

Chorological addition of *Sargassum trichocarpum* J. Agardh (Fucales, Sargassaceae) in the Alboran Sea (Southern Spain)

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Abstract

Drifted material from the deep-sea species *Sargassum trichocarpum* was found in the provinces of Malaga and Cadiz. These findings highlight that the species is still present on the western Mediterranean coasts despite the threats affecting its populations, which are in a state of decline.

Keywords: *algae* Cádiz, *chorology*, *drifted material*, Málaga, *Mediterranean Sea*.

Resumen

Adición corológica de *Sargassum trichocarpum* J. Agardh (Fucales, Sargassaceae) en el mar de Alborán (Sur de España)

Se ha encontrado material arrojado de la especie de aguas profundas *Sargassum trichocarpum* en las provincias de Málaga y Cádiz. Este hallazgo pone de manifiesto que la especie sigue estando presente en las costas del Mediterráneo Occidental, a pesar de las amenazas que afectan a sus poblaciones, las cuales se encuentran en fase de regresión.

Palabras clave: algas, arribazones, Cádiz, corología, Málaga, Mar Mediterráneo.

Members of the family Sargassaceae Kütz. (Fucales, Phaeophyceae) are ubiquitous, primarily distributed in tropical and subtropical regions (Aouissi *et al.*, 2018). These species are relevant habitat formers, providing shelter for juvenile organisms and serving as feeding and reproducing grounds (Komatsu *et al.*, 2014). In the Alboran Sea (Western Mediterranean Sea), the genus *Sargassum* is represented by different taxa, being *S. vulgare* C. Agardh, the most frequent one (Gómez Garreta *et al.*, 2000; Rodríguez-Prieto *et al.*, 2013). Other species such as *S. flavifolium* Kütz. were recorded in the coasts of Malaga and Granada, *S. acinarium* (Linnaeus) Setchell only in Eastern-Almeria (Flores-Moya *et al.*, 1995); *S. furcatum* Kütz. in Chafarinas Islands (Flores-Moya & Conde, 1998); and, on the south coast of the Alboran Sea, two records of *S. trichocarpum* J. Agardh in Morocco in 1990 (MGC herbarium). According to various protection regimes, *S. acinarium*, *S. flavifolium* and *S. trichocarpum* are included in the LESPRES list (Listado de Especies Silvestres en Régimen de Protección Especial) and the Barcelona Convention (UNEP/MAP-SPA/RAC, 2018), due to the fact that they are used to designate areas of special conservation.

The species *S. trichocarpum* is an occasional deep-water species endemic to the Mediterranean, typically found at depths greater than 30 m in areas with intense currents (Blanfuné *et al.*, 2022). Individuals of this taxa feature spiral-arranged foliaceous branches with a notable central midrib. Foliaceous branches are elongated and narrow, measuring 3-5 cm in length and 2-6 mm width, decreasing in apical parts, with wavy or toothed margins. Its aerocysts are either spherical or slightly elongated, sometimes mucronate, with diameters of 4-5 mm, and are supported by a pedicel 3-5 mm long that emerges from the axils of the foliaceous branches (Gómez Garreta *et al.*, 2000; Rodríguez-Prieto *et al.*, 2013; Ballesteros & Weitzmann, 2021).

Drifted material of *S. trichocarpum* was found during a field trip with students from the Biology and Environmental Sciences degrees of the University of Malaga on 26th April 2024 to the Faro de Calaburras (Málaga, Spain, 36°30'N 4°38'W) and on 10th May 2024 to the Isla de Tarifa (Cádiz, Spain, 36°00'N 5°36'W) (Figure 1).



Figure 1. Distribution of *S. trichocarpum* in the southern Spain and northern Africa. Red dots represented previous records and green dots the records of this study.

Figura 1. Distribución de *S. trichocarpum* en el sur de España y norte de África. Los puntos rojos representan las citas anteriores y los puntos verdes las citas correspondientes al presente estudio.

Material was transported to the laboratory in a cooler where herbarium sheets were prepared (MGC-PHYC 5588; MGC-PHYC 5587, respectively; herbarium acronym follows Holgrem *et al.*, 1990) (Figures 2-3). In order to confirm the identity, material was identified using the Flora phycologica Iberica (Gómez Garreta *et al.*, 2000) and by comparison with herbarium sheets of the species *S. trichocarpum* from Morocco deposited in the Herbarium of the University of Malaga (MGC-Algae 2309; MGC-Algae 2117). We also compared our material with herbarium sheets of *S. acinarium* (MGC-Algae 1914; MGC-Algae 2198).

Material found consisted of smooth and cylindrical primary branches, holding numerous foliaceous branches and aerocysts. These foliaceous branches were lanceolate, with wavy and denticulate margins, and a conspicuous midrib, measured 3.04 ± 0.36 cm length and 1.7 ± 0.6 mm width ($n = 10$), disposed spirally. The drifted thalli likely corresponded to the apical part of an adult individual, inferred from the size of the foliaceous branches and the lack of stipe. Aerocysts were spherical with a diameter of 5.0 ± 0.1 mm ($n = 10$), some mucronate, supported by a pedicel of 4.8 ± 0.8 mm length. This material did not bear fertile

branches. We acknowledge, however, that the identity of *Sargassum* species based on sterile material as ours should be cautious.



Figure 2. Herbarium sheet of *S. trichocarpum* from el Faro de Calaburras (Malaga).
Figura 2. Pliego de herbario de *S. trichocarpum* del Faro de Calaburras (Málaga).

The presence of species that provide habitat for native ones, as *Cystoseira* / *Ericaria*, *Fucus* and *Sargassum* is noteworthy, as they likely represent the last native reservoir for native fauna and associated flora. However, the populations formed by these species have been experiencing a regression due to different factors, including overgrazing by sea urchins, damage by fishing nets, increased turbidity or displacement by invasive species (Thibaut *et al.*, 2016a). The Alboran Sea is currently suffering an invasion process by *Rugulopteryx okamurae* (E. Y. Dawson) I. K. Hwang, W. J. Lee & H. S. Kim, which has a massive impact on the native flora, even on ecosystems located at depths of up to 50 m (Altamirano *et al.*, 2019).

Thus, observations of *S. trichocarpum* in the Alboran Sea are still consider rare and, despite not revealing the precise location of its populations, supports significant conservation value. Findings of drifted material on the coasts provide crucial evidence confirming the presence of these deep-water populations in nearby areas. This is particularly important because, according to the Barcelona Convention, *S. trichocarpum* is classified as a rare and declining species (Rodríguez-Prieto *et al.*, 2013; Thibaut *et al.*, 2016b), highlighting the need to detect these local habitats and the urgent need to implement conservation measures to protect these vulnerable ecosystems and their unique species.



Figure 3. Herbarium sheet of *S. trichocarpum* from the Isla de Las Palomas (Cadiz).
Figura 3. Pliegos de herbario de *S. trichocarpum* de la Isla de Las Palomas (Cádiz).

Conflict of Interest

None.

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