20-YEARS OCCURRENCE OF THE INVASIVE ALGA CAULERPA RACEMOSA VAR. CYLINDRACEA IN GREECE

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Abstract
The green seaweed Caulerpa racemosa var. cylindracea is one of the most aggressive and broadly distributed invasive taxa in the Mediterranean Sea. In the present study, an updated range expansion of the alga is provided for the Greek coasts, based on literature sources and recent personal collections. Moreover, invasive events hitherto reported from the Greek coasts are also cited in detail.

Keywords: Algae, Aegean Sea, Alien species, Ionian Sea

The green alga Caulerpa racemosa var. cylindracea (Sonder) Verlaque, Huismann & Boudouresque (Bryopsidales, Caulerpaceae) is one of the most notorious and aggressive invaders in the Mediterranean Sea ([11]). Since the last decade of the 20th century it has exhibited a spectacular expansion in the whole Mediterranean basin ([12]). Its presence has been related with negative impacts to the native benthic communities ([3]). Nevertheless, some positive impacts have been reported from deeper un-vegetated habitats (Relini, personal communication).

In the present study an updated range expansion of C. racemosa var. cylindracea (hereafter C. racemosa) along the Greek coasts is presented, based on both literature records and our recent collections (years 2007-2013), as part of one of the authors (KT) PhD thesis. After 20 years since its first report from Greece (1993 in Zakynthos Island [4]), today C. racemosa var. cylindracea can be found in the majority of the Greek seas (Figure 1), presenting an extremely high dispersion rate, possibly related with translocation in short distances through shipping (anchoring and fishing equipment). In fact, an ongoing gradual expansion from the S. Aegean towards the N. Aegean Sea can be observed (Figure 1).

Fig. 1. Distribution records and range expansion of Caulerpa racemosa var. cylindracea in Greece. Both old (before 2007 - black dots) and new records (after 2007 - grey dots) are also given.

C. racemosa is present through the whole year, but higher abundances have been recorded during summer months. Holocarpic plants have been also recorded during summer. There is an intense polymorphism of the thallus depending on the depth and the hydrodynamism (vesicles distichously to spirally arranged on the erect fronds).

C. racemosa presents a broad ecological niche, since it has been found on both polluted and pristine sites, in hard and soft substrates, from surface level down to 70 m depth. However, more abundant populations have been found on rocky slopes with macroalgae and on dead Posidonia matess ([5]).

Although C. racemosa has been found on numerous Greek coasts, only in 5 cases invasive behavior has been reported (Table 1). During our recent deep-sea exhibition using ROVs down to 120 m depth in the Greek Ionian Sea, vast meadows of C. racemosa lying between 40-70 m depth on sandy and muddy bottoms were detected (Table 1). This monopolization of the seabottom should be related with the empty ecological niches found on those depths and substrates. On the other hand, in shallower habitats, where competition from the native flora is much higher, C. racemosa abundance seems to be restricted in lower values.

Tab. 1. Invasive events of Caulerpa racemosa var. cylindracea in Greece

<table>
<thead>
<tr>
<th>Site</th>
<th>Season</th>
<th>Depth (m)</th>
<th>Substrate</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagman, Zakynthos Island</td>
<td>Spring 2001</td>
<td>2-3</td>
<td>rocky/sandy</td>
<td>[7]</td>
</tr>
<tr>
<td>Agios Kosmas, Samos</td>
<td>June 2007</td>
<td>2</td>
<td>rocky</td>
<td>[8]</td>
</tr>
<tr>
<td>Chios Isl</td>
<td>August 2009</td>
<td>3-40</td>
<td>rocky</td>
<td>[9]</td>
</tr>
<tr>
<td>Kalamaki, Kefalonia</td>
<td>July 2012</td>
<td>30-40</td>
<td>sandy</td>
<td>present study</td>
</tr>
<tr>
<td>Agiosoti, Kephalonia</td>
<td>March 2013</td>
<td>40-80</td>
<td>muddy</td>
<td>present study</td>
</tr>
</tbody>
</table>

References