids and larvae; and small colonies in early autumn (October), with immature zooids growing on branches of the gorgonian *Paramuricea clavata*. The ascidian is able to grow while firmly attached around the gorgonian branches.

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