THE LESSER-KNOWN MEDUSA DRYMONEMA DALMATINUM HAECKEL 1880 (SCYPHOZOA, DISCOMEDUSAE) IN THE ADRIATIC SEA

Alenka MALEJ & Martin VODOPIVEC
Marine Biology Station, National Institute of Biology, SI-6330 Piran, Fornače 41, Slovenia
E-mail: malej@mbss.org

Davor LUČIĆ & Ivona ONOFRI
Institute for Marine and Coastal Research, University of Dubrovnik, POB 83, HR-20000 Dubrovnik, Croatia

Branka PESTORIĆ
Institute for Marine Biology, University of Montenegro, POB 69, ME-85330 Kotor, Montenegro

ABSTRACT

Authors report historical and recent records of the little-known medusa Drymonema dalmatinum in the Adriatic Sea. This large scyphomedusa, which may develop a bell diameter of more than 1 m, was first described in 1880 by Haeckel based on four specimens collected near the Dalmatian island Hvar. The paucity of this species records since its description confirms its rarity, however, in the last 15 years sightings of D. dalmatinum have been more frequent.

Key words: scyphomedusa, Drymonema dalmatinum, historical occurrence, recent observations, Mediterranean Sea

LA POCO NOTA MEDUSA DRYMONEMA DALMATINUM HAECKEL 1880 (SCYPHOZOA, DISCOMEDUSAE) NEL MARE ADRIATICO

SINTESI

Gli autori riportano segnalazioni storiche e recenti della poco conosciuta medusa Drymonema dalmatinum nel mare Adriatico. Questa grande scifomedusa, che può sviluppare un cappello di diametro di oltre 1 m, è stata descritta per la prima volta nel 1880 da Haeckel, in base a quattro esemplari catturati vicino all'isola di Lésina (Hvar) in Dalmazia. La scarsità delle segnalazioni di questa specie dalla sua prima descrizione conferma la sua rarità. Tuttavia, negli ultimi 15 anni gli avvistamenti di D. dalmatinum sono stati più frequenti.

Parole chiave: scifomedusa, Drymonema dalmatinum, avvistamenti storici, segnalazioni recenti, mare Mediterraneo
INTRODUCTION

Large scyphomedusae are more common in cold seas and in the Mediterranean only a few species are known to reach more than 5 kg wet weight and exceed a bell diameter of 40 cm. Among these Rhizostoma pulmo is a rather common native species along Mediterranean coasts (Kogovšek et al., 2010; Fuentes et al., 2011). Phacellophora camtschatica is, in contrast, very rare in the Mediterranean and to our knowledge has not been observed since the late 1930s (Mayer, 1910; Fedele, 1937). Phyllorhiza punctata, another large-sized rhizostomid, was observed for the first time in the Mediterranean in 1965 off the Israeli coast (Galil et al., 1990) but has since been sighted only occasionally, mainly in the central Mediterranean (Abed-Navandi & Kikinger, 2007; Boero et al., 2009). Another large scyphomedusa Rhopilema nomadica is a Lessepsian invader that has been noted in the Mediterranean from the early 1970’s (Galil et al., 1990). Since then this scyphomedusa swarms recurrently along the Levantine coast with serious economic and environmental consequences (Galil, 2012).

Among native scyphomedusae found in the Mediterranean which may grow to an even larger size than these rhizostomids is the species Drymonema dalmatinum (Haeckel, 1880). Despite its conspicuous size this medusa has been very rarely observed in any Mediterranean area. The only recent information appears in Bayha & Dawson’s (2010) description of a new scyphozoan family Drymonematidae which mentions D. dalmatinum near Foça, Turkey. Mayer (1910) and Kramp (1961) listed two species: D. dalmatinum inhabiting the Mediterranean Sea and the West African coast, and Drymonema gorgo (Müller, 1883) from the Brazilian coast. According to Bayha & Dawson (2010) there are currently three valid Drymonema species from the three biogeographic provinces: D. dalmatinum from the Mediterranean (Haeckel, 1880), Drymonema larseni (Bayha & Dawson, 2010) from the Caribbean and D. gorgo from the Brazilian provinces; authors also speculate that the medusa described from the west coast of Africa (Kramp, 1959) may be D. gorgo or a novel form characteristic of the Guinean or Benguelan provinces.

In our contribution we review historical and recent observations of D. dalmatinum in the Mediterranean and specifically in the Adriatic Sea. Moreover, we provide new information improving the morphological description of this medusa.

MATERIAL AND METHODS

Our study of D. dalmatinum occurrences was focused on the Adriatic Sea, although, as far as possible, information was also collected from the other parts of the Mediterranean Sea. We have reviewed published data sources since Haeckel’s first description of this species in 1880. Information on the recent occurrences of the studied species originates from the author’s own observations as well as from informed citizens who provided photographs upon which the determination of species was based. With few exceptions, the photographers were also sources of information on the size of medusae. Photographs were also used for the description of the main characteristics of medusae.

RESULTS AND DISCUSSION

Figure 1 shows locations and dates of historical and recent D. dalmatinum sightings in the Adriatic Sea while in Table 1 we report on sources of information and give some data on the size of medusae observed in the Adriatic and the Mediterranean Sea.

Historical occurrence

In his publication System der Acraspeden Haeckel (1880) gave the first but only a brief diagnosis of D. dalmatinum (p. 642/3) based on four medusae that were given to him by G. Bučić. The well-known Croatian naturalist Bučić (Dubčić, 2001) collected medusae near the southern Adriatic island Hvar. The medusa name is derived from the Δροβιτς = a wood, τήςμα = threads, and the place (Dalmatia) where they were found. In the second part of Monographie der Medusen which appeared translated into English in the Challenger Report, Haeckel...
Tab. 1: *Drymonema dalmatinum* observations in the Mediterranean Sea since its description by Haeckel (1880). *In situ* estimated size (bell diameter) marked by *, other measurements on fixed material.

Tab. 1: Pregled pojavov dalmatinske lasaste meduze *Drymonema dalmatinum* v Sredozemskem morju od njenega opisa l. 1880 (Haeckel, 1880). Premer klobuka, ocenjen *in situ*, je označen z *, ostale meritve opravljene na fiksiranem materialu

<table>
<thead>
<tr>
<th>Locality</th>
<th>Date obs.</th>
<th>No. ind. observed</th>
<th>Depth obs.</th>
<th>Estimated size (bell diameter)</th>
<th>Comments &amp; Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gibraltar Strait</td>
<td>16 Jan 1873</td>
<td></td>
<td>1097 m</td>
<td>fragments</td>
<td>Haeckel, fragments in samples Challenger exp. stat. 4 (Haeckel, 1882)</td>
</tr>
<tr>
<td>Gulf of Izmir, eastern Mediterranean Sea</td>
<td>1887</td>
<td>bloom</td>
<td>shallow</td>
<td>50 - &gt; 100 cm*, 10-25 cm</td>
<td>Haeckel’s samples examined by Antipa (1892). Large ind. observed by Haeckel <em>in situ</em>, measurements of preserved medusae by Antipa</td>
</tr>
<tr>
<td>Hvar, southern Adriatic</td>
<td>1879</td>
<td>four</td>
<td>12-16 cm</td>
<td></td>
<td>Haeckel, material provided by Grgur Bučić (Haeckel, 1880)</td>
</tr>
<tr>
<td>Gulf of Trieste, northern Adriatic</td>
<td>1879-1882</td>
<td></td>
<td></td>
<td>fragments</td>
<td>Fragments in samples, Graeffe also observed Cyanea-like medusa at sea which escaped (Graeffe, 1884)</td>
</tr>
<tr>
<td>North-eastern Kotor Bay, southern Adriatic</td>
<td>29 May 1908</td>
<td>several in group</td>
<td>3 m</td>
<td>12 cm</td>
<td>Babić observed several individuals which escaped; one individual sampled and analysed (Babić, 1910, 2013)</td>
</tr>
<tr>
<td>Limski channel, northern Adriatic</td>
<td>20 Apr 1937</td>
<td>three</td>
<td>shallow water</td>
<td>9.5 cm</td>
<td>Kolosváry (1937), Stiasny examined Kolosváry’s material (Stiasny 1940a, b)</td>
</tr>
<tr>
<td>Bay of Žrnovnica, northern Adriatic</td>
<td>3 Nov 1984</td>
<td>one</td>
<td>6 m</td>
<td>50 cm*</td>
<td>This paper (photo credit C. Mlinar)</td>
</tr>
<tr>
<td>Orahovac, Kotor Bay, southern Adriatic</td>
<td>12 Jun, 3 and 14 Jul, 10 Aug 2001</td>
<td>two, one, one, one</td>
<td>few m</td>
<td></td>
<td>This paper (own observations, photo credit V. Mačić)</td>
</tr>
<tr>
<td>Foća, eastern Mediterranean Sea</td>
<td>19 May 2003</td>
<td>five</td>
<td>surface</td>
<td>40 cm*</td>
<td>This paper (photo credit B. Rameša).</td>
</tr>
<tr>
<td>Murter, middle Adriatic</td>
<td>11 May 2010</td>
<td>one</td>
<td>few m</td>
<td>40 cm*</td>
<td>This paper (photo credit V. Mačić)</td>
</tr>
<tr>
<td>North-eastern Kotor Bay, southern Adriatic</td>
<td>2 Jun 2014</td>
<td>one</td>
<td>surface</td>
<td>35 cm*</td>
<td>This paper (own observations, photo credit V. Mačić)</td>
</tr>
<tr>
<td>Piran, northern Adriatic</td>
<td>5 Jun 2014</td>
<td>one</td>
<td>surface</td>
<td>60 cm*</td>
<td>This paper (own observations, photo credit A. Popovič, T. Makovec)</td>
</tr>
<tr>
<td>Lignano, northern Adriatic</td>
<td>6 Aug 2014</td>
<td>one</td>
<td>few m</td>
<td>50 cm*</td>
<td><a href="http://www.blueblog.net/p=2483">www.blueblog.net/p=2483</a></td>
</tr>
<tr>
<td>Piran near buoy VID, northern Adriatic</td>
<td>6 Aug 2014</td>
<td>one</td>
<td>3 m</td>
<td>&gt;60 cm*</td>
<td>This paper (own observations)</td>
</tr>
<tr>
<td>Risan, Kotor Bay, southern Adriatic</td>
<td>8 Aug 2014</td>
<td>one</td>
<td>few m</td>
<td>20 cm</td>
<td>This paper (own observations, photo credit V. Mačić)</td>
</tr>
</tbody>
</table>
el (1882) gave the most in depth description we have of *D. dalmatinum* (p. 124-132, pls. 30, 31). The medusa was renamed as *Drymonema victoria*, and Haeckel added additional information obtained from material collected in the Strait of Gibraltar considering this medusa as a deep-water species. Mayer (1910) who reviewed *g. Drymonema* concluded that there was only one Mediterranean species, namely *D. dalmatinum*. Haeckel also created a new subfamily Drymonemidae within *f. Cyaneidae* recognizing differences among *Drymonema* and the other cyaneid genera. Graeffe (1884, p. 342) described numerous fragments of ‘cyaneid-like oral curtains’ in the collection of preserved plankton samples (1879-1882) from the Gulf of Trieste that might be fragments of *Drymonema*. Carus (1885) in his Prodromus Faunae Mediterraneae mentioned *D. dalmatinum* from Hvar and, in addition, he reported on another cyaneid *Cyanea lamarckii* collected near Nice (France). Babić (1910, p. 226-227), who observed and collected *D. dalmatinum* in the southern Adriatic, speculated that *Cyanea lamarckii* found near Nice was misidentified and was probably also *Drymonema*. Babić (1913) also reported his finding of *Drymonema* off the north-eastern coast of Kotor Bay in his review of planktonic coelenterates from the Adriatic.

During his second trip to Asia Minor in 1887 Haeckel found ‘the entire Gulf of Izmir filled with numerous medusae that belonged to the *Drymonemidae*’ (Antipa, 1892). Since medusae were found by a place called Cordelio, Haeckel named them *Drymonema cordelio*. As he did not have time to examine sampled and preserved material himself, Haeckel passed medusae to Antipa who analysed 10 individuals and described them, keeping the name *D. cordelio*. The medusae observed in life were very large having an average bell diameter of about 50 cm, the largest exceeding 100 cm (Antipa, 1892). There were no further observations of *Drymonema* in the Adriatic since Babić’s (1910) finding in Kotor Bay (southern Adriatic) till the late 1930s. In 1937 Kolosváry collected three individuals in the Limski Channel (northern Adriatic) and reported this finding in his contributions on the Adriatic coelenterates (Kolosváry, 1937, 1945). Stiasny, who examined the collection of Rhizostomida of the British Museum of Natural History in London, (Stiasny, 1931), mentioned some other remarkable ‘pieces’ of this museum’s Scyphomedusae collection among which was also Haeckel’s *D. dalmatinum* from Hvar. Stiasny who ‘tried for many years to obtain at least one sample of this beautiful medusa’ (Stiasny, 1940a) received one specimen from Kolosváry; he also obtained a photograph of *Drymonema* swimming freely in the Rovinj Aquarium from Prof. A. Steuer (Stiasny, 1940a, p. 16, Abb 1). Stiasny described the Kolosváry specimen in detail (Stiasny, 1940b) and kept Haeckel’s original name of *D. dalmatinum*. Later it was listed in a review of Scyphomedusae in the Adriatic Sea (Avian & Rottini Sandrini, 1994).

**Recent observations and species description**

We have found no information on *Drymonema* in the Adriatic from 1937 till 1984 when a diver photographed one individual in the small eastern Adriatic Bay of Žrnovnica (Tab. 1, Fig. 1, Fig. 2c). On the other hand there were several observations from 2000 to the present in the northern, middle and southern Adriatic with most sightings in the southern Adriatic. Medusae were seen in the upper water column (Tab. 1) with the ex-umbrella prevalingly oriented upwards or, more rarely, side-wards with tentacles trailing below (Fig. 2a-f). The size of the observed individuals varied from rather small (20 cm bell diameter) to very large (> 60 cm).

The following is a description of the Adriatic specimens based on observations and underwater photography of specimens with bell diameters from 20 to 60 cm (Fig. 2a-f):

The umbrella is in the form of a flat disc consisting of a thicker and more rigid central part and a thin peripheric velarium with 20 lappets per octant. Four oral arms are very broad, have a large, curtain-like surface, and are nearly as long as the diameter of the bell. There are four, long-band shaped gonads (Fig. 2a). In larger specimens there are clear brownish radial strakes on the exumbrellar surface that branch towards the bell margin (Fig. 2b) while in smaller specimens they are not so obvious. Tentacles are numerous, of unequal lengths and thickness, originate diffusely (Fig. 2c, d, f) from a wide zone of the subumbrella and do not appear in clusters as in genera *Desmonema* and *Cyanea*. The colour of larger specimens is darker (Fig. 2d, e) than that of smaller (Fig. 2f) which appear nearly transparent.

**Temporal and spatial variations**

Stiasny (1940b) suggested an approx. 30-year periodicity for this species based on records of *Drymonema* in the Adriatic since its description till 1940. However, in the last 40 years, *D. dalmatinum* was more frequently observed, *i.e.* in 1984, 2001, 2010 and 2014 with more sightings in the southern Adriatic (Tab. 1). With one exception, individuals observed in the middle and northern Adriatic were larger than those observed in the southern Adriatic (Tab. 1). We therefore speculate that specimens observed in the northern Adriatic were drifted from the south by currents during the winter-spring period when currents in a northern direction dominate general circulation in the eastern Adriatic Sea (Poulain, 2001; Vilibič & Orlić, 2002) and by SE winds (scirocco or jugo) which were very frequent this winter. Indeed, current measurements in 2014 at the location of oceanographic buoy Vida (45° 32’ 55.68” N, 13° 33’ 1.89” E; [http://buoy.mbsb.org/](http://buoy.mbsb.org/)) before *Drymonema* sightings in the Gulf of Trieste showed a prevalent component in the northern direction, which might indicate that *Drymonema* was brought from the south in the days before its capture.
Fig. 2a: D. dalmatinum collected on 2 June 2014 in Boka Kotorska, bell diameter 35 cm.
Sl. 2a: Dalmatinska lasasta meduza, ulovljena 2. 6. 2014 v Boki Kotorski, premer klobuka 35 cm

Fig. 2b: D. dalmatinum collected on 2 June 2014 in Boka Kotorska, bell diameter 35 cm.
Sl. 2b: Dalmatinska lasasta meduza, ulovljena 2. 6. 2014 v Boki Kotorski, premer klobuka 35 cm

Fig. 2c: D. dalmatinum photographed on 3 November 1984 in Bay of Žrnovica, bell diameter 50 cm.
Sl. 2c: Dalmatinska lasasta meduza, fotografrana 3. 11. 1984 v zalivu Žrnovnica, premer klobuka 50 cm

Fig. 2d: D. dalmatinum photographed on 11 May 2010, Murter, bell diameter 40 cm.
Sl. 2d: Dalmatinska lasasta meduza, fotografrana 11. 5. 2010 pri otoku Murter, premer klobuka 40 cm

Fig. 2e: D. dalmatinum photographed on 5 June 2014 in Piran port, bell diameter 60 cm.
Sl. 2e: Dalmatinska lasasta meduza, fotografrana 5. 6. 2014 v piranskem pristanišču, premer klobuka 60 cm

Fig. 2f: D. dalmatinum photographed on 8 August 2014 in Boka Kotorska, bell diameter 20 cm.
Sl. 2f: Dalmatinska lasasta meduza, fotografrana 8. 8. 2014 v Boki Kotorski, premer klobuka 20 cm
If we assume a similar growth rate as determined for *D. dalmatinum* from the Caribbean Sea (Larson 1987), medusae could reach the size observed in the Gulf of Trieste (between 50 and 60 bell diameter) in about 3 – 4 months which is consistent with the estimated time of travel if we take into the account current speeds ranging from 5 to 10 cm/s. Larson (1987) maintained *Drymonema* on a diet of *Aurelia* medusae which were also shown to be heavily preyed upon by *D. larsoni* in northern Mexico (Bayha et al., 2012). Since the 1980s an increase of *Aurelia aurita* bloom incidence has been observed in the northern Adriatic (Kogovšek et al., 2010). Blooms have been recorded annually (Malej et al., 2012) since the early 2000s consistent with an observed pelagic trophic shift (Mozetič et al., 2012). It’s interesting to note that a high abundance of *A. aurita* was also recorded during several years from 1874 – 1911 (see Table 1 in Kogovšek et al., 2010) when *Drymonema* was noted in the Adriatic Sea. However, while in the Adriatic *D. dalmatinum* has been observed only sporadically with few individuals, it formed large blooms in the Caribbean Sea where Williams et al. (2001) observed that an *Aurelia* outbreak preceded and coincided with the population explosion of *Drymonema*. With the increase of *Aurelia* blooms in the Adriatic, we may therefore expect that we will have the opportunity to observe and study *D. dalmatinum* more frequently in the near future.

**ACKNOWLEDGEMENTS**

We thank Vesna Mačić, Tihomir Makovec, Ciril Mlinar, Aleksandra Popovič, Branko Rameša, Valter Žiža, fishermen and divers for *Drymonema* photographs and reports of this medusa. This work was supported by Slovenian Research Agency program P1-0237, EU FP7 project PERSEUS, the Ministry of Science, Education and Sport of R Croatia and the Ministry of Science and Education of R Montenegro.
MANJ ZNANA MEĐUZA DRYMONEMA DALMATINUM HAECKEL 1880 (SCYPHOZOA, DISCOMEDUSAE) V JADRANSKEM MORJU


Ključne besede: redek klobučnjak, dalmatinska lasasta međuza, historični zapisi, nova opazovanja
REFERENCES


Boero, F., M. Putti, E. Trainito, E. Prontera, S. Piraino & T. A. Shiganova (2009): First records of Mnemiopsis leidyi (Ctenophora) from the Ligurian, Thyrhenian and Ionian Seas (Western Mediterranean) and first record of Phyllorhiza punctata (Cnidaria) from the Western Mediterranean. Aquatic Invasions, 4, 675-680.


