A new record for *Caulerpa mexicana* Sonder ex Kützing from Eastern Mediterranean Coast of Turkey

Doğu Akdeniz’in Türkiye kıyılarında *Caulerpa mexicana* Sonder ex Kützing için yeni bir kayıt

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Abstract

In this study, *Caulerpa mexicana* Sonder ex Kützing is recorded for the first time in the Hatay coasts of east Mediterranean of Turkey. The number of *Caulerpa* spp. are now reached to 10 taxa on the coasts of Turkey that were first observed in 1971. It was previously reported that the members of *Caulerpa* are widely threaten by the sea environment with their invader and migratory characteristics. The *C. mexicana* taxon was first reported by Rayss (1941) along the Palestine Coast in the east Mediterranean.

Key words: *Caulerpa mexicana*, Hatay, Mediterranean, Turkey

Introduction

Turkey has a rich biological diversity due particularly to the three seas that surround the country. However, this diversity is negatively affected, to some extend, by external factors like marine transportation, as well as interior agents including current dynamics and food etc. As a matter of fact, *Caulerpa* lamouroux is an example of an invader species that give rise to serious degradational changes in marine environments due to external factors.

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These factors are of significance not only they cause extensively distribution of invader species in the environment but also they threaten life condition of marine organisms and human life as well. In particular, *C. taxifolia* (M. Vahl) C. Agardh and *C. racemosa* (Forsskal) J. Agardh as a species of *Caulerpa* represented by 190 taxa appears to expand rapidly along the Mediterranean coast. A recent estimation by Aysel et al. (2002) suggested the possible involvement of this species from the eastern Mediterranean to the Turkish coasts has presently supported by Çevik et al. (2007) on the basis of the presence of *C. taxifolia* and *C. mexicana* species. *C. mexicana*, which naturally exists in the Antarctic and along coast of Mexico (Apartado et al. 2002) was first observed on the Mediterranean Coast of Turkey in 1941 (Olsen et al. 1998), which is likely associated with several factors such as sea currents, trade ships and tourism. *Caulerpa sp.* is characterized with 10 taxa on Turkey Coasts. *C. prolifera* (Forsskal) Lamouroux and *C. ollivieri* Dostal were cited by Güven and Öztürk (1971) and Zeybek et al. (1968), respectively. In the study of Aegean and Eastern Mediterranean area are *C. racemosa* (Forsskal) J. Agardh var. *racemosa* (Cirık and Öztürk 1991), *C. racemosa* (Forsskal) J. Agardh var. *lamourouxii* f. *requenii* (Montagne) Weber-van Bosse, *C. racemosa* var. *occidentalis* (J. Agardh) Borgesen (Tolay et al. 2001) and *C. racemosa* var. *cylindracea* (Sonder) Verlaque, Huisman and Boudouresque (Verlaque et al. 2003) was also reported from Turkey Coasts. In addition, *C. scalpelliformis* (Brown ex Turner) C. Agardh (Ertan et al. 1998) and *C. scalpelliformis* (Decaisne) Weber-van Bosse var. *denticulata* (Aysel et al. 2002) were shown formerly. The existence of *C. sertularioïdes* (S. G. Gmelin) Howe in the Sea of Marmara were first reported by Skolka and Vasiliu (Gallardo et al. 1993).

In this study, *Caulerpa mexicana* Solder ex Kützing that distributed on Hatay Coasts is investigated.

**Material and Method**

The samples collection was carried out on natural rocky refuges and the stones that surrounding these rocks near by Çevlik Site and Meydan Beach (Figure 1). The determination was made according to Taylor (1960).
Results

*C. mexicana* Sonder ex Kützing is first observed on the Turkish coasts in this study. The majority of *Caulerpa* members, with a total of 190 taxa, develop in sandy and muddy environments with the exception of a few species that are known to live in deeper parts of the sea. It is represented by five taxa on variety and morphology scale. A total of the 11 *Caulerpa* taxa are observed with *C. mexicana* on the Turkish coasts (Table 1).
Table 1. Distribution of taxon of *Caulerpa* Lamouroux on the Turkey Coasts (BS: Black Sea, MS: Marmara Sea, AS: Aegean Sea, M: Mediterranean, RN:Reference Number).

<table>
<thead>
<tr>
<th>TAXA</th>
<th>BS</th>
<th>MS</th>
<th>AS</th>
<th>M</th>
<th>RN</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Caulerpa</em> olivieri Dostal</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>8</td>
</tr>
<tr>
<td><em>C. prolifera</em> (Forsskål) Lamouroux</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>8</td>
</tr>
<tr>
<td><em>C. racemosa</em> (Forsskål) I. Ag. var. <em>racemosa</em></td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>5</td>
</tr>
<tr>
<td><em>C.---</em> var. <em>lamourouxii</em> (Turner) Weber-van Bosse f. <em>requeni</em> (Mont) Weber van Bosse</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>C. racemosa</em> (Forsskål) I. Ag. var. <em>occidentalis</em> (J. Agardh) Borgesen</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>C. racemosa</em> (Forsskål) I. Ag. var. <em>cylindracea</em> (Sonder) Verlaque, Huisman &amp; Boudouresque</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>C. scalpelliformis</em> (R. Brown ex Turner) C.Ag.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>6</td>
</tr>
<tr>
<td><em>C. scalpelliformis</em> (Decaisne) Weber van Bosse var. <em>denticulata</em> (Decaisne) Weber van Bosse</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>3</td>
</tr>
<tr>
<td><em>C. sertularioides</em> (S.G. Gmelin) Howe</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td><em>C. taxifolia</em></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>4</td>
</tr>
<tr>
<td><em>C. mexicana</em> Sonder ex Kützing</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>-</td>
<td>1</td>
<td>6</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

The samples were collected from two sites: The first site is a rocky area that is approximately 1 km from Çevlik Harbour approximately 1 km. This is a narrow refuge with an average depth of 1 meter characterized with good water circulation and preservation. Its deep sediments are composed of sand and rocky masses along its coastal zone. *Cystoseira* C. agardh and *Sargassum* C. Agardh populations are developed in this site that is protected from direct wave impacts.

The second site is at the starting point of the Meydan Beach. This small site also shows the same characteristics among rock masses where *Laurencia* sp. lamouroux were extensively observed. *C. mexicana*, however, was found to be plastered on rock surfaces near this area.

In addition, a vast coverage of species is observed to develop on the beach between September and October. Actually, the fishermen that fish in Domuz Burnu, revealed that fishing nets are largely filled with *Caulerpa* species.
On the contrary of the absence of *Caulerpa* on the Black Sea Coast, it is characterized with one taxon on the Coast of Marmara Sea, six taxons on Aegean and nine taxons on Mediterranean.

In this work, the identification key, developed by Aysel and Dural (1998), for the taxa of *Caulerpa* genus was improved as it below.

1. Erect blades flat, entire sparingly proliferous from stalk or face of the blades

   2. Blades broadly ........................................... *C. prolifera*

   2. Blades narrowly ........................................... *C. ollivieri*

1. Erect portion of the plant either filiform or massive, variously branched, lobed or cleft

   3. Branchlets or lobes of the erect blades with minutely aculeate tips

   4. Erect branchlets bearing flat blades with broad flat marginal pinnæ ........................................... *C. mexicana*

   4. Erect branchlets bearing either dentate or flattened blades ........................................... *C. sertularioides*

   3. Branchlets or lobes of erect blades flat, cylindrical or separate flattened

   4. Erect separated blades flat ........................................... *C. scalpelliformis*

   4. Erect separated blades cylindrical and tips obtuse

   5. Erect spindle flat, branches pear shaped ......................

                                  ...................... *C. racemosa var. lamourouxii f. requenii*

5. Erect spindle orbicular

   6. Branchlets cudgel shaped ...........................................

                                  ...................... *C. racemosa var. racemosa*

   6. Branchlets cylindrical ...........................................

                                  ...................... *C. racemosa var. cylindracea*

Considering the morphological features of the algal involved, various characteristics were defined as follows:
Main body of tallus shaped like stolon and branched off stolons thin and slim. Size limits characterized by (0,4-) 0,7- 1,1(-1,5) mm in diameter and (12-) 15-35 (-55) cm in length. Differentiated branches as rizoid at very little distances one or two mm (Fig. 2 A-D). Erect blades exist distances of 1-2 (-4) on the main stolon. Blades are with short stem, oblong or enlarging lanseolat-shaped with (0,4-) 1-15 (-23) cm length and (3-) 6-9 (-13) mm width (Fig. 2E). Simple or sometimes spiny, pinnate, generally 1 or 2 mm wide (Fig. 2F, G) and have vessels in the middle, anatomic reticular structure is seen dominantly (Fig. 2H). Pinnat young blades are placed closely, sometimes covered one another, opposite, flat, variable from oval to oblong, sometimes finished with points, the bases become narrow, long points (2-), 3-6, (-8) mm, with apiculate pinnules (Fig. 2I) (Taylor 1960).

**Figure 2.** Anatomic and morphologic characteristics of the taxon.
Discussion

_C. mexicana_ like the other members of _Caulerpa_ was first recorded in Paletsine by Rayss (1941) is an invasive species whose presence was reported in Israel, Lebanon, Syria (Rayss 1941, Mayhoub 1976) and then in the eastern Mediterranean shores of Turkey.

An invasive species of warm seas grows best in warm water. There is no doubt that with global climate change induced increase in the temperature this species is going to have a wider occurrence along Turkish shores. Similarly, _C. racemosa_ var. _cylindracea_ has been previously seen in İzmir has also been reported in Geyikli (Çanakkale, Turkey) in 2005 and in the sheltered areas of southern shores of Bozaada (Çanakkale).

In general, _C. mexicana_ grows on pebbles with various sizes in sheltered areas and shallow areas, and in lagoons in sandy and muddy areas. We believe that this taxon, which has also been observed in warm water pools in coastal areas, is going to increase in dominance and encroach on the marine life.

Özet

Bu araştırmada Doğu Akdeniz’de Hatay kıyısında yayılış gösteren _Caulerpa mexicana_ Sonder ex Kützing Türkiye kıyıları için ilk kez verilmektedir. Türkiye kıyılardında ilk kez 1971 yılında gözlenen _Caulerpa_ üyeleri bugün 10 taksona ulaşmıştır. Önceki çalışmalarda _Caulerpa_ üyelerinin deniz yaşamını göçmen ve istilaçı özellikleri ile tehdit ettiğini belirtilmiştir. Doğu Akdeniz de ilk kez
Filistin de Rayss (1941) tarafından bulunan C. mexicana taksonu da sahip olduğu bu özellikleri ile kıyaslarımızda giriş yapmıştır.

References


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