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Short communication

Occurrence of *Codium fragile* subsp. *tomentosoides* (van Goor) P.C. Silva (Chlorophyta: Bryopsidophyceae: Bryopsidales: Codiaceae) in Greece

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Abstract

The green alga *Codium fragile* subsp. *tomentosoides* is one of the most common alien macroalgae in the Mediterranean, with a wide distribution in both the western and eastern basin. Populations of this taxon are present in Greece at least since the last decade of the 20th century, and today it can be found in several locations of the central and north Aegean Sea. Its spread seems to be still in progress along Greek coasts, presenting some sporadic blooms. However, no invasive behavior was observed at any studied site until today.

Key words: alien algae, *Codium fragile*, Greece, Mediterranean

Codium fragile subsp. *tomentosoides* originates from the Pacific Ocean (Japan) and has been spread to both hemispheres, mainly due to shipping (Carlton and Scanlon 1985). In Europe, it was first found on the Dutch coasts of the North Sea in 1900 (Silva 1955), and since then, it was introduced in the western Mediterranean through Gibraltar in 1940 (Meslin 1964). Today, it has been spread also in the eastern basin of the Mediterranean Sea, including the Turkish coasts (Gurner et al., 1985).

On the Greek coasts *C. fragile* subsp. *tomentosoides* is known at least from the last decade of the 20th century. However, its occurrence was never reported in any scientific paper. References of its presence in Greece can be found in technical reports of national monitoring programs (such as these of Thermaikos and Saronikos Gulf) and through personal communications.

According to our data (Annex), *C. fragile* subsp. *tomentosoides* was first found in Maliakos Gulf (C. Aegean) in 1992 (Figure 1). A large population of this taxon was observed by P. Panayotidis on big stones among muddy habitats at 1m depth in Stylida bay. This bay showed eutrophic water conditions during that year, caused by a sunken ship which carried fertilizers.

Afterwards, this taxon was collected during a monitoring program (HCMR 1996) in the inner part of Thermaikos Gulf (NW. Aegean) in 1995 (Figure 1). It was observed on big stones among muddy substrate at 1m depth near Kalochori, where it formed dense populations. In that case, agricultural pollution from the Axios river delta and the urban pollution from Thessaloniki may have supported the population development.

In 1998, *C. fragile* subsp. *tomentosoides* was found in Saronikos Gulf (C. Aegean – Figure 1) during the national monitoring of pollution caused by the urban area of Athens and the port of Piraeus (HCMR 1999). The taxon was collected from big stones among muddy sand at depths of 2-3 m at the eastern coasts of Salamina Island (Kaki

Vigla bay), where it formed relatively dense populations. Since then, it was observed in Saronikos Gulf each year until today, not only on the coasts of Salamina Island (Kaki Vigla and Ampelakia bays) but also in Aegina Island. Although its distribution expanded in Saronikos Gulf during the last years, its original dense presence has now diminished. This phenomenon could be attributed to the recovery of the Saronikos ecosystem due to the waste water treatment plant of Athens.

Finally, *C. fragile* subsp. *tomentosoides* was found along the coasts of Kavala (NE. Aegean – Figure 1) in 2000 during the sampling cruises of the Hellenic "NATURA 2000" program. It was observed on rocky substrate at low water depth (0.3m) in relatively high abundances (S. Orfanidis personal communication).

In conclusion, *C. fragile* subsp. *tomentosoides* is an alien green alga occurring in Greece, at least since the last decade of the 20th century, and its spread seems to be still in progress along the Greek coasts. Taking into account that this alga can easily be spread through shipping, it is not surprising that it was found mainly in locations near busy Greek harbors (Piraeus, Thessaloniki, Kavala and Stylis). However, marine vegetation is poorly studied in Greece (considering the important length of the coastline) and this taxon may be found in several other sites. Regarding native algae, *C. fragile* subsp. *tomentosoides* does not show a competitive behavior. The observed dense populations, until today, could be attributed to local eutrophic conditions.

Figure 1. Occurrence of *Codium fragile* subsp. *tomentosoides* in Greece until today (1 = Saronikos Gulf, 2 = Maliakos Gulf, 3 = Thermaikos Gulf, 4 = Kavala)

Figure 2. The green alga *Codium fragile* subsp. *tomentosoides* in Ampelakia bay (Salamina Island, Saronikos Gulf) among *Ulva* spp. populations (Photo by Maria Salomidi)

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Annex
Records of *Codium fragile* subsp. *tomentosoides* in Greece in 1992-2000

Map reference	Location	Depth	Substrate	Record coordinates		Record Date	Collector
				Latitude, °N	Longitude, °E		
1	Saronikos Gulf	2-3m	Stones in muddy sand	37°54'40"	23°30'46"	1998	Panayotidis P. (HCMR 1999)
2	Maliakos Gulf	1m	Stones in muddy sand	38°54'35"	22°37'06"	1992	Panayotidis P. (Personal observations)
3	Thermaikos Gulf	1m	Stones in muddy sand	40°34'43"	22°50'11"	1995	Panayotidis P. (HCMR 1996)
4	Kavala	0.3m	Rocky	40°49'38"	24°20'10"	2000	Orfanidis S. (Natura 2000 dataset)