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Some charophytes (*Charales*) collected on the island of Evia, Greece in 2009

Abstract

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In this article charophytes are reported from the island of Evia, the second largest island in Greece. On 14 investigated localities, charophytes have been found in 11 of them. All localities, except one (loc. 2) are freshwater. The most common species is *Chara vulgaris*, which has been found in five localities, of which the waterfalls north of Dhrimona is the most interesting and where the alga has optimal conditions. The two species *C. connivens* and *C. globularis* were found in the highly eutrophic alkaline lake Dhistou. In north and west of Prokopi there are several lakes in an old mining area. In the two northern of these *C. kokeilii*, a rare species in Europe, was found. In the western lakes only *C. canescens* was found. As these lakes are freshwater, they are unusual places to find *C. canescens*.

Key words: Evia, Greece, *Chara vulgaris*, *C. kokeilii*, *C. globularis*, *C. connivens*, *C. canescens*.

Introduction

The island of Evia is situated close to the mainland in the Aegian Sea, and is the second largest after Crete. I visited many water bodies, including all which can be seen on the Evia map, Anavasi 1: 100.000. The localities are listed in Table 1, and of fourteen lakes, charophytes were found in eleven of them.

Materials and methods

This work is based on material collected in the given localities in 2009. The specific conductivity of the water was measured with a Milwaukee, SM 301 EC meter, range 0-1990 $\mu\text{m}/\text{cm}$. pH was measured with a Milwaukee pH meter, type pH 52. The calcium- and chloride content was measured with Aquamerck test kits. The charophytes nomenclature is in accordance with Krause (1997) and Moore (1986).

The coordinates are from Google Earth and are given in degrees, minutes and seconds. Specimens collected are deposited at the Botanical Museum, University of Oslo (Herb. O).

Results

THE LOCALITIES

The visited localities can be found in Table 1. The most interesting localities are briefly commented on below.

Lake Dhistou (loc. 3)

This is a highly eutrophic lake as indicated by conductivity and the rich vegetation of *Phragmites communis*, which fills up most of the lake indicate this.

In shallow parts along the shore the vegetation is poor. Here I found scattered colonies of *Chara connivens* mixed with *C. globularis*. The substrate is of brown clayish soil. Plants which were found include *Myriophyllum* sp., *Scirpus lacustris*, *Potamogeton* sp., *Veronica*

Table 1. The visited localities in Evia, coordinates from Google Earth, pH, specific conductivity, calcium and chloride and charophytes found in each locality.

Locality	Coordinates	pH	Specific conductivity uS/cm	Ca ²⁺ mg/L	Cl ⁻ ppm	Charophytes
1. River c. 2 km west of Karistos	24°24'21''E, 38°00'40''N	7.8	7300	-	240	<i>Chara vulgaris</i>
2. Brook by the road, c, 2 km west of Karistos	24°24'12''E, 38°00'37''N	8.4	7410	-	1800	<i>Chara vulgaris</i>
3. Lake Dhistou	24°08'11''E, 38°20'16''N	8.7	1320	32	-	<i>Chara connivens</i> , <i>C. globularis</i>
4. River 1 km southwest of Avlonari	24° 07'11''E, 38°29'43''N	8.0	950	120	-	<i>Chara vulgaris</i>
5. Stomio beach	24° 08'09''E, 38°34'55''N	8.0	580	100	44	<i>Chara vulgaris</i>
Loc 6-7 are lakes in mining area, north of Prokopi						
6.	23°18'52''E, 38°46'11''N	8.7	500	20	-	<i>Chara kokeilii</i>
7.	23°29'04''E, 38°46'30''N	9.0	500	14	-	<i>Chara kokeilii</i>
Loc. 8-11 are lakes in mining area, west and southwest of Spathari						
8.	23°15'45''E, 38°43'31''N	9.4	500	10	30	<i>Chara canescens</i>
9.	23°24'47''E, 38°44'58''N	8.7	440	14	24	<i>Chara canescens</i>
10.	23°24'53''E, 38°44'28''N	-	-	-	-	-
11.	23°24'09''E, 38°44'40''N	9.6	590	10	20	<i>Chara canescens</i>
12. Waterfalls north of Dhrimona	23°17'37''E, 38°52'24''N	8.5	730	70	20	<i>Chara vulgaris</i>
13. Kanatadhika-Mikro Dhivari	23°06'25''E, 38°59'26''N	-	Salt: 17.20‰	-	9000	--
14. Lake Fliva in Gialtha Bay	22°59'06''E, 38°53'01''N	-	Salt: 7.45‰	-	3800	-

anagallis-aquatica and *Ranunculus* sp. Among the vegetation occurred much filamentous algae belonging to the genera *Cladophora* and *Oedogonium*.

The animal life in this lake seems very rich, with birds and tadpoles as important components.

Localities 6-11 are in an old mining area with magnesite and dolomite. When the mining stopped, the area was left with several lakes. In these lakes the vegetation is relatively poor, with a few exceptions.

Lakes north of Prokopi (loc. 6 and 7)

These two lakes are similar in appearance – the watercolour is blue, the shores are steep and the vegetation is limited to small shallow benches along the shore. The bottom has relatively coarse lime rich sediments. Here I found small and scattered compact tufts of *Chara kokeilii*. Other plants were *Phragmites communis* and *Scirpoides holoschvexus*. In loc. 6 I found *Spirogyra* sp. and fertile *Mougeotia* sp.



Fig 1. Loc. 6. *Chara kokeilii* was found here. Photo 18.5.2009.

Lakes west and southwest of Spathari (Loc 8- 11)

Of eight lakes, I have visited four. These lakes have shallow shores and in three of them I found *Chara canescens*. This is strange as the chloride contents indicate freshwaters (Table 1).

Loc. 8 is the best developed lake. It is relatively large, with scattered stands of *Phragmites communis* and dense stands of *C. canescens* covering all visible parts of the bottom. Small waterbodies on the shore were filled with small, richly fertile specimens of *C. canescens*. Fertile species of Zygnemataceae were also found here.

Loc. 9 has little water surface and is more or less filled with dense

stands of *Phragmites*. In small pools I found *C. canescens*. In both localities the bottom is of lime rich clay.

In loc. 10 the bottom was very soft and without vegetation.

Waterfalls, Dhrimona (loc. 12)

In this area the bedrock is limestone. Below the waterfall there is a pond with slowly running water. The bottom of this pond is covered with dense stands of *Chara vulgaris* which exhibits optimal development here. Vascular species include *Equisetum arvense* and *Mentha* sp. Algae present include *Zygnema* sp. and *Lemanea fluviatilis*.

THE CHAROPHYTES

Chara vulgaris

This species has been found in five localities (loc. 1,2,3,5,12).

Chara vulgaris var. *longibracteata* has been found in two localities (loc 4/river) and loc 12/pond)). In these localities the growth of the species is optimal, with specimens to 26 cm long and strongly encrusted. The fertility is high, but the spores were not ripe.

In loc. 2 by Karistos I found *C. vulgaris* var. *papillata* which has spine-cells in furrows. Specimens collected here were richly fertile, but no ripe oospores were found. In loc 5 all



Fig. 2. Loc. 11. *Chara canescens* is found here. Photo 18.5.2009



Fig. 3. Loc 12. *Chara vulgaris* cover the bottom.
Photo 19.5.2009

specimens were sterile. In loc 1, which perhaps is a more extreme locality for *C. vulgaris*, specimens with ecorticated branchlets were common. Here the oospores were ripe and brown. An interesting observation is that many plants had germinated oospores on the mother plants.

Chara globularis and *C. connivens*

These two species have both been found only in Lake Dhistou (loc. 3) where they grew in small mixed populations. They were difficult to separate in the field, as both were connivent. Under microscope they could easily be separated because of the monoecious/dioecious conditions.

1) *Chara globularis*

Monoecious species, 10 cm long, strongly encrusted. Cortex triplostichous, isostichous.

Spine-cells papillous. Branchlets as long as or shorter than the internodes, connivent. Posterior bract-cells papillous, anterior bract-cells and bracteoles as long as the oogonium. The specimens were richly fertile, but no ripe oospores was found.

2) *Chara connivens*

Dioecious species, 13 cm long, encrusted, both male (many) and female (few) plants were found. Stipulodes and spine-cells rudimentary. Bract-cells papillous. The specimens were richly fertile. Antheridia to 650 µm in diameter.

Chara kokeilii

This species has been found in two localities (loc. 6, 7).

Monoecious species, to 12 cm long, stem diameter 500 µm. Internodia to 2 cm long, slightly encrusted, with root-bulbils on the rhizoids. Cortex mostly triplostichous but diplostichous several places. Tylacanthous. Cortex lacking on lowest segments. Spine-cells single, acute, short, 0.3-0.5 x stem diameter, some as long as stem diameter, often in parts of the internodium, not regularly distributed. Stipulodes diplostephanous (difficult to see because they are small and only partly developed).



Fig. 4. *Chara kokeilii* from Loc. 6, A. Oospore B. The uppermost part C. Details of ecorticated branchlets and corticated stem with spine-cells.

Branchlets 10, to 15 mm long, with 3-4 segments. The cortex is absent on lowest internodia, but developed on stem near the top of the plants. Anterior bract-cells are as long as the oogonium and the posterior are short to papillous. Gametangia on the ecorticated branchlets, on nodia 2 and 3. Very richly fertile, with ripe, brown oospores in loc. 7.

Chara canescens

This species has been found in three localities (loc. 8, 9, 11).

The species is dioecious and/or parthenogenetic and only female plants were found. The best developed specimens were found in loc. 8, where they were up to 7 cm long, unencrusted and with short spiky branchlets, 1/5-1/10 of the internodes. The specimens correspond with *Chara canescens* f. *filiformis* Migula and were all sterile. Richly fertile, small plants were found in shallow, flooded ponds on the shore of this lake.

In the two other lakes the specimens were small (1-2 cm long) and with low fertility.

Discussion

Evia is the second largest island in Greece, situated in the Aegian Sea. On this island I found charophytes in eleven out of fourteen surveyed water bodies of different kinds. Only one of the localities can be characterized as brackish (loc. 2) with *Chara vulgaris*, which also was found in four freshwater bodies. *Chara vulgaris* is a species which is adapted to

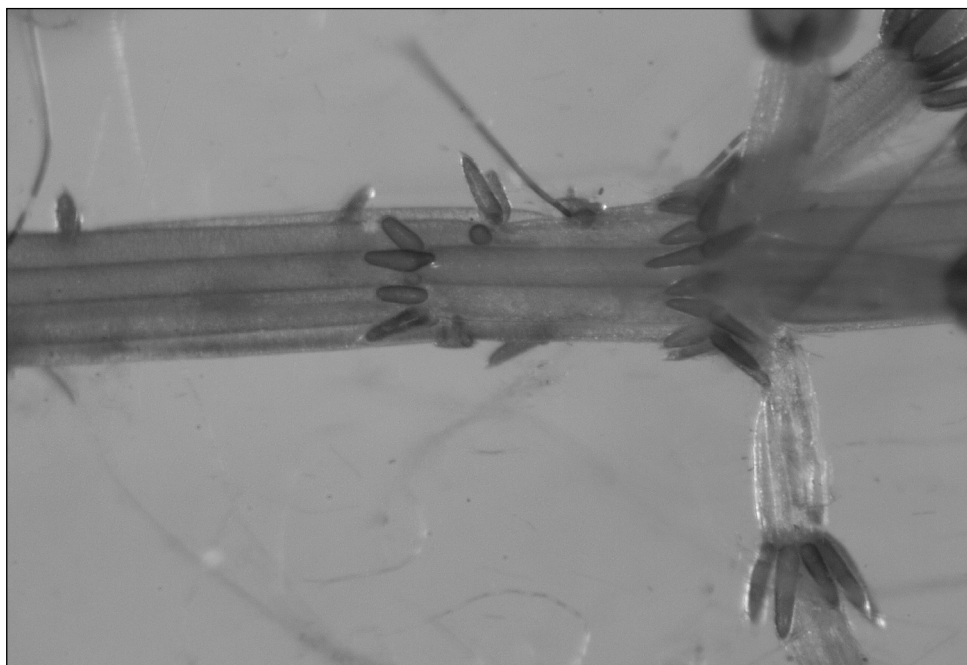


Fig. 5. *Chara canescens* f. *filiformis*.

both freshwater and slightly brackish-water. Studies show that the species is able to regulate turgor (Kirst & al. 1988). *Chara vulgaris* is a common species in Europe (Krause 1997) and reported from Greece (Langangen 2004, 2005, 2008) but not by Koumpli-Sovantzi (1997) or Raabe & Koumpli-Sovantzi (2000, 2002). In lake Dhistou (loc. 3), which is a highly eutrophic lake I found small quantities of two species, *Chara connivens* and *C. globularis*. This was the only locality with these species on the island. A similar combination of charophytes is described by Krause (1983) from Portugal.

Chara globularis is common throughout Europe (Corillion 1957; Krause 1997) and presumably also common in Greece as many actual localities have been reported in Koumpli-Sovantzi (1997), and Langangen (2004, 2007). *Chara connivens* is found in localities with alkaline or mildly brackish water (Moore 1986). Lake Dhistou is an alkaline lake with high content of calcium (table 1). In Europe *Chara connivens* is a rare species (Corillion 1957; Krause 1997). It is found in several places in former Yugoslavia (Blazencic & al. 1990) but not reported from Greece (Blazencic & Blazencic 2002, 2003 and Blazencic & al. 2006a). In Blazencic & al. 2006b it is stated, without comments as a species of Greece.

In Evia *Chara canescens* was found in three lakes in a closed mining area near Prokopi. According to the chemical parameters in table 1, these lakes must be characterized as freshwater. This is interesting, as *C. canescens* is a brackish water species, but according to Winter & Kirst (1990) the species is able to regulate turgor, and therefore can inhabit waters with different salt content. *Chara canescens* is widely distributed in Greece (Koumpli-Sovantzi 1997; Langangen 2004, 2007, 2008).

The last and perhaps the most interesting species is *Chara kokeilii* which is a rare species in Europe (Krause 1997). In the Balkans it seems to be more frequent as it is found in most of the countries there (Blazencic & al. 2006b). In Greece it was reported by Blazencic & Blazencic (2002) from Ioannina in Northwest Greece. The localities in Evia are interesting as they are relatively young, and one can wonder how this charophyte has been dispersed to the island. The most obvious answer is by water birds as discussed in Proctor 1962).

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