

A new alien bryozoan *Celleporaria brunnea* (Hincks, 1884) in the Aegean Sea (eastern Mediterranean)

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SUMMARY: The ascophoran Bryozoa *Celleporaria brunnea*, a new record for the Mediterranean Sea, was found on *Mytilus galloprovincialis* collected in the inner part of Izmir Bay (Aegean Sea, Turkey) in September 2004. The species was previously reported from the Pacific coast of the United States. Its occurrence in the polluted inner part of Izmir Bay, near Alsancak Harbour, suggests that it has been newly introduced to the area, possibly via ship hulls. The morphological, ecological and zoogeographical characteristics of the species are given and discussed.

Keywords: introduced species, *Celleporaria brunnea*, Izmir Bay, Aegean Sea, eastern Mediterranean, Turkey.

RESUMEN: UN NUEVO BRIOZOO INTRODUCIDO *CELLEPORARIA BRUNNEA* (HINCKS, 1884) EN EL MAR EGEO (MEDITERRÁNEO ORIENTAL). – El briozoo ascoforo *Celleporaria brunnea*, especie nueva para el mar Mediterráneo, se encontró en *Mytilus galloprovincialis* recolectado en la parte interna de la bahía de Izmir (mar Egeo, Turquía) en septiembre de 2004. La especie se había reportado previamente en la costa del Pacífico de Estados Unidos. Su aparición en la parte interna contaminada de la bahía de Izmir, cerca del Puerto de Alsancak, sugiere que ha sido introducida en el área, posiblemente a través de los cascos de los barcos. En este trabajo se presentan y discuten las características morfológicas, ecológicas y zoogeográficas de la especie.

Palabras clave: especie introducida, *Celleporaria brunnea*, bahía de Izmir, mar Egeo, Mediterráneo oriental, Turquía.

INTRODUCTION

Non-induced movements of marine species between different biogeographical regions are an increasing trend worldwide (Por, 1971; Leppakoski, 1991; Gollasch, 2002; Paavola *et al.*, 2005). The Mediterranean Sea is one of the major recipients of alien species (Galil, 2000; Galil and Zenetos, 2002). The main vectors of introduction of alien species in the region are Lessepsian migration, shipping and aquaculture (Cognetti and Maltagliati, 2000). The opening of the Suez Canal in 1869 resulted in the migration of Red Sea species to the eastern Mediterranean basin (Por, 1971; Zibrowius, 1991).

According to Streftaris *et al.* (2005), Erythrean species entering the Mediterranean using the Suez Canal constitute a significant part (52%) of the exotic fauna and flora in the Mediterranean Sea, and within this zoobenthic organisms are the most important taxa, accounting for 70% of the aliens.

Particular conditions within ports, including eutrophication and pollution, may facilitate the establishment of alien species (Minchin and Gollasch, 2003; Galil, 2000). High food availability in ports may also facilitate the settlement of alien species (Koçak *et al.*, 1993). Most invasive species have an r-selected life history and their capacity to tolerate environmental stress allows them to become

established easily in new non-native habitats and to be competitively dominant over native species (Byers, 2002; McMahon, 2002; Ambrogi and Savini, 2003). In brackish waters, low species richness provides less competition and unoccupied niches for establishing species (Leppakoski and Olenin, 2000; Paavola, *et al.*, 2005).

Bryozoans are benthic colonial invertebrates in marine hard-bottom environments and some of them occur in hull fouling communities (Lewis *et al.*, 2004; Carlton, 1985; Gollasch, 2002). Several studies have been conducted on the bryozoan species collected from the Levantine Sea including the coasts of Israel (Powell, 1969a; Brood, 1980; d'Hondt, 1988), Lebanon (Bitar and Bitar, 2001), Turkey (Ünsal and d'Hondt, 1979) and Cyprus (Koçak *et al.*, 2002).

The present study provides a new distant locality for *C. brunnea*, and additional information about its morphological and ecological characters.

MATERIALS AND METHODS

The present results are part of a study carried out seasonally from July 2003 to September 2004 at four hard-bottom stations in Izmir Bay (Aegean Sea) (Fig. 1). At each station, three samples were taken at 0.2 m depth by scraping off an area of 400 cm² using a spatula. Material was fixed in 4% formaldehyde in the field and washed through a sieve with 0.5 mm mesh size in the laboratory. Afterwards, samples were sorted under a stereomicroscope and preserved in 70% ethanol. At all stations, bryozoan species

were determined at species level. In September 2004, a new alien bryozoan species, *Celleporaria brunnea*, was found on *Mytilus galloprovincialis* species at Station 4 near Çakalburnu Lagoon. Measurements of some parts of zooids were made using ocular micrometer. The autozooid morphology was illustrated by scanning electron microscope (SEM). The specimens are deposited at the Museum of the Faculty of Fisheries, Ege University (ESFM: Ege Üniversitesi Su Ürünleri Fakültesi Müzesi).

RESULTS AND DISCUSSION

Order CHEILOSTOMATIDA Busk, 1852
Suborder ASCOPHORINA Levinsen, 1909
Family CELLEPORARIIDAE Harmer, 1957
Genus *Celleporaria* Lamouroux, 1816
***Celleporaria brunnea* (Hincks, 1884)**
(Figs. 2A-D)

Holoporella brunnea Hastings, 1929: 731-732, pl. 16, Figs. 108-110; Osburn, 1952: 496-497, pl. 62, Figs. 10-12; Soule, 1961: 55-56; Soule and Soule, 1964: 38-40, Figs. 13-14.
Celleporaria brunnea Soule *et al.*, 1997: 267-268, pl. 101, A-C.

Material examined. Aegean Sea (Izmir Bay): Station 4 (38°24.780'N-27°02.020'E), Inciraltı, ESFM-BRY/04-1, 0.2 m, 14 September 2004 (temperature 21°C, salinity 38.6 psu, dissolved oxygen concentration 7.6 mg/l), 18 colonies on *Mytilus galloprovincialis*, serpulid and spirorbids.

Description. Encrusting colony with irregular autozooids (Fig. 2A). Mean autozoocial length, 442 µm, mean width 277 µm. Zoaria white to gray in colour. Opercula, sclerite of mandibles, base of spines dark brown. Frontal shield calcification smooth or finely granular with few small indistinct marginal pores. Boundaries distinct at growing edge. Primary orifice wider than long, with proximal concave border. Mean length of orifice 131 µm, mean width 154 µm (Fig. 2B). Distal border of primary orifice rounded, sometimes bearing a pair of tall, stout, widely spaced distal oral spines or more rarely three spines close to each other. Peristome more developed along proximal edge of orifice. A single, proximal suboral avicularium present on midline of orifice border, perpendicular to frontal plane. Rostrum oval, rounded with fine denticulations on distal rim (Fig. 2C). Columella absent, sclerites of mandible semielliptical, dark brown in colour. Vicarious avicularia abundant, measuring 328 µm long, 130 µm wide (Table 1). Rostrum parallel-sided, subspatulate, enlarged slightly through

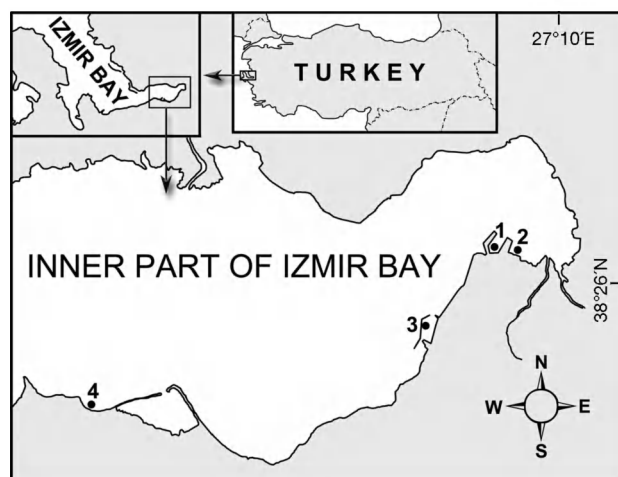


FIG. 1. – Map of the investigated area with the location of stations. *Celleporaria brunnea* was collected only at Station 4.

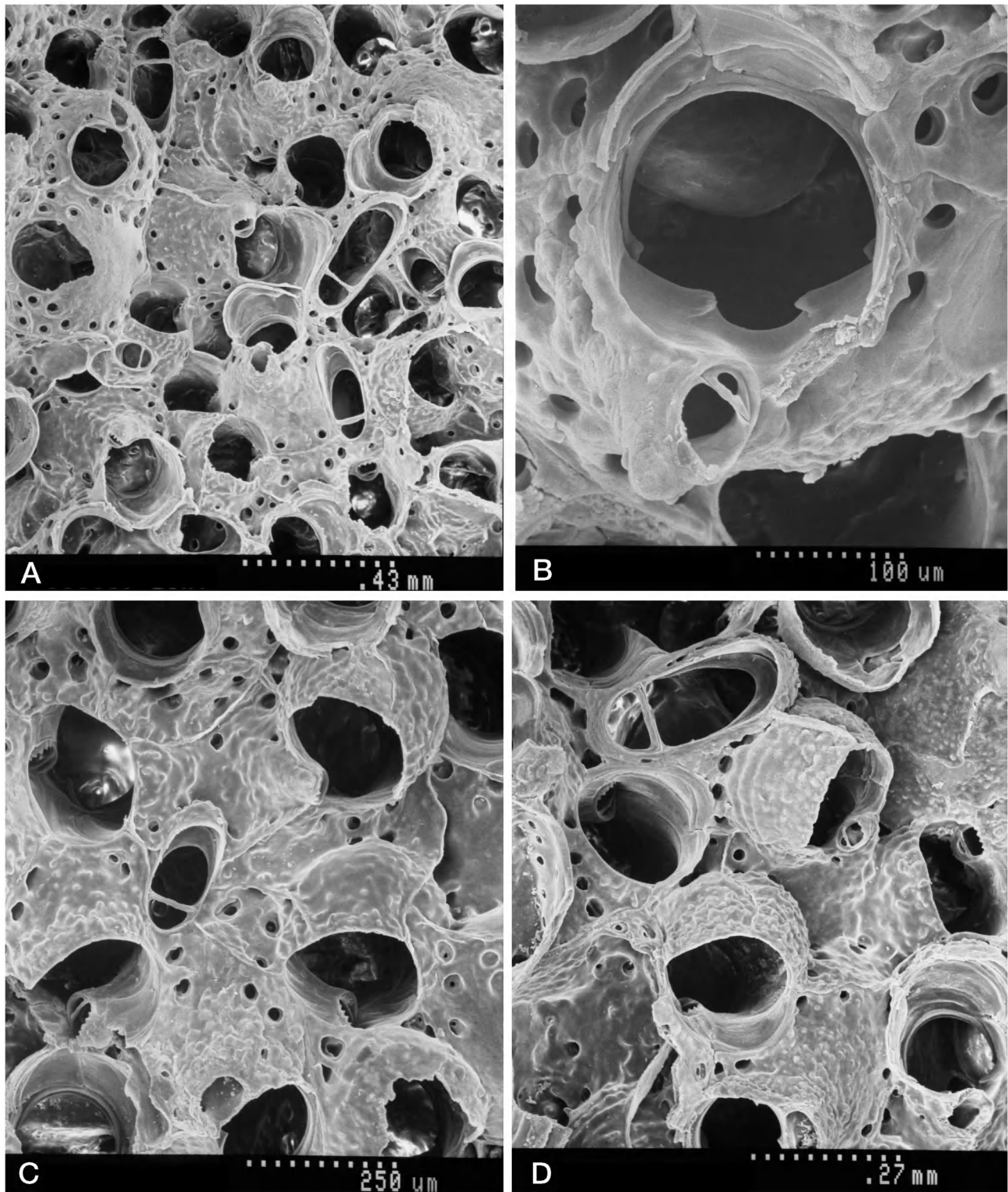


FIG. 2. – *Celleporaria brunnea*. A. General view of a colony, B. Primary orifice, C. Suboral avicularium with fine denticulations on distal rim, D. Ovicellated colony with interzooidal avicularia.

distal part. Sclerites of mandible spade-shaped with short handle, dark brown in colour. Crossbar slender without columella. Ovicell widely open, finely granular, unpunctured (Fig. 2D).

Associated bryozoans species. *Celleporaria brunnea* was the most frequent bryozoan species at Station 4 in September 2004 with other bryozoan species: *Bowerbankia gracilis* Leidy, 1855,

TABLE 1. – Measurements (μm) of *Celleporaria brunnea*.

	N	Mean	Minimum	Maximum	SD
Autozoid length	20	442	340	540	55
Autozoid width	20	277	240	340	24
Primary orifice height	12	131	110	150	12
Primary orifice width	12	154	140	170	9
Vicarious avicularia length	12	328	240	400	59
Vicarious avicularia width	12	130	120	140	10

N, number; SD, Standard deviation

Cryptosula pallasiana (Moll) and *Schizoporella unicornis* (Johston in Wood). *Bowerbankia gracilis* and *C. pallasiana*, which are known to be widespread fouling species in ports and estuaries, were found on *Mytilus galloprovincialis*, barnacles and serpulid polychaetes. Only a colony of *Schizoporella unicornis* was found on *M. galloprovincialis* at Station 4. Among the species, *B. gracilis* was considered as an alien species in New Zealand and the United States (Carlton, 1989; Cranfield *et al.*, 1998), *C. pallasiana* and *S. unicornis* in Australia (Pollard and Pethebridge, 2002).

Distribution. *Celleporaria brunnea* is one of the most common species in California and Baja California waters (Soule and Soule, 1964). The distribution of the species extends from British Colombia southward to Ecuador (Soule *et al.*, 1997). This species was found in the vicinity of the Panama Canal (Hastings, 1929). It was also recorded from Hawaii, where it may have been transported via hull fouling (Godwin, 2003).

The genus *Celleporaria* includes 72 recent species worldwide. Among them, three species have been previously reported from the Mediterranean Sea: *Celleporaria aperta* (Hincks, 1882), *Celleporaria fusca* (Busk, 1854) and *Celleporaria pilaefera* (Canu and Bassler, 1929). *Celleporaria aperta* was first found on the Israeli coast and considered as a Lessepsian migrant (Powell, 1969a). Agius *et al.* (1977) reported this species and *C. pilaefera* on the fouling cages of an oyster farm on Malta Island and suggested that they were introduced there via shipping. A total of 6 *Celleporaria* species [*C. labelligera* Harmer, 1957, *C. vermiformis* (Waters, 1909), *C. columnaris* (Busk, 1881), *C. trispiculata* d'Hondt, 1988, *C. bicornis* (Canu and Bassler, 1923) and *C. pigmentaria* (Waters, 1909)] were reported from the Red Sea (Powell, 1969a; 1969b; d'Hondt, 1988). The species belonging to this genus show a strong

positive response to free space and are highly opportunistic and invasive (Dunstan and Johnson, 2004). Thus, they have favourable attributes to colonise new habitats. *Celleporaria brunnea*, which was known to inhabit tropical and temperate (warm and cool temperate) waters (Soule and Soule, 1964), was recorded for the first time in the Mediterranean Basin.

In the genus *Celleporaria*, the main morphological characters used in systematics are the shape of aperture, size, and the position and type of avicularia. In the Aegean specimens of *C. brunnea*, dark brown operculum and sclerites of mandibles in both oral and interzoooidal avicularia were noted. In these specimens, the aperture was rounded distally but a distinct notch was not observed in the proximal part, as described by Soule (1961), Soule and Soule (1964) and Soule *et al.* (1997). The proximal border of apertures of our specimens was concave and arc-shaped, with lateral condyles. The mandible of large interzoooidal avicularia on the Pacific specimens had a spade-shaped brown reinforced sclerite in the midline (Soule and Soule, 1964). However, the mandible of interzoooidal avicularia of our specimens had a spade-like sclerite with a short handle, as observed on the specimens collected from the coasts of Ecuador and Galapagos (Osburn, 1952; Hastings, 1929).

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