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A new Antarctic *Osthimosia* (Bryozoa, Cheilostomata, Celleporidae) with dimorphic zooids

Juan López Gappa · María G. Liuzzi

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Abstract *Osthimosia chaotica* sp. nov., a new celleporid cheilostome bryozoan, is described from samples collected in the South Shetland Isles and the Antarctic Peninsula. It differs from other Antarctic and Subantarctic species of the genus *Osthimosia* in the absence of vicarious avicularia, the characteristic development of its peristome and the reduced size of the primary orifice of the ovicelled zooids compared to those of autozooids. The occurrence of sexual polymorphism in the Bryozoa is discussed. The new species lives on laminar and filamentous algae.

Keywords *Osthimosia* · Cheilostome bryozoan · Sexual dimorphism · New species · Antarctica

Introduction

The bryozoan family Celleporidae is characterized by the presence of closely packed zooids lacking regular orientation, smooth frontal walls with only marginal pores, a primary orifice usually with a proximal sinus and adventitious avicularia often associated with a peristome. Vicarious, gigantic spatulate avicularia may also be present (Hayward and Ryland 1979; Gordon 1984).

Most Antarctic and Subantarctic Celleporidae belong to the genus *Osthimosia* Jullien (Hayward 1992, 1995), whose main diagnostic feature is the imperforate ovicellular entooecium and sometimes also the ectooecium. Many species of *Osthimosia* have been described based on material collected during oceanographic cruises to Antarctica and the Southern Ocean (Busk 1881, 1884; Jullien 1888; Waters 1904; Calvet 1904, 1909; Rogick 1959; Liu and Hu 1991; Hayward 1992, 1993). The biodiversity of the Antarctic *Osthimosia* has been summarized by Hayward (1995).

Although the Antarctic Peninsula is one of the most intensively surveyed areas of the Southern Hemisphere, we unexpectedly found an undescribed species of *Osthimosia* on laminar and filamentous macroalgae. The new species can be easily distinguished because the primary orifices of the ovicelled zooids are remarkably smaller than those of the remaining autozooids, an unusual feature for the family, which, however, had been previously found in another Antarctic *Osthimosia* (Rogick 1959). The existence of dimorphic zooids in the Celleporidae has remained unnoticed in recent diagnoses of the family. Therefore, our aim is to describe this new species and to highlight that sexual dimorphism has evolved in at least two species of Celleporidae.

Materials and methods

Antarctic samples of the branching seaweed *Ballia callitricha* (C. Agardh) Kützing were initially fixed in 5% formalin and later transferred to 70% ethanol. Bryozoan colonies were bleached with NaOCl. Specimens examined with scanning electron microscopy were coated with gold–palladium. The type material has been deposited in the collection of invertebrates of the Museo Argentino de Ciencias Naturales (MACN-In). Dry material on red algae stored in the phycological herbarium of the Museo Argentino de Ciencias Naturales (BA herbarium) was also examined.

J. López Gappa (✉) · M. G. Liuzzi
Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Ángel Gallardo 470,
Buenos Aires C1405DJR, Argentina
e-mail: lgappa@mail.retina.ar

Results

Osthimosia chaotica sp. nov

Description

Colony encrusting on algae, forming massive, irregular extensions (9.0 mm × 7.5 mm in the holotype). Zooids oriented in all directions, giving the colony a disorganized or chaotic general appearance (Fig. 1). Autozooids predominate in more elevated areas of the colony, while ovicelled zooids are relatively more frequent in depressions.

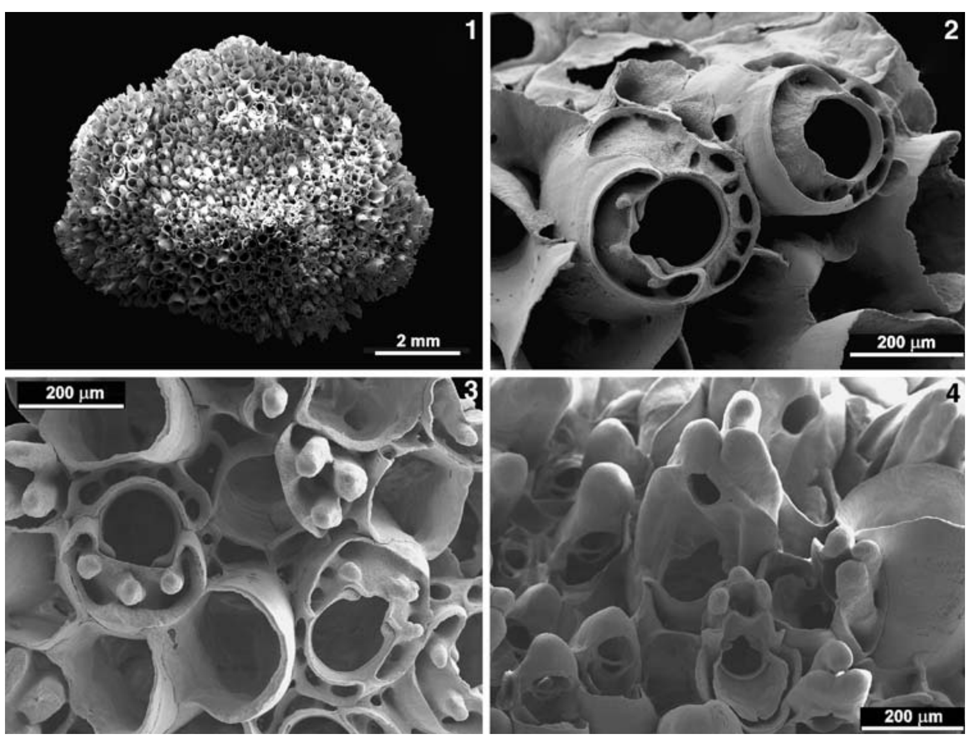
Autozooids smooth-walled, crowded, without spines. Marginal pores present. Primary orifice longer than wide, bearing a pair of well-developed condyles and a relatively wide U-shaped sinus occupying approximately one-third of orifice width (Fig. 2). Peristomes budding three rounded proximal tubercles (Figs. 2, 3) that increase in size to form three (less frequently four) blunt columns (Figs. 3, 4) that may coalesce during later ontogeny. On the suboral side of this structure there is a median avicularium perpendicular to the primary orifice (Fig. 4) with a complete crossbar and a frontally directed oval rostrum scarcely visible in frontal view. Avicularian cystid prolonged basally and connecting with the main autozooidal cavity through communication pores. Some suboral avicularia ending in a rounded apex, probably originated by fusion of the columns. Other adventitious or vicarious avicularia apparently absent.

Primary orifice of ovicelled zooids much smaller than those of the autozooids (Fig. 4), slightly wider than long, with a wide and shallow median sinus limited by conspicuous condyles, occupying approximately one-third of orifice width (Fig. 5). As in autozooids, the peristomes of ovicelled zooids bud three proximal tubercles during early ontogeny (Fig. 5). Peristomial avicularium usually ending in a rounded apex (Fig. 6), although up to three blunt columns can also be seen in some cases (Fig. 4). Ovicell nearly spherical. Ectooecium smooth, exposing a narrow, semilunar imperforate area of entooecium limited proximally by the peristome (Fig. 6). Communication pores occur at the base of the ectooecium (Fig. 5).

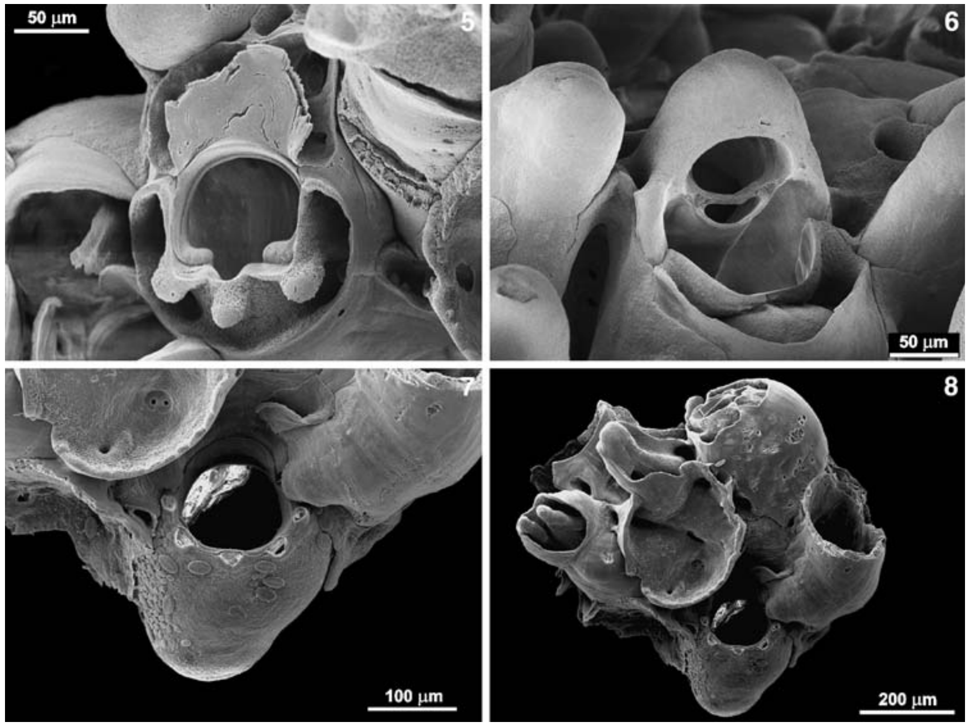
Polypide with 14 tentacles. Ancestrula tatiform, usually 0.34 mm long × 0.25 mm wide, with a subcircular opesia bearing five delicate erect spines around its proximal margin (Fig. 7). Distal margin apparently without spines. Plane of ancestrular opesia tilted towards the substratum distally. Early astogeny asymmetrical (Fig. 8), giving rise to a distally directed distolateral zooid, and later to a laterally directed zooid budding perpendicularly to the first one.

Material examined

Holotype: Potter Cove, King George Island, South Shetland Isles, Antarctica, 18 February 2006. One colony on *Ballia callitricha* (MACN-In 37489), coated with gold–palladium and illustrated in Figs. 1, 2, 3, 4, 5, 6. Leg. Liliana Quartino.



Figs. 1–4 *Osthimosia chaotica* sp. nov., holotype. **Fig. 1** Entire colony. **Fig. 2** Primary orifice of autozooid. **Fig. 3** Early ontogeny of autozooidal peristomes. **Fig. 4** Autozooids and ovicelled zooids, showing the different size of their primary orifices



Figs. 5–8 *Osthimosia chaotica* sp. nov. **Fig. 5** Holotype, early ontogeny of the ovicelled zooid. **Fig. 6** Holotype, fully developed ovicelled zooid showing the suboral avicularium and the semilunar exposed area of entooecium. **Fig. 7** Paratype, tatiform ancestrula showing the bases of the spines. **Fig. 8** Paratype, early astogeny

Paratypes: Same locality and date as holotype. Six colonies in different astogenetic stages on *Ballia callitricha* (MACN-In 37490).

Other material examined in the phycological herbarium of the Museo Argentino de Ciencias Naturales: Media Luna Island, South Shetland Archipelago (BA herbarium 13850, on *Gigartina* sp.). Melchior Archipelago (BA herbarium 19875, on *Gigartina* sp.; BA herbarium 19856, on *Plocamium* sp.). Esperanza Bay, Antarctic Peninsula (BA herbarium 15093, on *Plocamium* sp.).

Etymology

From the Greek *chaos*, alluding to the irregular arrangement of the zooids in the colony.

Remarks

Osthimosia chaotica sp. nov. differs from other Antarctic and Subantarctic species of this genus (see Liu and Hu 1991; Hayward 1992, 1995) in the absence of vicarious avicularia, the characteristic development of its peristome and the reduced size of the primary orifice of the ovicelled zooids compared to those of autozooids. It has only been found as epibiont on laminar and filamentous red algae, sharing this habitat with other cheilostome bryozoans, such as *Inversiula nutrix*, *Harpecia spinosissima* and several species of *Antarctothoa*.

Osthimosia chaotica sp. nov. resembles *O. milleporoides* (Calvet), another Antarctic species with sexual dimorphism. *O. milleporoides* was described and illustrated in detail by Rogick (1959) and scanning electron images of ovicells, peristomes and peristomial avicularia can be seen in Hayward (1995). Biometrical and morphological differences between both species are summarized in Table 1.

Discussion

Cases of sex-linked zooidal polymorphism are known in a variety of unrelated cheilostome bryozoans (Silén 1977). This feature reaches its highest expression in several members of the family Hippothoidae, where female and male zooids, usually of a smaller size, co-occur with autozooids in the same colony (Cancino and Hughes 1988; Moyano 1986; Wright et al. 2007).

Gordon (1968) found that male polypides of *Odontoporella bishopi* (as *Hippopodinella adpressa*, see Carter and Gordon 2007), a species belonging to the family Hippoporidridae, have fewer tentacles than in typical feeding autozooids. Differences, however, are restricted to the soft parts, because male zooecia are identical to the autozooecia. In *Hipporidra senegambiensis*, another member of the same family, two types of zooids are known (Cook 1968). Autozooids possess 12 ciliated tentacles, whereas cortical zooids have just six tentacles devoid of cilia. It is presumed that cortical zooids could be males, although no spermatozoa have been seen in living specimens.

The watersiporid *Uscia mexicana* has also dimorphic zooids. Typical autozooids are common throughout the

Table 1 Summary of biometrical and morphological differences between *Osthimosia chaotica* and *O. milleporoides*

	Osthimosia chaotica			*Osthimosia milleporoides*	
	n	$\bar{x}$	SD	$\bar{x}$	Range
Secondary orifice of autozooid, length	15	0.172	0.030	0.196	0.173–0.216
Secondary orifice of autozooid, width	15	0.195	0.037	0.192	0.166–0.216
Secondary orifice of ovicelled zooid, length	15	0.067	0.013	0.138	0.122–0.158
Secondary orifice of ovicelled zooid, width	15	0.128	0.010	0.126	0.101–0.158
Primary orifice of autozooid, length	20	0.206	0.010	–	–
Primary orifice of autozooid, width	20	0.165	0.010	–	–
Primary orifice of ovicelled zooid, length	20	0.096	0.013	–	–
Primary orifice of ovicelled zooid, width	20	0.104	0.011	–	–
Ovicell length	15	0.124	0.012	0.262	0.216–0.302
Ovicell width	15	0.199	0.020	0.235	0.187–0.274
Peristomial avicularium, length	20	0.109	0.012	0.080	0.072–0.086
Vicarious avicularia	Absent			Present	
Three to four peristomial tubercles/columns	Present			Absent	
Exposed entooecium	Narrow			Wide	
Peristomial avicularia	Pointing frontally, scarcely visible in frontal view			Pointing proximally, visible in fontal view	

Measurements in mm. Length and width of secondary orifice of autozooids and ovicelled zooids of *O. chaotica* exclude avicularium. Means and ranges of *O. milleporoides* from Rogick (1959) ($n = 10$)

colony. The second type, or B zooids, make up less than 1% of the autozooids and possess enlarged and reinforced opercula and augmented occlusor muscles. It is not known whether this dimorphism is related to sex (Banta 1969).

A more unusual case is the presence of dimorphic ovicelled zooids in the cribrilinid *Cribrilina annulata*. Regular ovicelled zooids occur in the basal layer of the colony, while frontally budded dwarf zooids (Powell 1967), almost invariably ovicelled, arise from distal and disto-lateral basal pore-chambers. A detailed anatomical study of these polymorphs revealed that they are simultaneous hermaphroditic autozooids possessing a feeding polypide (Ostrovsky 1998).

In the thalamoporellid *Thalamoporella evelinae*, the female zooids are shorter and wider (Soule et al. 1992) and have fewer tentacles than the sterile and male zooids (Marcus 1941).

Rogick (1959) was the first to note that the orifices of the ovicelled zooids of the Antarctic celleporid *Osthimosia milleporoides* have different shape and size than those of the autozooids, a fact that had been overlooked in the original description of the species (Calvet 1909). Sexual dimorphism, however, is apparently absent in many other southern species of *Osthimosia* (Uttley and Bullivant 1972; Moyano 1974, 1991; Hayward 1980, 1992, 1995; Gordon 1984, 1989; Taylor et al. 1989; Liu and Hu 1991).

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