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Charophytes (*Charales*) from Samos and Ikaria (Greece) collected in 2013 and report on some localities in Skiathos (Greece)

Abstract

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In 2013 three Greek islands, Samos, Ikaria and Skiathos were visited. Charophytes were found in Samos and Ikaria but not in Skiathos. Out of 23 visited localities charophytes were found in 12. Seven species of charophytes were found in Samos (*Lamprothamnium papulosum*, *Chara canescens*, *C. vulgaris*, *C. gymnophylla*, *C. corfuensis*, *Tolypella nidifica* and *T. glomerata*) and in Ikaria one species (*Chara vulgaris*). Species richness in Samos is due to a variety of different habitats including brackish water lakes, running brackish water, fresh water pools and slowly moving rivers.

Key words: *Tolypella nidifica*, *T. glomerata*, *Lamprothamnium papulosum*, *Chara canescens*, *C. vulgaris*, *C. gymnophylla*, *C. corfuensis*.

Introduction

Samos and Ikaria are the two southernmost islands of the Northeast Aegean Islands. Several water bodies including lakes, reservoirs, brackish water, brooks and springs were visited. Localities with charophytes are listed in Table 1 and localities without charophytes in Table 2. Skiathos, an island in the Northern Sporades, where no charophytes were found, was also visited.

Materials and methods

This work is based on material collected in the localities on Samos and Ikaria in May (Fig. 1) and Skiathos in September 2013. The specific conductivity of the water was measured with a Milwaukee, SM 301 EC meter, range 0-1990 $\mu\text{m}/\text{cm}$ and Martini EC 60 Meter, range 0- 20 mS/cm. Calcium and chloride content was measured with Aquamerck test kits. Charophyte nomenclature is in accordance with Krause (1997) and Moore (1986). Nomenclature of vascular plants follows Lid & Lid (2007).

Coordinates are from Google Earth (WGS84) and are given in degrees, minutes and seconds. Specimens collected are deposited at the Botanical Museum, University of Oslo (Herb. O).

Table 1. Localities with charophytes in Samos (1-9) and Ikaria (10-12). Coordinates from Google Earth, specific conductivity (1 mS=1000 μ S), calcium, chloride and charophytes found in each locality.

Locality	Coordinates	Conductivity μ S/cm (σ)	Ca ²⁺ mg/l	Cl ⁻ mg/l	Charophytes
1. Alykes (Psili Ammos).	37°42'29"N, 27°00'47"E	31,4mS/cm	-	-	<i>Lamprothamnium papulosum</i>
2. Mesokampos. Dam- hidden lake.	37°42'38,4"N, 26°59'19,2"E	6,38 mS/cm	-	2700	<i>Chara corfuensis</i>
3. Mesokampos. Canal from area with unfinished buildings.	37°42'31,8"N, 26°59'19,8"E	17,8 mS/cm	-	4000	<i>Chara canescens</i> , <i>C. vulgaris</i> , <i>Tolypella nidifica</i> ,
4. Mesokampos Small waterpool near the canal, 100 m from the shore.	37°42'30,2"N, 26°59'20"E	18,98mS/cm	-	4000	<i>Lamprothamnium papulosum</i>
5. Mesokampos Small pools at the border reed- shore.	37°42'27,3"N, 26°59'12,8"E	1940	120	400	<i>Chara vulgaris</i>
6. Potakaki beach south of the airport.	37°40'49"N, 26°54'05"E	-	-	-	<i>Tolypella glomerata?</i> Dry
7. Karlovassi – western river.	37°47'46,8"N, 26°42'02,3"E	780	160	30	<i>Chara vulgaris</i>
8. Karlovassi – eastern river.	37°48'01"N, 26°43'06"E	1010	152	40	<i>Chara gymnohylla</i>
9. Kokkari West of the town, at the beach.	37°46'45"N, 26°52'52"E	440	92	20	<i>Chara vulgaris</i>
10. Dam, Kosikia.	37°34'52,5"N, 26°10'06.7"E	400	80	20	<i>Chara vulgaris</i>
11. Steli.	37°35"N, 26°10"E	400	80	20	<i>Chara vulgaris</i>
12. Keramio.	37°37"N, 26°11"E	760	80	20	<i>Chara vulgaris</i>

Results

THE LOCALITIES

The visited localities are listed in Table 1 and Table 2. The localities with charophytes (Fig. 1) are commented on below. The localities without charophytes are briefly described in Table 2.

SAMOS

Alykes (Psili Ammos) (loc. 1).

This is a brackish water lake protected because of its rich birdlife. The water is not clear. The lake is surrounded by stands of *Phragmites australis* and different species of *Juncus* e.g. *J. subulatus* and *J. acutus*. The bottom is more or less covered with dense stands of the charophytes *Lamprothamnium papulosum* together with relatively much *Potamogeton* sp. and *Ruppia maritima*. Alykes is an environmentally protected area.

Loc 2-5 Area southeast of Mesokampos. This is a big swampy area covered by dense stands of reed, mostly *Phragmites australis*. It is difficult to get into the area, and all my

Table 2. Visited localities without charophytes in Samos (1-3), Ikaria (4-6) and Skiathos (7-11) with coordinates and comments on the localities.

Locality	Coordinates	Comments
1. Lakes Glifada. (Samos).	37°41'17"N, 26°56'24"E	Two lakes, both brackish water (conductivity (σ)= 33,00 mS/cm). The east lake is highly eutrophic. <i>Zanichellia</i> is a dominating plant. Encrusted cushions of filamentous algae. The west lake is a dam with unclear, green water nearly without vegetation. Beside the dam there are eutrophic parts.
2. Dam Mytilini (Samos).	37°43'29"N, 26°59'44"E	This is a small lime-rich reservoir with clear green water (σ = 390 uS/cm). Rich birdlife. Figure 6.
3. Potami waterfalls (Samos).	37°47'16"N, 26°40'01"E	This is a river with waterfalls and small pools (σ = 540 uS/cm). The water is lime-rich.
4. Dam north of Glaredo (Ikaria).	37°36'44"N, 26°16'29"E	An artificial dam where the shores are covered by plastic.
5. Moni Mounte lake (Ikaria).	37°36'00,8N. 26°06'03,8"E	Two separate dams with little vegetation. Presumably oligotrophic.
6. Nas (Kato Raches) (Ikaria).	37°37'20"N, 26°03'37"E	Brackish water pool with contact to the sea. Figure 8.
7. Lake Airport (Skiathos).	39°10'11"N, 23°30'17,5"E	Brackish water lake (σ = 56,20 mS/cm) with contact to the sea at high tide. Unclear water. Sandbottom with <i>Zostera marina</i> . Much garbage around the lake.
8. Vramolimnos (Skiathos)	39°10'11"N, 23°26'47"E	Pool at the beach surrounded by dense stands of <i>Phragmites australis</i> . Green water with soft bottom which made it impossible for me to take a water sample. <i>Ruppia</i> sp. scattered and much blue green algae. Figure 9.
9. Strofyllia lake (Skiathos).	39°09'09"N, 23°24'02"E	Brackish water (σ = 55,4 mS/cm) without vegetation. <i>Phragmites</i> scattered along the shores.
10. Tougria island (Skiathos). Northern pool.	39°07'36"N, 23°29'47,2"E	Shallow pool at the beach. Without water. Dried plants on the bottom.
11. Tougria island (Skiathos). Southern pools.	39°07'13"N, 23°29'47,4"E	Shallow pools at the beach. In the northern part there is a little water (σ = 9,3 mS/cm). <i>Ruppia cirrhosa</i> on the bottom. The southern part is dry. The bottom is partly of white salt.

localities are in its outskirts. A few meters from loc. 2 there is a group of eight big unfinished, abandoned buildings. The three first localities are brackish and the fourth is fresh water.

Dam Mesokampos hidden lake (loc 2) (Fig. 2).

This is a very special locality, a dam with a weir and part of a house of limestone. It has probably been part of a mill or something similar. The water is shallow and crystal clear and brackish. The dam is surrounded by stands of *Phragmites australis*. In the water there is vegetation of *Chara corfuensis*, rather dense stands along the western side (Fig. 2) and elsewhere scattered along the borders. In the middle part of the water there is sand bottom without vegetation.

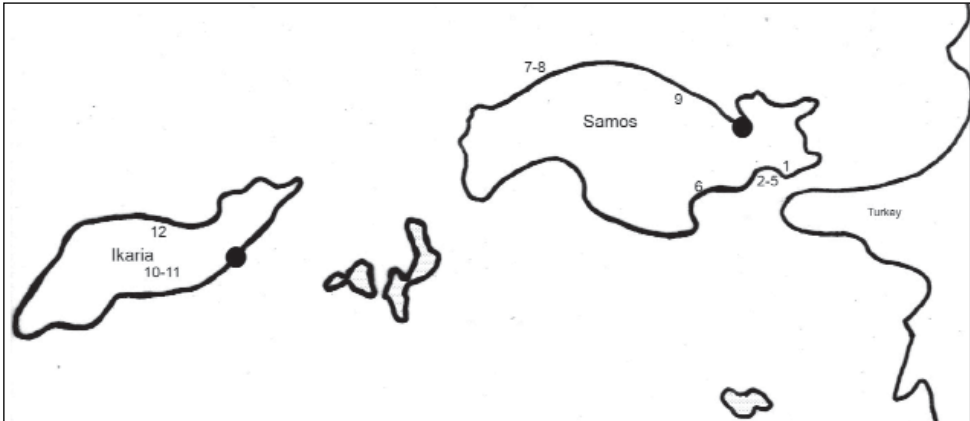


Fig. 1. The localities with charophytes in Samos (1-9) and Ikaria (10-12).

Mesokampos. Canal from area with unfinished buildings (loc. 3)(Fig. 3).

This canal runs along the east side of the swamp and comes from the area around loc. 1. The water is brackish. Parts of the canal are filled with charophytes, in some places in dense stands (Fig. 3).

The species found here are *Chara canescens* (dominating), *C. vulgaris* and *Tolypella nidifica*. In the upper part the charophytes are partly covered with soil, in the lower parts it is not so (Fig. 3).



Fig. 2. Hidden lake in Mesokampos. The water is crystal clear with scattered stands of charophytes as can be seen here. Photo 4.5.13.



Fig. 3. Dense vegetation of charophytes in the canal.
Photo 4.5.13.

Mesokampos. Small waterpool near the canal, 100 m from the shore (loc. 4).

The pool is in an open part of the swamp, with shallow water and with *Lamprothamnium papulosum* on clay bottom.

Mesokampos. Small pools at the border reed- shore (loc. 5).

This locality is located at the border between the beach and the swamp, and in vegetation of *Phragmites* and other plants. The water is shallow with much *Chara vulgaris*, *Chaetophora incrassata* and filamentous green algae.

Potakaki beach south of the airport (loc. 6).

A shallow wetland which now was dry. In a flat area here there was much dried *Tolypella glomerata*. When moistened I could remove them from the ground.

Karlovassi – western river (loc. 7)(Fig. 4).

At this time of the year there is little water in the river, and parts of the river bank are wet exposed land (Fig. 4). Along the eastern bank (left in the photo) there is a zone with *Cochlearia officinalis*, small stands with *Typha latifolia*, then scattered cushions with *Chara vulgaris* and in the water *Zanichellia*, and on the water surface masses of the green alga *Cladophora* (Fig. 4). The *Chara* growing on wet land is an interesting variety of *C. vulgaris*.

Karlovassi – eastern river (loc. 8)(Fig. 5).

This river has more water. The bottom is covered with different water plants and large areas with dense mats of *Chara gymnophylla* and *C. vulgaris* (Fig. 5). Fertile specimens of the filamentous green algae *Oedogonium* were common here.



Fig. 4. Western river in Karlovassi, lower part. Photo 6.5.13.

Kokkari, west of the town, at the beach (loc. 9).

This is a stream with a small pool at the beach with little vegetation on the sand bottom, scattered colonies of *Chara vulgaris* and masses of the filamentous green alga *Zygnema*. The pool is surrounded by stands of *Phragmites australis*.

Dam Mytilini (loc. without charophytes, see Table 2)(Fig. 6).

IKARIA

Dam, Kosikia (loc. 10).

This is a dam with low level of the unclear green water. On the sand bottom in shallow parts scattered *Chara vulgaris* grew. No other vegetation occurred.

Steli (loc. 11).

This is a spring reservoir which recently has been emptied and cleaned, but still contains *Chara vulgaris* and the filamentous alga *Cladophora* on the bottom.



Fig. 5. Dense mat with *Chara gymnophylla* in the eastern river in Karlovassi. Photo 6.5.13.



Fig. 6. Dam northeast of Mytilini. Photo 5.5.13.

Keramio (loc. 12)(Fig. 7).

This is a spring filled with dense mats of *Chara vulgaris*. The water is crystal clear.

Nas (loc. without charophytes, see Table 2)(Fig. 8).

SKIATHOS

Vramolimnis (loc. without charophytes, see Table 2) (Fig. 9).



Fig. 7. The spring in Keramio is filled with charophytes. Photo 10.5.13.



Fig. 8. The locality in Nas. Photo 10.5.13.

THE CHAROPHYTES

Chara canescens

This species has been found in one locality in Samos (loc. 3). The specimens here were up to 20 cm long and typical. The fertility was good with many young oogonia and some black, ripe oospores. *Chara canescens* is a brackish water species.

Chara vulgaris

This species has been found in eight localities on the two islands, Samos (loc 3, 5, 7, 8, 9) and Ikaria (loc. 10, 11, 12).



Fig. 9. Skiathos. Vramolimnis. Photo 18.9.2013.

The species was fertile in all localities, slightly in the one brackish locality (loc. 3) and richly fertile in the other localities which are freshwater. Ripe oospores are found in loc. 5 with black oospores and in loc. 12 with brown oospores. Specimens vary in height from 10 to 30 cm. *Chara vulgaris* var. *longibracteata* is the most common variety (loc. 5, 9, 10). *Chara vulgaris* var. *papillata* is found loc. 5. In loc. 7, the western river in Karlovassi there is a small, interesting variety of *Chara vulgaris* which I will briefly describe: *Chara vulgaris* –var. (Fig. 10).

Small specimens growing in dense mats in shallow fresh water. Plants 2.5-3.5 cm high, slightly encrusted, green. Axes diameter 0.5-0.75 mm, internodes 3-5 mm long, branchlets up to 1-2 times longer. Branchlets to 7 mm with 3- 4 segments. End segment with two ecorticated cells. Anterior bract-cells 3-4 times longer than the oogonium, papillous. Posterior bract cells are long. Cortex diplostichous, isostichous to aulacanthous. Spine-cells normally short, but in younger internodes many are as long as the stem diameter. Stipulodes short, developed in both series with equal length. Monoecious. Gametangia on all branchlet nodes, including some of the ecorticate segments. The specimens are very richly fertile. Oogonia solitary, to 0.75 mm long, 0.45 mm wide, with 9-10 spiral cells. Ripe oospores are black. Antheridia solitary, up to 0.35 mm in diameter.

Chara gymnophylla

This species has been found in one locality (loc. 8) in Samos. Plants are up to 15 cm long. Branchlets ecorticated or with cortex on the lowest internodes. Posterior bract-cells are long. Fertile.



Fig. 10. The variety of *Chara vulgaris*.

Chara corfuensis (Fig. 11)

This species has been found in one brackish locality in Samos (loc. 2), Mesokampos hidden lake. Plants to 30-40 cm long, green. Cortex diplostichous, tylacanthous. Spine-cells acute, single, some in pairs, as long as or to 2x longer than stem diameter (Fig. 12). Stipulodes diplostephanous. Branchlets with cortex only on one or two internodes, the others are ecortical (f. *gymnophylla*). Fertility is low, with few small oogonia and antheridia. This species is also described by Langangen (2007, 2010).

Lamprothamnium papulosum

This species has been found in two localities in Samos (loc. 1 and loc. 4). Typical specimens are from 7-10 cm high. In Alykes they are richly fertile, but not yet with ripe oospores. In loc. 4 with white, round bulbils.

Tolypella nidifica

This species has been found in one brackish-water locality in Samos, Mesokampos (loc. 3). In a canal here it was found mingled with a *Chara canescens* (dominating) and *C. vulgaris*. The specimens were up to 10 cm long, green, richly fertile with red antheridia and yellowish brown oogonia. Monoecious. Oogonia c. 500 μm long, antheridia 250-350 μm in diameter.



Fig. 11. *Chara corfuensis*.



Fig. 12. *Chara corfuensis*. Details of cortex and spine-cells.

Tolypella glomerata

This species has been found in one locality in Samos, Potakaki beach (loc. 6). The locality was dried out before my visit, but the *heavily encrusted* specimens suggest freshwater or slightly saline water. The specimens collected were richly fertile with yellowish brown oospores. Monoecious. The oospores had 8 ridges and were 250 μm long. Antheridia up to 400 μm in diameter.

Discussion

Out of 23 visited localities I found charophytes in 12, all on Samos and Ikaria. The five localities in Skiathos (Table 2) are all brackish, without charophytes. In Samos I found seven species of charophytes (*Lamprothamnium papulosum*, *Chara canescens*, *C. vulgaris*, *C. gymnophylla*, *C. corfuensis*, *Tolypella nidifica* and *T. glomerata*) and in Ikaria one species (*Chara vulgaris*). The richness of species in Samos is due to a variety of habitats, varying from brackish water lakes, running brackish water, fresh water pools to slightly running rivers.

Chara canescens is not common in Greece. The species has been reported from scattered brackish water localities along the coast and the islands (Koumpli- Sovantzi 1997; Langangen 2004, 2008, 2010a; Raabe & Koumpli- Sovantzi 2000; Stephanides 1940) and Christia & al. (2010). In the Balkans this species is redlisted as vulnerable (VU) (Blazencic & al. (2006). In Europe it is found scattered along the coasts (Corillion 1957).

Chara vulgaris is a common species in Greece. It is commonly found in lime-rich freshwater and slightly brackish water. *Chara gymnophylla* is a species close to *C. vulgaris* and often regarded as a variety of this. In Greece it has also been reported from Samos (this article) and Khios (Langangen 2008).

Chara corfuensis is an endemic species to the Balkans (Blazencic et al. 2006). The distribution of this species is discussed in Langangen (2010). Two new localities are also given in Christia & al. (2010), Kaiafas and Prokopos lagoons, both on Peloponnese. The species is redlisted as critically threatened (CR) (Blazencic & al. 2006), which after many new finds should be re-evaluated.

Lamprothamnium papulosum has been reported by Koumpli- Sovantzi (1997) and by Langangen (2004, 2007, 2008, 2010b, 2013), and is relatively common in Greece. In Europe it is found scattered along the coasts (Corillion 1957).

Two species of *Tolypella* have been determined in Samos: *T. nidifica* and *T. glomerata*. Both are rare species in the Balkans. *Tolypella nidifica* is known from Croatia (Blazencic et al. 2006) and *T. glomerata* is found in Romania and Greece (Blazencic et al. 2006). In the Balkans *T. nidifica* is redlisted as CR and *T. glomerata* as endangered (EN) (Blazencic & al. 2006). In Europe *T. nidifica* is most common in brackish ditches and lakes of northern Europe. It is also reported from Cyprus by Nordstedt in Holmboe (1914). *T. glomerata* is fairly common throughout Europe (Moore 1986).

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