# The non-indigenous ascidian *Distaplia bermudensis* in the Mediterranean: comparison with the native species *Distaplia magnilarva* and *Distaplia lucillae* sp. nov.

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Three species of *Distaplia* from the Mediterranean are described: *D. bermudensis* is a species introduced from the western Atlantic Ocean, which principally differs from the native *D. magnilarva* in having hermaphroditic zooids. The new species *D. lucillae* differs from the preceding ones in the structure of its stomach wall which is regularly plicated both externally and internally. *Distaplia lucillae* has colonies with hermaphroditic, but only male ripe, zooids and exclusively female colonies; this is a condition closely related to *D. magnilarva* though different. A key to European *Distaplia* is provided.

## INTRODUCTION

The non-indigenous ascidian Distaplia bermudensis from the western Atlantic Ocean was found for the first time in the year 2000 in the Taranto Seas (Ionian Sea, southern Italy) (Figure 1) where an abundant population of beautiful colonies is present. In the Taranto Seas D. bermudensis occurs on natural and artificial hard substrata at depths of 0.5 to 3.5 m. This species may have entered the Mediterranean as a fouling organism on ships' hulls. Distaplia bermudensis was first described from Bermuda (Van Name, 1902) and subsequently widely reported from elsewhere in the western Atlantic Ocean (Van Name, 1945; Plough, 1978) including Brazil (Millar, 1958, 1977; Rodrigues & da Rocha, 1993; da Rocha, 1998), from the Caribbean (Millar, 1962), Guyana (Millar, 1978), and Guadalupe (Monniot, 1983). It was reported again from Bermuda by Monniot (1972). Wishing to compare this species with the native D. magnilarva, a search among the samples collected in past years by the second author was performed; specimens identified as 'Distaplia sp.' were found and recognized as a new species. We describe these three species here; a key to the European Distaplia is given.

# SYSTEMATICS

Order ENTEROGONA Suborder APLOUSOBRANCHIA Family HOLOZOIDAE Genus Distaplia

Distaplia bermudensis Van Name, 1902 (Figures 2 & 3)

Material examined

Several colonies from the Taranto Seas (Mar Piccolo and Mar Grande) since 2000.

Description

The colonies may be capitate (young small colonies, Figure 2A) or form an encrusting sheet which may reach a diameter of about 20 cm or more (Figure 3). The colour of living colonies sampled in the Taranto Seas varied from pale brown to dark violet with evident white rings around the orifices (Figure 3). Zooids are about 5 mm in length and arranged in circular or radiating systems. Oral siphon smooth-edged or merely irregularly sinuate. Atrial aperture large with a simple dorsal languet. Tentacles, 8-9, triangular and very small. Four rows of stigmata with parastigmatic vessel. About 20 stigmata per half-row. Dorsal languets on the left side at a distance of 2-3 stigmata from the dorsal vessel. The ovate stomach with a small pyloric end is smooth walled. A gastric reservoir of the pyloric gland is present. The intestine is not differentiated and ends with a bilobed anus at the level of the third interstigmatic vessel. As reported by Berrill (1948, p. 258) ampullae are present in the vascular process which extends into the common test from the posterior end of the abdomen. The zooids are hermaphroditic, the ovary is on the right of the testis at its centre. The vas deferens surpasses the anus a little. The oviduct continues with the brood pouch generally containing about three embryos. These sacs separate from the parent and survive in the common test. The mature larva has a trunk of about 0.8 mm length and a relatively short tail (about 1.5 mm) in which the oozooid is completely formed. The sensory vesicle contains an otolith and an ocellus. The three adhesive organs are on a ventral process of the trunk. They present four ampullae at their bases: one in each dorsolateral organ and two in the medioventral one.

#### Remarks

Our observations are in good agreement with the original (Van Name, 1902) and subsequent descriptions of the species (Van Name, 1945; Berrill, 1948; Plough, 1978). It is 'the commonest species on the Atlantic continental shelf' (Plough, 1978, p. 60) and 'extrêmement commune'



Figure 1. Map of the Taranto Seas (Mar Grande and Mar Piccolo).

in Bermuda (Monniot, 1972, p. 961). It lives at shallow depths and being sunlight-proof goes up to the suface. The only difference between the Italian and American populations regards the zooid size which is larger in our samples. However, the difference is not so important (over 3 mm in Van Name, 1945, p. 146 versus our  $\sim 3$  mm). It is probably a specific variability enhanced by the environmental conditions. A high variability in zooid size was also observed by Monniot (1972, p. 961) in the Bermuda population ('la taille des zooides varie aussi enormêment selon les colonies'). The other differences in larva size are probably due to their different development degrees. *Distaplia bermudensis* is certainly a relatively recent immigrant, its hermaphroditic zooids being easily distinguishable from the native *D. magnilarva*.

## Distaplia magnilarva Della Valle, 1881 (Figure 4)

## Material examined

One colony (female phase) Kvar Island (north-east Adriatic coast, water depth 28 m) 10 August 1983; two colonies (male phase) north Adriatic (on an outcrop, coordinates: 45°20'15"N 12°43'30"E, water depth 23 m) 26 June 1990.

#### Description

Colonies are capitate with one or more heads. Zooids are about 7 mm long, in double rows systems converging in a common cloaca at the summit of the head. Oral siphon with six small shallow lobes. Tentacles, about 15, finger-like of two sizes. Thirty to 35 stigmata per half row. Four rows of stigmata with parastigmatic vessels. Stomach both externally and internally smooth walled, intestine not differentiated, bilobed anus at the level of the third interstigmatic vessel. Gastric reservoir of the pyloric gland present. Zooids unisessuate: all zooids of the same colony are males or females. Testis on the right of the intestinal loop with several testicular follicles some of which may protrude out the left side. The spermaduct ends a little beyond the anus. The ovary, in the form of a cluster of ovocytes, is also on the right of the intestinal loop. The mature larva has a trunk of about 1.5 mm and a tail of about 2.5 mm in length. The three adhesive organs have a peculiar form with an enlarged base but without ampullae. They are on a ventral process of the trunk.

#### Remarks

The morphology of the adhesive organs observed by us agrees with the original accurate description and figure by Della Valle (1881). On the contrary, Berrill (1948) showed the adhesive organs with an ampulla at their bases. Therefore the tadpole larva of *D. magnilarva* would differ from those of *D. rosea* and *D. bermudensis*, apart from size, by having only one rather than two ampullae at the base of the medioventral adhesive organ. The absence of ampullae in the adhesive organs might indicate incomplete maturity of the tadpole larva. However, Della Valle observed several larvae through metamorphosis that are clearly described; he also drew fully mature larvae. Lahille



**Figure 2.** *Distaplia bermudensis.* (A) Colony; (B) system; (C1) zooid, right side; (C2) intestinal loop, dorsal view; (D) small vegetative individual not yet arranged in system, notice the ampullae on the vascular process and the small testis in the intestinal loop; (E) tentacles; (F1) immature larva; and (F2) mature larva.



**Figure 3.** Colony of *Distaplia bermudensis* photographed in the Mar Piccolo of Taranto (October 2003) at 0.5 m depth.



**Figure 4.** *Distaplia magnilarva.* (A) Colony; (B) tentacles; (C1 and C2) zooid, male phase: (C1) left side, (C2) right side; (D) zooid, female phase; (E) immature larva; and (F) mature larva.

(1890) drew the adhesive organ without ampullae and Salfi (1925), who carefully observed the genesis of the colony from the free-swimming larvae, confirmed Della Valle's observations. We believe that Berrill based his observations on material accidentally exchanged with other samples.

# Distaplia lucillae Brunetti sp. nov. (Figure 5)

## Type material

Holotype: the type material consists of the only known specimens, which are two colonies deposited in the Municipal Museum of Natural History in Venice, registration no. 16701 (North Adriatic Sea, on an outcrop, coordinates: 45°20'15"N 12°43'30"E; water depth 23 m). Collected by R. Brunetti, 25 April 1990.



1 mm

**Figure 5.** *Distaplia lucillae* Brunetti sp. nov. (A) Colonies (holotype); (B1) hermaphrodite zooid; (B2) intestinal loop of the same enlarged; (C) intestinal loop of female zooid; (D1) immature larva; and (D2) mature larva.

## Description

Colonies are capitate with one or more heads. The poor quality of the old material does not allow an accurate observation of the zooid disposition in the colony, however, a figure drawn at the time of collection shows the presence of double row systems converging at the summit of the head. Zooids are 4-5 mm long with a simple dorsal languet. Thirty to 35 stigmata per half row. The parastigmatic vessels are present, the stomach is very regularly plicated both externally and internally. The intestine presents a differentiated mid-intestine. No gastric reservoir of the pyloric gland was detected. Of the two colonies one was hermaphroditic and one exclusively female. In the first case the testis was a cluster of testicular follicles from the centre of which the spermduct originates. A cluster of unripe ovocytes was present in the centre and on the right of the testis. In the second case no trace of the testis was present and instead there was a cluster of ovocytes, one of which developed on the spot. No brood pouch was present but single developing embryos were found in the common test near the ripe zooids. The larva has a trunk about 1.2 mm long and a relatively short tail about 1.8 mm long. The three adhesive organs present an ampulla at their bases and are placed on a ventral process.

## Remarks

This new species is clearly defined by the structure of the stomach and the presence of colonies of exclusively female zooids lacking a brood pouch. The exclusively female zooid is a peculiar feature which is in common with D. magnilarva but in that species a brood pouch is present. Moreover, in the new species it is not correct to speak of unisexual colonies. The presence of a small ovary in the zooids with ripe testis indicate that the female phase is obtained by the ripening of this ovary at the same time as the testis completely regresses. A Distaplia colony with a plicated stomach was found in the Mediterranean Sea (south of Sicily) by Pérès (1956) and classified, on the basis of this single character, as Distaplia stylifera: however, the colony was unripe and the determination is not reliable. The new species presents a high number of stigmata per half-row, this character which the species presents in genus common with D. magnilarva is not frequent in Distaplia.

#### Etymology

This species is named after the second author's daughter Lucilla Brunetti.

The main differences among the three above discussed species of *Distaplia* are synthetically reported in Table 1.

**Table 1.** Main differences among the Distaplia species.

	D. bermudensis	D. magnilarva	D. lucillae sp. nov.
Number of stigmata/half-row	18–19 (Van Name, 1945) ~25 (Monniot, F., 1972) ~20 (present work)	30–35	30-35
Stomach wall	smooth	smooth	plicated
Intestine	not differentiated	not differentiated	differentiated
Gastric reservoir	present	present	absent
Ampullae on larval adhesive organs	1 on each dorsolateral a. org 2 on the medioventral a. org.	absent	l on each a. org

a. org., adhesive organ.

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#### CONCLUDING REMARKS

Three other species of Distaplia have been reported in the Mediterranean: D. rosea Della Valle, 1881, D. lubrica Drasche, 1883 and D. intermedia Heiden, 1893. The first, described again by Berrill (1948, 1950) and Millar (1970), was not found by us. It is a species also found on the English coasts and is characterized by a smooth walled stomach or with only short folds or marks and hermaphroditic zooids with a peduncled ovary below the testis. Its larva is like that of D. bermudensis but smaller (Berrill, 1948). Distaplia lubrica Drasche, 1883, from the north Adriatic, is known only from the original description which refers exclusively to the aspect of the colony, encrusting and mucous, with zooids arranged in circular systems. However, in Drasche's table IX, figure 8 an hermaphroditic zooid is shown: it presents an ovary below the testis that looks like that of D. rosea, a brood pouch and a reticulated stomach wall. Distaplia intermedia Heiden, 1893, originally poorly described and never redescribed, was considered by its author as an intermediate form between D. magnilarva and D. lubrica. It has unisexuate zooids like D. magnilarva, of which it might be a junior synonym.

Outside of the Mediterranean but still in European waters three other species have been detected: *D. livida* (Sars, 1851) and *D. clavata* (Sars, 1851) from the Scandinavian coast (Millar, 1966) (for a description of these species see Van Name, 1945) and *D. corolla* F. Monniot, 1974 from the Azores Islands. *Distaplia garstangi* Berrill, 1947 recorded from Plymouth was later synonymized with *D. rosea* by Millar (1970).

#### Key to European species of Distaplia

<ul> <li>1. Stomach smooth walled</li></ul>
plicated D. lucillae — Stomach with complete or broken ridges or markings 4
2. Brood-pouch present
3. Double row systems, zooids unisexuate D. magnilarva — Circular or radiating systems, zooids hermaphroditic D. bermudensis
4 Colonies encrusting 5
- Colonies as dome-shaped or globular masses basally
connected by test D. rosea
- Circular or radiating systems, zooids hermaphroditic
D. clavata
5. Systems absent D. livida — Systems present D. lubrica
-/

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