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Short Communication

First record of the invasive stinging medusa *Gonionemus vertens* in the southern hemisphere (Mar del Plata, Argentina)

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ABSTRACT. In this paper we report the first finding of the hydromedusa *Gonionemus vertens* Agassiz, 1862 in the southern hemisphere. About thirty newly released medusae were found within an aquarium on September 2008. The aquarium contained benthic samples collected in intertidal and subtidal rocky fringe off Mar del Plata, near a commercially important harbor in Argentina. Medusae were fed with *Artemia salina* until sexual maturation. Possible way of species introduction is discussed.

Keywords: *Gonionemus vertens*, Limnomedusae, Hydrozoa, biological invasions, Argentina.

Primer registro de la medusa urticante invasora *Gonionemus vertens* en el hemisferio sur (Mar del Plata, Argentina)

RESUMEN. En este trabajo se da a conocer el primer hallazgo de la hidromedusa *Gonionemus vertens* Agassiz, 1862 en el hemisferio sur. Alrededor de 30 medusas recientemente liberadas fueron encontradas en un acuario en septiembre de 2008. Este acuario contenía muestras bentónicas colectadas en la franja rocosa intermareal y submareal de Mar del Plata, cerca de uno de los puertos más importantes de Argentina. Las medusas fueron alimentadas con *Artemia salina* hasta su maduración gonadal. Se discute la posible vía de introducción de esta especie.

Palabras clave: *Gonionemus vertens*, Limnomedusae, Hydrozoa, invasiones biológicas, Argentina.

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Introductions of non-indigenous species increased in frequency across coastal regions of the world in the early 20th century. Introduced species are transported within and between oceans regardless of physical, spatial, or temporal barriers (Carlton & Geller, 1993; Carlton, 1996). In marine ecosystems, ship's ballast water is considered the main route for most of the described marine introductions (Carlton & Geller, 1993).

Although there are few described occurrences of gelatinous zooplankton that have successfully invaded different coastal environments of the world (Graham & Bayha, 2007), some of these invasions had dramatic economic and ecological consequences (Miglietta & Lessios, 2009). Examples include high concentrations of medusae clogging fishing nets and stinging species creating problems along recreational beaches (Graham *et al*., 2003; Graham & Bayha, 2007). Hydromedusae (Cnidaria, Hydrozoa) can be transported through ballast water, but if the species has a meroplanktonic life cycle, their benthic stage can also be introduced as a part of the ship's fouling fauna (Rees & Gershwin, 2000; Genzano *et al*., 2006; Miglietta & Lessios, 2009).

In the southwestern Atlantic Ocean, the Hydrozoa fauna have been widely studied in recent decades and its species richness is well known (see Migotto *et al*., 2002; Genzano *et al*., 2008, 2009; Rodriguez *et al*., 2012, and references therein). New species have been recently described (Nogueira *et al*., 2013), and two invasive species were also discovered. The two invasive species were well known non-indigenous hydromedusae *Blackfordia virginica* Mayer, 1910 and

Moerisia inkermanica Paltschikowa-Ostroumova, 1925, found in different estuaries and harbors with intense shipping traffic along the south Atlantic coast (Genzano *et al*., 2006; Nogueira & Oliveira, 2006; Bardi & Marques, 2009; Freire *et al*., 2013).

In this paper we present the finding of another invasive hydromedusa, *Gonionemus vertens* Agassiz, 1862 (Hydrozoa, Limnomedusae), found for the first time in the southern hemisphere. This species has been introduced in several regions (Edwards, 1976; Wolff, 2005) and has gained notoriety due to its strong effects on human health (Pigulevsky & Michaleff, 1969). The medusa of *G. vertens* produces severe envenomation, pain and neuropsychiatric changes. Humans who come into contact with its stinging cells may suffer severe allergic reactions, including burning, edema, convulsions, disturbed respiration, psychological disorders, etc. (Pigulevsky & Michaleff, 1969; Arai & Brinckmann-Voss, 1980).

This species is strictly littoral, occurring in shallow waters close to the shore and in coastal lagoons. It has adapted unusual behavior due to its semi-benthic habit (Mills, 1993). Helped by their adhesive tentacles, the medusae clings to weeds or other objects, and only at nightfall or on cloudy days they swim to the surface (Edwards, 1976; Singla, 1977). Furthermore, this species has minute polyps which are extremely difficult to find *in situ*. Due to their behavior and habitats, polyps and medusae have been frequently reported in aquaria (Bakker, 1980).

About thirty newly released medusae were found within an aquarium on September 2008. This aquarium contained benthic samples collected in intertidal and subtidal rocky fringe of Punta Iglesias, Mar del Plata coast (38º18'S, 57º45'W) near one of the most commercially important harbors of Argentina (Fig. 1). The temperature (~18°C) and salinity (~33.7) conditions were controlled and the medusae were fed with *Artemia salina* (Linnaeus, 1758) until gonad maturation.

These medusae were assigned to the genus *Gonionemus*, which is well distinguished from other marine genera of Limnomedusae. The genera *Eperetmus* Bigelow, 1915, *Maeotias* Ostroumoff, 1896, and *Olindias* Müller, 1861 have centripetal canals; *Nuarchus* Bigelow, 1912 and *Hexaphilia* Gershwin & Zeidler, 2003 have six radial canals; *Gossea* Agassiz, 1862 has tentacles arranged in groups; and *Cubaia* Mayer, 1894 and *Vallentinia* Browne, 1902 have two kinds of tentacles (Bouillon & Boero, 2000; see Table 6 in Gershwin & Zeidler, 2003). The genus *Scolionema* Kishinouye, 1910 is very similar to *Gonionemus* Agassiz, 1862, however, *Scolionema* has up to 16 statocysts (Bouillon & Boero, 2000; Gershwin & Zeidler, 2003) and *Gonionemus* has statocysts alternating with successive tentacles, varying in number from somewhat fewer than the marginal tentacles to nearly twice as many (Arai & Brinckmann-Voss, 1980).

These analyzed specimens of *Gonionemus* have: around a 10 mm width, four radial channels, a manubrium shorter than the umbrella cavity, a mouth with four lips slightly crenulated, four folded gonads along radial channels leaving the distal part free, between 40 and 44 hollow tentacles, each tentacle has ring-like nematocyst clusters and adhesive pads near the distal end, and one or two statocysts between successive tentacles enclosed in mesoglea near ring canal with a single endodermal club. These characteristics agree with previous descriptions of the species *Gonionemus vertens* Agassiz, 1862 (Arai & Brinckmann-Voss, 1980; Russell, 1953) (Fig. 2).

G. vertens is distributed in very shallow temperate waters of the northern hemisphere (Pacific, Atlantic and Mediterranean), but it is absent from arctic and tropical zones (Edwards, 1976; Arai & Brinckmann-Voss, 1980). The region of origin for *G. vertens* is not entirely clear; some authors have proposed that it is indigenous to the North Pacific (Japan, Korea and China) and others that it is indigenous to the Atlantic coast of North America (Edwards, 1976; Eno *et al*., 1997; Wolff, 2005). The species is abundant in Japan while in others regions its presence is sporadic. The introduction of the species in other parts of the world may be related to the transport of Japanese oysters, which carried the benthic stage of *G. vertens*, or they may have been part of the fouling community on ships (Edwards, 1976; Baker, 1980).

The city of Mar del Plata has one of the most important commercial harbors in Argentina, receiving both national and international cargo ships and fishing vessels (Meretta *et al*., 2012). This harbor is considered to be a "hot spot" for non-indigenous species (Albano *et al*., 2013). Numerous invasive marine species have been found in the harbor (Orensanz *et al*., 2002); therefore, it is not surprising that *G. vertens* polyps inhabit this community. Further, the intertidal zone of Mar del Plata coast is characterized by dense beds of the mussel *Brachidontes rodriguezii* (D'Orbigny, 1846) (Scelzo *et al*., 1996), which could serve as substrate for polyps of *G. vertens*.

The polyp is solitary, very small (1 mm length), and remains attached to seaweed, sea grasses and oysters (Edwards, 1976). These polyps are able to survive for years without forming medusae buds so the species can exist in an ecosystem long-term solely in its benthic stage. Additionally, the polyp is able to asexually produce vermiform buds or "frustules" which give rise to new polyps, consequently increasing the number of

Figure 1. Location of where the specimens of *Gonionemus vertens* were found (black circle).

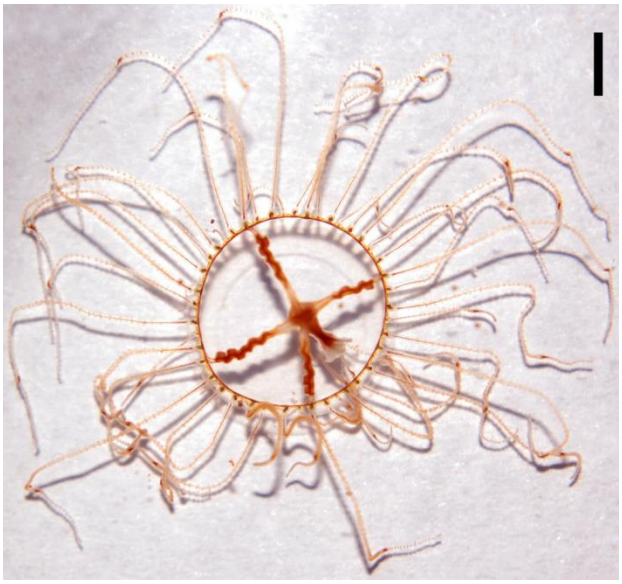

Figure 2. Specimen of *Gonionemus vertens* found in this study. Scale bar 3 mm.

polyps over time (Edwards, 1976; Bakker, 1980). These characteristics of *G. vertens* increase the probability of benthic stage transport to new regions. The polyps can remain dormant in a new ecosystem until environmental conditions are favorable and then reproduce asexually generating medusae.

The Buenos Aires coast presents the most important recreational beaches of Argentina. In some of them two hydromedusae, *Olindias sambaquiensis* Müller, 1861 and *Liriope tetraphylla* Chamisso & Eysenhardt, 1821 typically cause severe stings on bathers (Kokelj *et al*., 1993; Mianzan & Ramirez, 1996; Mianzan *et al*., 2000, 2001; Mosovich & Young, 2012), affecting tourist activities. The presence of additional stinging hydromedusae should be taken into consideration because of the public health impacts and economical losses it may cause. Therefore, it is important to continue studies to corroborate if this species has been established in Mar del Plata.

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