

**NEW OCCURRENCE AND DISTRIBUTION OF *NITELLA HYALINA* (DC.)
AGARDH (CHARACEAE) AND THE FIRST REPORT ON *NITELLETUM HYALINAE*
CORILLION 1957, IN CROATIA**

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Abstract - In 2011, a new population of the stonewort *Nitella hyalina* was found on the island of Pag, in a pond between Novalja and Lun, near the cove of Dubac. At the littoral, unshielded zone of this unnamed, small shallow lake *Nitella hyalina* forms large monodominant patches or grows together with *Potamogeton trichoides* Cham. et Schl. and *P. nodosus* Poir. We identified these stands as the species' poor association of *Nitelletum hyalinae* Corillion 1957, a new vegetation type of Croatia. *Nitella hyalina* is sparse in Europe and rather rare on the Balkan Peninsula. It was previously detected only in two places in Croatia. Considering its severely fragmented distribution and the fact that at present it is known to exist at only three locations, *Nitella hyalina* should be treated as an endangered (EN) taxon among the Charophytes of Croatia.

Key words: Aquatic vegetation, endangered, *Nitellion flexilis*, Pag island, stonewort

INTRODUCTION

Nitella hyalina (DC.) Agardh (Charophyceae) is a macroscopic green alga, a stonewort, which has a cosmopolitan distribution, but it is rare and local almost everywhere in the world (Zaneveld, 1940, Corillion, 1957, Moor, 1986, Wood and Imahori, 1965, Krause, 1997). In Europe it occurs in Austria, Finland, France, Germany, Greece, Great Britain, Italy, Lithuania, Netherlands, Portugal, Romania, Russia, Spain and Switzerland (Corillion 1957, Tarnavski and Olteanu 1958, Gollerbah and Krasavina 1983, Koumpli-Sovantzi 1997, Schubert and Blindow 2004, Stewart 2004, Cirujano et al., 2008, Langangen 2012). It also occurs, though rarely, in the area of the former Yugoslavia: in Montenegro (Krause, 1990, 1997, Blaženčić in ed.), FYR Macedonia (Kostić, 1936, Talevska, 2002, Urbaniak and

Blaženčić, 2012) and Croatia (Migula, 1897, Krause, 1997, Blaženčić et al. 1998). *Nitella hyalina* is one of the rarest stonewort species in Europe. It is extinct in Great Britain (Stewart and Church, 1992), and critically endangered in Germany (Schmidt et al., 1996), in northern European countries (Langangen 2007) and in the Balkans (Blaženčić et al., 2006). It usually prefers open sunny edges of lakes, pools, sea shores, sheltered openings in reed stands with calcareous mud and can withstand some dehydration when water levels drop in the summer (Zaneveld, 1940, Corillion, 1957, Moore, 1986, Schubert and Blindow, 2003).

MATERIALS AND METHODS

The specimens were collected by hand-picking during July 2011. They were preserved in 5% formalin

solution and dried as herbarium specimens for morphological observations. The Characeae material was identified with the help of an extensive literature review (e.g. Moore, 1986, Blaženčić, 1995, Schubert and Blindow, 2004), while the phanerogams were identified using Király (2009). The voucher specimens are kept in the collection of JPU. Photomicrographs of more important parts of species, especially dactyls, were taken with the help of a digital camera under a stereo microscope with magnification of 100 to 400x. The distribution map of *Nitella hyalina* in Croatia was prepared on the basis of field observations, literature data and herbarium collections (BEOU). In the habitat of the species, phytocoenological relevés were taken according to the Braun-Blanquet methodology (Mueller-Dombois and Ellenberg, 1974). Geocoding (in WGS) of the site was performed using a GPS device.

RESULTS AND DISCUSSION

Nitella hyalina is a monoecious, erect, but relatively short (up to 30 cm) stonewort. Plants are dark or brownish-green, usually unencrusted. Axes moderately slender, up to 0.7 mm in diameter, internodes 2-4 times as long as branchlets. Branchlets usually 8, heteroclemous, with a primary whorl and accessory whorls of branchlets (Fig. 1.a). Dactyls 2-celled, gametangia conjoined at the primary branchlets (Fig. 1.b). Oogonium and antheridium solitary, up to 0.4 mm in diameter (cp. Moore, 1986).

According to the data from literature and from Herbaria, occurrences of *N. hyalina* in Croatia (Fig. 2) are the followings:

Literature – Cres Island, Vrana Lake (Migula 1897: 195., Krause 1997: 140.)

Herbarium – Cres Island, the freshwater permanent Vrana Lake, northern part, depth 2-2.5 m. Leg. and det. J. Blaženčić. 02.08.2010. Col. Nr. 2190 and 2217 Ch (BEOU).

Sladinac Lake (coordinates: 43° 04 32 95 N, 17° 25 12.60 E), one of the eight Baćinska lakes, near the

Neretva estuary. Leg. and det. W. Krause, 1989. (Ch (BEOU)).

Sladinac Lake (one of the Baćinska lakes) 05.08.1989. Leg. and det. J. and Ž. Blaženčić. Col. nr. 1321, 1322, 1337 Ch (BEOU).

Pag Island, unnamed pond near Dubac Cove [lat. 44.611860°, lon. 14.824625°], 09.07.2011. Leg. and det. J. Csiky (JPU).

Although *N. hyalina* is abundant in sites in Croatia, it should be treated as an endangered (EN) species of the Croatian flora, facing a high risk of extinction in the wild in the near future, as defined by the following IUCN criteria (<http://www.iucn.org/themes/ssc/red-lists.htm>): B) The extent of occurrence was estimated to be is less than 5 000 km² and 2). The area of occupancy was estimated to be less than 500 km² and a); it is severely fragmented or known to exist at no more than five locations (most individuals of this taxon are found in small and relatively isolated subpopulations, these small subpopulations may become extinct, with a reduced probability of recolonization) and c) (iv) Extreme fluctuations in numbers of mature individuals were recorded.

Nitella hyalina was found in Lake Sladinac, one of the Baćinska lakes complex in the close vicinity of Ploče harbor on the Adriatic seacoast, near the Neretva estuary, in 1989. The Baćinska lakes consist of eight lakes connected by canals, except for Šipak Lake, which is not directly connected with the others. These lakes are located on the karst region of the Croatian seacoast, at app. 15 m a.s.l. The water of the Baćinska lakes is clean and very transparent (up to the depth of 10 m). According to the chemical content, the lakes belong to the Ca-Carbonate type (Živković, 1969, 1972).

The data of habitat characteristics and phytocoenological relevés were taken over from the manuscript of Jelena and Živojin Blaženčić.

Water is neutral to mild basic reaction (pH = 7.2-8.4). The bottom is fine silt, near the bank it is

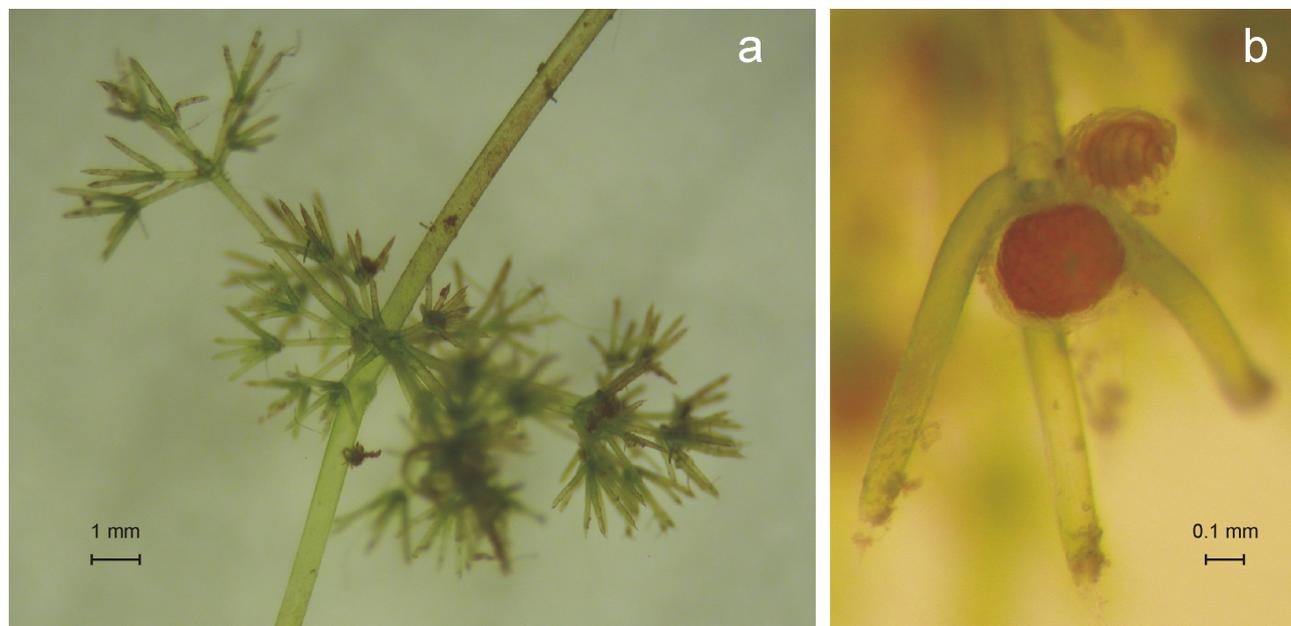


Fig. 1. *Nitella hyalina*: a) axial node with primary and accessory whorls and b) third branchlet node of the primary branchlet with conjoined oogonium and antheridium surrounded by three dactyls (Photo: János Csiky).



Fig. 2. Localities of *Nitella hyalina* in Croatia.

mixed with sand. The relief of the bottom varies in the lakes from vertical to slightly sloping. Around Sladinac Lake there is a zone of emerged plants (*Scirpo-Phragmitetum*) which is partly intermittent (camps, weekend houses, approaches for boats). There is no zone of floating plants, but small patches of *Potamogeton natans* L. on sites are surrounded by *Schoenoplectus triqueter* L. *Nitella hyalina* was found on three of the 13 cross-transects performed in the bank area, at a depth of 0.6 (T/3); 0.2-1.0 (T/5) and 0.5 m (T/13), on muddy ground or grey-white silt (silt mixed with sand); measured pH = 7.8-8.0. In shallow water near the bank a very thick vegetation layer of submerged plants incrustated with CaCO₃ was found; *Nitella hyalina* was there among other plants.

Relevé 1. (in a part of shore where the reed was cut)

Date: 05.08.1989.; Area: 10 m x10 m; Depth of water: 0.6 m; Temperature of water: 25 °C, pH = 7.8-8.0; Substrate: silt mixed with water. *Nitella hyalina* 5, *Potamogeton pectinatus* 3, *Chara corfuensis* 1, *Nitellopsis obtusa* 1, *Myriophyllum spicatum* +, *Najas marina* +, *Nitella confervacea* +, *Potamogeton pusillus* +, *Chara globularis* r, *Potamogeton natans* r.

Relevé 2. (in the part of shore where the reed was cut for access to the lake from the bungalow)

Date: 05.08.1989.; Area: 10 m x10 m, Depth of water: 0.2 m to 1.0 m; Temperature of water: 25 °C, pH = 7.4-7.8; Substrate: silt covered by stones. *Nitellopsis obtusa* 3, *Myriophyllum spicatum* 2, *Chara corfuensis* +, *Chara globularis* +, *Najas marina* +, *Nitella hyalina* +, *Potamogeton pectinatus* +, *Potamogeton trichoides* +, *Potamogeton perfoliatus* r.

Relevé 3. (near the camp, close to the restaurant)

Date: 05.08.1989.; Area: 10 m x 10 m, Depth of water: 0.2 m to 1.0 m, Temperature of water: 25 °C, pH = 7.4-7.8; Substrate: silt covered by pebbles and stones.

At this site the plants were densely interlaced, forming a thick plant layer, making it impossible to estimate their abundance. Therefore, only a species list was prepared without quantitative data: *Chara corfuensis*, *Ch. virgata*, *Myriophyllum spicatum*, *Najas marina*, *Nitella confervacea*, *N. hyalina*, *Nitellopsis obtusa*, *Phragmites australis*, *Potamogeton natans*, *P. perfoliatus*, *P. pusillus*, *Schoenoplectus triqueter*.

The habitats of this species on Cres Island were not described in papers of Migula (1897) and Krause (1997). The description of the habitat of *N. hyalina* in Vrana Lake on Cres Island presented here was taken over from the manuscript of J. Blaženčić et al. (in ed.).

N. hyalina was found in the littoral zone of Vrana Lake, at the depth of 2.0-2.5 m, in August 2010. Water was transparent down to the bottom (the water transparency in the lake is often up to the depth of 9-10 m). The bottom was muddy-sand. *Nitella hyalina* was found with *Schoenoplectus lacustris* (fragments), *Najas intermedia*, *Najas* sp. and *Mentha aquatica*.

The zonation of the pond on Pag begins with a *Potamogeton nodosus* and *P. trichoides* dominated stand in the deepest, open part of the water body. In the shallow parts of the pond, *Nitella hyalina* is determinant in the submerged layer, but in some places *Potamogeton trichoides* was codominant in the normal herb (E1n) layer. At the waterfront, *Eleocharis palustris* agg. and *Typha* spp. become dominant. On wet mud, *Mentha pulegium* L., *Pulicaria vulgaris* Gaertn., *Plantago major* s.l. and *Peplis portula* L. occur. Since the pond is a drinking-water source for goats and sheep, the transparency of the water is rather low (to 50 cm). The bottom of the lake is covered with silt, mud and limestone rocks.

Nitelletum hyalinae Corillion 1957 relevé made by János Csiky, Date: 2011.07.12., Location: Croatia/Dubovac (unnamed freshwater pond), Position (coordinate): 44.611860°, 14.824625°, Altitude: 46 m, Plot size: 1 m², Cover total: 100%, Cover E1n: 1%, Cover E1s: 100%, Cover open water: 99%, Height E1: 40 cm, Depth of water: 40-50 cm, Cover abundance

scale: "Braun-Blanquet old": *Nitella hyalina*: 5, *Potamogeton trichoides*: 1.

The monodominant carpets of *N. hyalina* on Pag Island can be identified as the association of *Nitelletum hyalinae* (Corillion 1957) within the alliance of *Nitellion flexilis* Krause 1969. In the original description, Corillion (1957: 385-386) published five relevés in which *N. hyalina* associated with *Chara braunii*, the only accompanying species in two cases. The abundance-dominance (AD) value of *N. hyalina* is rather low in all samples: 3-1 after the old Braun-Blanquet scale. According to the description, stands of this community usually develop from June to October. In space and time *Nitelletum hyalinae* Corillion (1957) is closely related to *Eleocharis*-dominated grasses, pioneer mud vegetation and *Potamogeton*-dominated vegetation types (Corillion 1957). Golub et al. (1991) described *Nitelletum hyalinae* as a new association but these authors did not cite Corillion (1957). Theurillat and Moravec (1991) indexed this name as *Nitelletum hyalinae* Losev in Gloub, Losev and Markin 1991 as a new syntaxon, although Corillion (1957) earlier published a valid description with the same name. The species composition of this vegetation type is simple (1-3 species). Since the denominating taxon (*Nitella hyalina*) is dominant, while the other species are rare or accidental in the samples, we can treat these publications as two descriptions of the same association. According to the (§31) of the International Code of Phytosociological Nomenclature (Weber et al. 2000), the priority of Corillion (1957) is unquestionable, while Losev's name is a homonym.

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