



# Overview of the stoneworts (Charales) of Serbia with the estimation of the threat status

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**ABSTRACT:** The study provides insights into stoneworts of Serbia (1851-2013). For each taxon, the synonym(s), distribution, threat factors and the IUCN threat category is given. In Serbia, 23 species are present of ca. 400 known worldwide.

**KEY WORDS:** stonewort, Charales, Serbia, distribution, threat status

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## INTRODUCTION

The study of stonewort flora and vegetation, their distribution and ecological characteristics are needed at both the regional and global levels. Thus, this review presents the first complete up-to-date overview on stoneworts of Serbia. The overview includes data both from the literature and unpublished author records.

The first data on stoneworts in Serbia were dated from the herbarium of Josif Pančić. In the period from 1851 to 1880, he collected stoneworts from 17 localities in Serbia. Data on the Pančić collection were considered jointly with his own data from Southern Serbia and published by Nedeljko Košanin (KOŠANIN 1907a, 1907b).

After that, until the 1970s, information on stoneworts in Serbia could be found in several publications on aquatic flora and vegetation (SIMIĆ 1905/06; KATIĆ 1899/1900; JANKOVIĆ 1953; SLAVNIĆ 1956; ČANAK 1964; MARINOVIĆ 1955; MARINOVIĆ & KRASNIĆI 1970; VUKOJE 1979; CVIJAN 1985; GUELMINO 1973; BUTORAC et al. 1994).

Since the 1970s, continuous and detailed investigation of stoneworts has taken place in the western and central Balkans (BLAŽENČIĆ 1980, 1984, 1995; BLAŽENČIĆ &

RADOTIĆ 1982; BLAŽENČIĆ *et al.* 1990, 1995a, b, 2006a, b; BLAŽENČIĆ & BLAŽENČIĆ 1991, 1997; RANDJELOVIĆ & BLAŽENČIĆ 1996; BLAŽENČIĆ & STANKOVIĆ 2008; VESIĆ *et al.* 2011).

The catalogue, as a forerunner of the Flora of Stoneworts of Serbia, gives a latin name for each taxon present in Serbia, followed by synonymy, taxonomic status, characteristics, habitat type, distribution in Serbia, threat factors, number of localities and threat status. Collection numbers are given for each taxa present in the BEOU Charophyta collection (VUKOJIĆIĆ *et al.* 2011).

The threat status of each species is estimated according to STEVANOVIĆ (1999) and the IUCN (2001). The standard IUCN criteria have been used for threat estimation (STEWART 2004; BLINDOW 2000; BLAŽENČIĆ *et al.* 2006a,b) where possible, or slightly modified and adjusted to water macrophyte algae, taking into account ecological parameters of the habitat (SCHMIDT *et al.* 2006).

Classification and nomenclature of the stoneworts follow KRAUSE (1997). In Serbia, so far, 23 species of stoneworts are known, belonging to four genera: *Nitella* (7 species, 1 form), *Tolypella* (3 species), *Nitellopsis* (one species) and *Chara* (12 species, 25 forms and 3 varieties).

**Conspectus of stoneworts of Serbia***Nitella* Agardh 1824

1. *Nitella brachytelea* A.Br.
2. *Nitella capillaris* (Krocker) J. Groves et Bullock-Webster 1920  
f. *longifolia* A.Br.
3. *Nitella confervacea* (Bréb.) A. Braun ex Leonh. 1863
4. *Nitella gracilis* (Sm.) C. Agardh 1824
5. *Nitella mucronata* (A. Braun) Miq. in H. C. Hall 1840 emend. Wallman 1853
6. *Nitella opaca* (Bruzelius) C. Agardh 1824
7. *Nitella syncarpa* (Truill.) Chevall. 1827

*Tolypella* (A. Braun) A. Braun 1850

1. *Tolypella prolifera* (Ziz ex A. Braun) Leonhardi 1863
2. *Tolypella intricata* (Trentepohl ex Roth) Leonhardi 1863
3. *Tolypella glomerata* (Desv.) Leonh.

*Nitellopsis* Hy 1889

1. *Nitellopsis obtusa* (Desv. In Loisel.) J. Groves 1919

*Chara* Vaillant 1919

1. *Chara braunii* C. C. Gmel. 1826  
f. *máxima* Mig.  
f. *tenuior* A. Br.
2. *Chara canescens* Desv. & Loisel. in Loisel. 1810
3. *Chara connivens* Salzm. ex A. Braun 1835
4. *Chara contraria* A. Braun ex Kütz. 1845 s.str.  
f. *capillacea* Mig.  
f. *stagnalis* F.  
f. *aspera* F.  
var. *nitelloides* A. Br.
5. *Chara globularis* Thuill. 1799  
f. *humilior* Mig.  
f. *lacustris* Mig.  
f. *laxa* Mig.  
f. *stricta* Mig.  
f. *normalis* Mig.
6. *Chara hispida* (L.) Hartm. 1820
7. *Chara intermedia* A. Braun in A. Braun, Rabenh. & Stizenb. 1859  
f. *decipiens* A. Br.  
f. *brachyphylla* Mig.
8. *Chara tenuispina* A. Braun 1835  
f. *nitida* Mig.
9. *Chara rohlenae* Vilh.
10. *Chara tomentosa* L. 1753
11. *Chara virgata* Kütz. 1834
12. *Chara vulgaris* L. 1753  
f. *nidifica* Mig.

- f. *pseudocontraria* Mig.  
f. *normalis* Mig.  
f. *vulgaris* Mig.  
f. *pulchella* Mig.  
f. *cuspidata* Mig.  
f. *aequistriata* A.Br.  
f. *gymnophylla* (A. Br.) Hy  
f. *subnudifolia* Mig.  
f. *paludosa* F.  
f. *subsegregata* Nordst.  
f. *tenuissima* Mig  
var. *longibractea* (Kutz) J. Grov. Bull.-Web.  
var. *nitelloides* A. Br.

**Additional data on stonewort taxa in Serbia*****Nitella brachytelea* A. Braun 1864**

Syn.: *Nitella mucronata* var. *crassa* et *brachiteles* A. Braun in herbar

*Nitella furcata* subsp. *mucronata* var. *sieberi* f. *brachytelea* (A. Br. in Leonh.) R. D. W. 1965

Habitat: Channels; Limnophyte, it inhabits shallow slowly moving oligo-mesotrophic waters, on muddy to clayey substrate.

Distribution in Serbia: Channel by Srebrno lake near Veliko Gradište (*leg. Jelena & Živojin. Blaženčić, 30.09.1983*); Channel by Padinska Skela (*leg. Zoran Romčević, 10.09.1998*)

Threat factors: Agricultural chemistry, overgrowing by vascular plants, mechanical cleaning of the channels.

IUCN Threat status in Serbia: EW (?) – only two records, not seen at the localities again after record was made

***Nitella capillaris* (Krocker) J. Groves et Bullock-Webster 1920**

Syn.: *Chara capillaris* Krocker, 1814; *Nitella capitata* Ag., 1824; *Nitella syncarpa* var. *capitata* (Nees) Kütz., 1845; *Nitella capillaris* f. *capillaris* Wood, 1962; *Nitella syncarpa* var. *Capitata* (Nees) Kütz. in R. D. W. 1965

Habitat: Channels, ponds; In shallow water (to 0.7 m) in channels, ponds within the meadows or water depression in riparian forests. Water of neutral to slightly alkaline pH (7.0 -7,8). It can often be found with other stoneworts and vascular plants (BLAŽENČIĆ *et al.* 1995a, b; VESIĆ *et al.* 2011).

Distribution in Serbia: In the Markova sedmica small lake by Graničar near Subotica

(BLAŽENČIĆ *et al.* 1995a, b); Special Nature Reserve “Zasavica” (VESIĆ *et al.* 2011); in the lake by Pirot (KOŠANIN 1907a, b; MILOVANOVIĆ 1949)

f. *longifolia* A. Br. (as *Nitella capitata* (N ab Es) Ag.) (KOŠANIN 1907a, b; MILOVANOVIĆ 1949).

Threat factors: drainage, field drying, mechanical cleaning of the channels, eutrophication, overgrowing  
IUCN Threat status in Serbia: DD (CR).

***Nitella confervacea* (Breb.) A. Br. 1863**

Syn.: *Nitella batrachosperma* (Reich.) A. Br. 1847; *Nitella gracilis* var. *confervacea* Bréb., 1849; *Nitella nordstedtiana* J. Grov. 1890; *Nitella confervacea* ssp. *brébissonii* (A. Br. ex Bréb.) Hy, 1905; *Nitella gracilis* ssp. *gracilis* var. *confervacea* f. *confervacea* R. D. W. 1965

Habitat: ponds; inundating zone in riparian forests, shallow.

Distribution in Serbia: Special Nature Reserve “Zasavica” (VESIĆ *et al.* 2011);

Threat factors: extensive tourism, boating, mechanical cleaning of the water habitats

IUCN Threat status in Serbia: CR (D), one location with less than 50 individuals.

***Nitella gracilis* Agardh 1824**

Syn.: *Chara gracilis* Smith, 1810; *Nitella gracilis* (Smith) Ag. 1824 et auct. plur.; *Nitella gracilis* ssp. var. *etf. Gracilis* Wood, 1962

Habitat: accumulations on peatlands and streams after thermo-mineral sources; mesotrophic waters (to 6m), on muddy and sandy substrate covered by detritus. Water reaction (pH=7.0-7.4) (BLAŽENČIĆ 1984; BLAŽENČIĆ & BLAŽENČIĆ 1991; RANDJELOVIĆ & BLAŽENČIĆ 1996; STEVANOVIĆ *et al.* 2003).

Distribution in Serbia: Rgoška banja, Vlasinsko jezero, Vrujci, Danube by Banatska Palanka.

Threat factors: extensive tourism, mechanical cleaning of the water habitats, eutrophication

IUCN Threat status in Serbia: CR (B1,B3c).

***Nitella mucronata* (A. Br.) Miquelin H. C. Hall 1840 emend. Wallman 1853**

Syn.: *Chara furcata* Barbieri, 1827; *Chara flexilis* Bischoff non L. 1828; *Chara mucronata* Braun, 1834; *Nitella flabellata* Kütz. 1843; *Nitella mucronata* f. *mucronata* R. D. W. 1962; *Nitella furcata* ssp. var. *etf. mucronata* R. D. W. 1962

Habitat: lakes, channels, fishponds; Limnophyte, in coastal region (0.2-1.0 m), on muddy substrate, water (pH=6.4 - 8.2).

Distribution in Serbia: Blace (near Prokuplje, *leg. J. & Ž. Blaženčić*, 20.08.1986); Čenta, Vojvodina (*leg. Z. Romčević*, 27.08.1998), Savsko lake near Belgrade (Ada Ciganlija) (BLAŽENČIĆ 1995), Special Nature Reserve “Zasavica” (*loc.*: Ostrovac, Gradina, Lug, Sadžak Valjevac, Preseka, Šumareva ćuprija, Pačija bara, Bostanište Trebljevine and Panjevine) (VESIĆ *et al.* 2011)

Threat factors: eutrophication, anthropogenic activities, low competence ability with other hygrophytes, drying, tourism.

IUCN Threat status in Serbia: CR (A1e, C2a).

***Nitella opaca* Agardh 1824**

Syn.: *Chara opaca* Bruz., 1824; *Nitella syncarpa* var. *opaca* (Bruz) Kützing, 1845; *Nitella syncarpa* var. *glomerata* A. Braun 1847; *Nitella flexilis* var. *flexilis* f. *flexilis* R. D. W., 1962

Habitat: lakes, drained channels; limnophyte, to 1.0 – 6.0 m. It prefers cold water currents, near sublacustric sources, water (pH = 5.6 - 6.4). From plain to montane areas.

Distribution in Serbia: Tresetište by Subotica (BLAŽENČIĆ *et al.* 1995a,b); Vlasinsko jezero (BLAŽENČIĆ & BLAŽENČIĆ 1991; RANDJELOVIĆ & BLAŽENČIĆ 1996)

Threat factors: eutrophication, low competitiveness with other hygrophytes

IUCN Threat status in Serbia: CR (A1e).

***Nitella syncarpa* (Thuill.) Chevallier 1827**

Syn.: *Chara syncarpa* Thuill. 1799; *Tolypella coutinhoi* Gonçalves da Cunha, 1935; *Nitella capillaris* f. *syncarpa* (Thuill.) Wood 1962; *Nitella syncarpa* var. *syncarpa* (Thuill.) Chev. em. R. D. W. 1962

Habitat: lakes, streams, brakish ponds; limnophyte, shallow clear mesotrophic to eutrophic, neutral to slightly alkaline waters (0.5 – 3.0 m), on detritus, slime or muddy sands Characteristic species in ass. *Utriculari-Nitelletum syncarpe* V. Randl. & J. Blaž. 1995

(RANDJELOVIĆ & BLAŽENČIĆ 1996)

Distribution in Serbia: Vlasinsko blato (KOŠANIN 1907a, b; MILOVANOVIĆ 1949), Vlasinsko lake (RANDJELOVIĆ & BLAŽENČIĆ 1996), Danube, left side in pond across the Lido by Zemun, Bajina šljunkara (between Danube and Crvenka, *leg. Snežana Perišić* and *Z. Romčević*, 19.06.1999), Special Nature Reserve “Zasavica” (VESIĆ *et al.* 2011)

Threat factors: pollution, drying, low competence, agrochemistry.

IUCN Threat status in Serbia: CR (C2a).

***Tolypella glomerata* (Desv.) Leonh. 1863**

Syn.: *Chara glomerata* Desv. In Lois., 1810; *Nitella glomerata* Chev., 1830; *Tolypella glomerata* Leonh., 1863; *Tolypella nidifica* var. *glomerata* (Desv. In Lois) R. D. W. 1962

Habitat: ponds; in shallow (0.5m), ephemeric waters, on sandy substrate, water (pH = 7.5)

Distribution in Serbia: ponds by r. Danube near Borča (Belgrade) (*leg. Z. Romčević*, 11.06.1999), Subotička peščara, in Majdan pond (N: 46° 09'32.6"; E: 19° 36'21.4", 108 m, *leg. J. Blaženčić* 9.05.2011)

Threat factors: drying, overgrowing  
IUCN Threat status in Serbia: CR (C2a).

***Tolypella intricata* (Trentep. ex Roth.) Leonh. 1863**

Syn.: *Chara intricata* Trent. ex Roth. 1797; *Nitella intricata* /Trent. ex Roth.) Ag. 1824;

*Tolypella intricata* var. *intricata* f. *intricata* R. D. W. 1962

Habitat: ephemeric ponds in swamp forests, channels, waterholes, early spring species; In shallow (to 0.5 m) water (pH = 7.8), on bogland mold (BLAŽENČIĆ & STANKOVIĆ 2008; VEŠIĆ *et al.* 2011)

Distribution in Serbia: Special Nature Reserve "Zasavica" (VEŠIĆ *et al.* 2011: 886)

Threat factors: drying, overgrowing, eutrophication  
IUCN Threat status in Serbia: CR (A1a, B2a, C2a).

***Tolypella prolifera* (Ziz. Ex Braun) Leonh., 1863**

Syn.: *Chara prolifera* Barun 1834; *Nitella prolifera* (Ziz ex A. Br.) Kütz 1845; *Tolypella prolifera* Leonh. 1863; *Tolypella intricata* var. *intricata* f. *prolifera* (Ziz. ex A. Br.) R. D. W. 1962

Habitat: ponds by rivers and in inundated forest; ephemeric shallow ponds (to 0.2 m) on slim-sandy substrate.

Distribution in Serbia: Senta, Mrtva Tisa (GUELMINO 1973), ponds near r. Danube by Zemun, Belgrade (*leg. Z. Romčević. 15.06.1999*); Special Nature Reserve "Zasavica" (VEŠIĆ *et al.* 2011: 886)

Threat factors: drying, overgrowing  
IUCN Threat status in Serbia: CR (A1a, B2a, C2a).

***Nitellopsis obtusa* (Desv. in Lois.) J. Grov. 1919**

Syn.: *Chara obtuse* Desv. 1810; *Chara stelligera* Bauer in Reich. 1829; *Nitella stelligera* (Bauer in Reich.) Hy 1890; *Nitellopsis stelligera* (Bauer in Reich.) Hy 1890; *Tolypellopsis stelligera* (Bauer in Reich.) Migula 1890; *Tolypellopsis ulvoides* Wille 1891; *Tolypellopsis obtusa* (Desv.) Beg. & Form. 1907

Habitat: Inundation areas by rivers, river bays, permanent and ephemeric ponds; Limnophyte of oligo to mesotrophic waters (to 1.5 m). On slime substrate in neutral to slightly alkaline waters (pH = 7.0 - 7.7). Dominant species in community *Nitellopsidetum obtusae* (Sauer 1937) Damska 1961 (STEVANOVIĆ *et al.* 2003)

Distribution in Serbia: Ada Čibuklija by Ram (STEVANOVIĆ *et al.* 2003), Dolnice by Banatska Palanka (STEVANOVIĆ *et al.* 2003), Bela Crkva, pond by Nera (*leg. Aleksandra Vesić. 15.09.2012*)

Threat factors: eutrophication, low competence ability, drying  
IUCN Threat status in Serbia: CR (A1e, A2e).

***Chara braunii* Gmelin 1826**

Syn.: *Chara coronata* Ziz. Ex Bischoff 1828; *Charopsis barunii* (Gmel.) Kütz. 1843; *Nitella braunii* (Gmel.) Rabenh. 1847; *Chara braunii* f. *braunii* Gmel.em. R. D. W. 1962

Habitat: ponds, river sides, fishponds, lakes, swamps, pools with radioactive water (radon); limnophyte, in permanent to ephemeric, mesotrophic to eutrophic waters (0.3 to 1.0 (6.0) m), water (pH = 5.6 - 8.0), on muddy substrate (BLAŽENČIĆ & BLAŽENČIĆ 1991; BLAŽENČIĆ *et al.* 1995a, b). In ass. *Nitelletum opacae* Corillion 1957 (RANDJELOVIĆ & BLAŽENČIĆ 1996), and ass. *Najadeto-Charetum braunii* V. Randj. et J. Blaž. 1995 (RANDJELOVIĆ & BLAŽENČIĆ 1996)

Distribution in Serbia: Kupinovo (sensu *C. coronata* Ziz. - FILARSZKY 1931), By Skela near Sava (sensu *C. coronata* Ziz. - FILARSZKY 1931), Ečka (fishponds), Vlasinsko lake (BLAŽENČIĆ & BLAŽENČIĆ 1990; RANDJELOVIĆ & BLAŽENČIĆ 1996), Zemun (Belgrade) in ponds and pools on the left Danube riverside across the Lido (*leg. Z. Romčević. 19.06.1999*), Belgrade, ponds by Danube riverside near Pančevački bridge (*leg. Z. Romčević. 22.07.1999*), Petrovaradinski rit (*leg. Imre Krizmanić. 05.07.1999*), Štrbac (Gornje Podunavlje, *leg. Dušianka Laketić. 07.07.2010*)

f. *máxima* Mig.: Jakovo in Srem by r. Sava (as *C. coronata* Ziz., FILARSZKY 1931)

f. *tenuior* A. Br.: Kupinovo in Srem (as *C. coronata* Ziz., FILARSZKY 1931)

Threat factors: drying, fish over-population, water level variation, agrochemistry  
IUCN Threat status in Serbia: VU (A1e, A2e, B1, B3a)

***Chara canescens* Desv. Et Lois. 1810**

Syn.: *Chara horridula* Deth 1811; *Chara crinita* Wallr. 1815; *Chara pusilla* Kütz. 1857; *Chara canescens* f. *canescens* Desv. In Lois. em R. D. W. 1962

Habitat: ponds, salt marshes; brakish shallow water (to 0.5 m) on muddy substrate.

Distribution in Serbia: In surroundings of Prokuplje (Suva česma and Bresnička salt marsh). (*leg. Vladimir Randjelović & Bojan Zlatković. 21.07.2005*)

Threat factors: drying and overgrowing  
IUCN Threat status in Serbia: EW (?)

***Chara connivens* Salzm. Ex A. Br. 1835**

Syn.: *Chara globularis* f. *connivens* (Slazm. ex A. Br.) R. D. W. 1962

Habitat: drained channels; in shallow water (to 1.0 m), on slimy substrate

Distribution in Serbia: Srebrno lake by Veliko gradište (*leg. J. & Ž. Blaženčić. 30.09.1980 and 17.07.1984*).

Threat factors: agrochemistry, overgrowing  
IUCN Threat status in Serbia: CR (A1ae)

***Chara contraria* A. Braun ex Kützing 1845**

Syn.: *Chara foetida* var. *moniliformis* A. Br. 1834; *Chara foetida* var. *contraria* (A. Br. ex Kütz.) Coss. et Germ. 1882; *Chara vulgaris* var. *vulgaris* f. *contraria* A. Br. ex Kütz. em R. D. W. 1962.

Habitat: rivers, ponds in meadow depressions by rivers, around springs, riversides, lakes peat bogs, drained channels, sources, fishponds and brakish waters, cattle watering places; limnophyte of permanent and ephemeral oligotrophic to mesotrophic waters (0.5-2.0 m), on muddy to sandy substrates in neutral to slightly alkaline waters (pH = (6.4) 7.4 - 7.8)

Distribution in Serbia: lake by Čenta (BLAŽENČIĆ *et al.* 1995a,b), Kišnica by Badovac - 15 km from Prištine. (*leg. Z. Krivošej* 26.05.1993), Gračaničko lake, down from the water factory system (*leg. Z. Krivošej* 26.05.1993), Savsko lake in Belgare (BLAŽENČIĆ 1995 (1997)), Ošljak (Šara Mt): in ponds down from the springs at Ošljak (*leg. Pedja Janačković*, 15.07.1995), peatland Mala Batura in Tara Mt near Crni vrh, in meadow depressions with clear water up to 0.5 m. (*leg. Ljubinka Obušković*, 06.1994), Malo Savsko lake ("Safari") in Ada Ciganlija (Belgrade) (*leg. J. Blaženčić* 5.11.1996), Subotica at loc. "Tresetište" (BLAŽENČIĆ *et al.* 1995a,b), Ribariće, ponds near Ibar river (*leg. Nusret Prelević*, 20.10.1998), Zemun, in ponds by r. Danube across Zemun (Lido). (*leg. Z. Romčević*, 19.06.1999), Belgrade in ponds near Danube at Pančevački bridge (*leg. Z. Romčević*, 22.07.1999), Pešter, lake by the village Kara Jukića bunar (*leg. P. Lazarević*, 06.2001), in Jadovnik Mt, peak Katunić, 1600 m, in pond, 0.2 - 0.5 m, (*leg. P. Lazarević* ?), Drenovac near Kragujevac in Jelina bara pond, (*leg. J. Blaženčić*, 10.05.1976), village Paležnica, rivulet Marila, (*leg.?* 17.09.2002), Niš - salt spring Oblačina (*leg. V. Randjelović & B. Zlatković*, 08.09.2005), Lepajsko vrelo spring, Očni izvor (*leg. V. Randjelović & B. Zlatković*, 21.07.2005), Vranjak at Tara Mt, in the gorge between Veliko Zaovinsko lake and Spajića lake, in the stream coming out from a tunnel (*leg. V. Stevanović*, 05.08.2003), Special Nature Reserve "Zasavica" by Sremska Mitrovica (VEŠIĆ, *et al.* 2011), Ribar banja - Franjina skela, (*leg. D. Laketić* 12.07.2010), Subotička peščara, Majdan bara - road to Kelebija (N 46° 09' 32.6"; E 19° 36' 21.4", 108 m, *leg. J. Blaženčić* 09.05.2011), village Bube in Rogozna Mt (Ibarski Kolašin), near road, 932 m nv. (Leg ? date ?), Channel by Srebrno lake (Veliko Gradište) (*leg. J. Blaženčić*, 30.09.1983)

**f. *capillacea* Mig.** Valjevo in the river Gradac. (*leg. D. Lakušić*, 25.05.1993), Zvonce spa in river Veternica, fishpond 100 x 25 m (*leg. Gordana Subakov-Simić*, 06.08.2004).

**f. *stagnalis* F.** In stagnant water of the river Beli Rzav (FILARSZKY 1931)

**f. *aspera* F.** In r. Sava by Skela and Kupinovo as *Chara pseudogymnophylla* F. syn. *Chara contraria* var. *gymnophylla* A. Br. (FILARSZKY 1931)

**var. *nitelloides* A. Br.** microaccumulation in river Pčinja by the monastery Sv. Prohor Pčinjski (*leg. J. Blaženčić*, 4.06.1995), Niš - Lalinačka slatina. (*leg. V. Randjelović & B. Zlatković*, 08.09.2005, 02.06.2013), Niš - Slani spring, (*leg. V. Randjelović & B. Zlatković*, 08.09.2005), Donje Vlase in Seličevica Mt, well at 1 m. (*leg. B. Zlatković*, 04.06.1991), Vranje, Aleksandrovačko lake, ponds at saltlands (*leg. Snežana Simić*, 11.06.2011), Mokra Gora, Prokletije, ponds at Ponor down from Kliniski peak (1600 m) with *C. rohlena*. (*leg. P. Lazarević*, 28.09.2010).

Threat factors: Eutrophication, low competence ability, habitat drying, tourism, agrochemistry

IUCN Threat status in Serbia: LR (nt)

***Chara globulara* Thuillier 1799**

Syn.: *Chara capillacea* Thuill. 1799; *Chara fragilis* Desvaux in Loiseleur-Deslongchamps 1810; *Chara hedwigii* Ag., in Bruzelius 1824; *Chara globularis* f. *globularis* R. D. W. 1962;

*Chara globularis* var. *globularis* f. *Globularis*. D. W. 1965; *Chara fragilis* Desv. in Lois. 1810; *Chara pulchella* Wallr. 1815; *Chara globularis* var. *globularis* f. *globularis* Thuill. em. R. D. W. 1962.

Habitat: rivers, ponds by the rivers, channels, lakes, peatlands, sources, springs, fishponds; limnophyte, fresh to mineral and brakish neutral to slightly alkaline waters (pH = 7.0 - 7.8), at detritus and slimey-sandy substrates (0.1 - 3.0 m).

Distribution in Serbia: Belgrade (Karaburma), in r. Danube (sensu *C. fragilis* Desv., KOŠANIN 1907a, b; MILOVANOVIĆ 1949), Belgrade surrounding - Viliman, Ostružnička river (MARINOVIĆ 1955), Poklek spa (Kosovo, sensu *Ch. fragilis* MARINOVIĆ & KRASNIĆI, 1970), Channel by Srebrno lake (Veliko Gradište, *leg. J. & Ž. Blaženčić*, 30.09.1983; 09.06.1983; 17.07.1984; 20.07.1985 and 14.05.2002), Banatska Palanka (old Karaš river bed, *leg. V. Stevanović*, 6.05.2000), Muhadžer Babuš (by Priština, *leg. J. & Ž. Blaženčić*, 29.06.1985), Vrujci spa (*leg. Pavle Andjus* 3.10.1991), Belgrade, Savsko lake at Ada Ciganlija (BLAŽENČIĆ 1995 (1997)), pond in Deliblatska sands (*leg. D. Lakušić*, 1998), Belgrade in ponds by r. Danube at Pančevački bridge (*leg. Z. Romčević*, 22.07.1999), Uvac in small lake down from dam (*leg. Jelena Krizmanić*, 20.08.1999), Vrujci spa in rivulet Toplica and in the thermal stream (*leg. M. Živić*, 30.01.2001 and 20.04.2002), Apatin, Kopačko jezero (*leg. Darinka Milovanović*,

30.05.1948 and 08.08.1948), Sredorek by Kragujevac, ponds between Rasina and Morava (leg. ? 07.08.1979), Banatska Palanka, ponds by r. Danube in willow forest (leg. V. Stevanović, 06.05.2000), Uvac, Štrpce, upstream from a bridge. (leg. M. Veljić, 05.05.2000), South Morava, by Puk (leg. ? 13.09.1990), r. Danube, Dolnice, ponds. (leg. V. Stevanović, 18.07.2004), Banatska Palanka, "Jaruga", (leg. V. Stevanović, 15.10.2002), r. Danube, Dolnice, ponds in Stevanova plain (leg. V. Stevanović, 18.07.2004), Kolubara by Obrenovac, old river bays (leg. D. Lakušić, ?), Special Nature Reserve "Zasavica" by Sremska Mitrovica (VESIĆ et al. 2011), Subotička peščara, Selevenjska ponds, N 46° 07' 38.9" E 19° 50' 10.9", (leg. J. Blaženčić, 09.05.2011), Ciglana Stanišić (leg. Gabor Mesaroš, 23.06.2011).

**f. humilior Mig.** (as *C. fragilis*). River Sava by Jakovo in Srem (FILARSZKY 1931).

**f. lacustris Mig.** (as *C. fragilis*). River Sava by Jakovo in Srem (FILARSZKY 1931).

**f. laxa Mig.** (as *C. fragilis*). River Sava by Jakovo in Srem (FILARSZKY 1931).

**f. stricta Mig.** (as *C. fragilis*). River Sava by Jakovo in Srem (FILARSZKY 1931).

**f. normalis Mig.** (as *C. fragilis*). River Sava by Jakovo in Srem (FILARSZKY 1931).

Threat factors: Eutrophication, habitat drying, water level variation, mechanical cleaning

IUCN Threat status in Serbia: VU (D2).

***Chara hispida* (L.) Hartm. 1820**

Syn.: *Chara major* Vaill. 1721; *Chara hispida* var. *major* Hartm. 1820; *Chara spinosa* Rupr 1845; *Chara major* Hy 1913; *Chara hispida* ssp. *eu-hispida* (L.) Corill.1957; *Chara hispida* var. *hispida* f. *hispida* L. em R. D. W. 1962; *Chara hispida* var. *major* f. *major* L. em. R. D. W. 1962

Habitat: secondary, ephemeral fresh shallow waters, on clay and sandy substrate; shallow ponds with slightly alkaline waters (pH = 7.5).

Distribution in Serbia: Ždrlica near Kragujevac (KATIĆ 1898/99), Makova sedmica by Subotica (leg. Georg Džukić, 09.1998), Subotička peščara, Majdan pond – road to Kelebija N 46° 09' 32.6" E 19° 36' 21.4" (leg. J. Blaženčić, 09.05.2011), Subotička peščara, Selevenjska pond, N 46° 07' 38.9" E 19° 50' 10.9" (leg. J. Blaženčić, 09.05.2011)

Threat factors: habitat drying, pollution, overgrowing  
IUCN Threat status in Serbia: EN (B1, B2a, B3c).

***Chara intermedia* A. Braun in Braun, Rabenh. & Stizenb. 1859**

Syn.: *Chara aculeolata* Kütz. In Reich. 1832; *Chara hispida* var. *aculeolata* Rabenh.1853;

*Chara aculeolata* ssp. *intermedia* (A. Br.) Cirill.1957; *Chara hispida* var. *major* f. *intermedia* (A. Braun) R. D. Wood 1962.

Habitat: ponds; limnophyte, on muddy substrate

Distribution in Serbia:

**f. brachyphylla A. Br.** In ponds around Negotin (KOŠANIN 1907a, b; MILOVANOVIĆ 1949).

**f. decipiens Mig.** South Serbia, Tiodže by Semeteša in Kopaonik Mt, Spring of Lisinski stream (KOŠANIN 1907a, b; MILOVANOVIĆ 1949).

Threat factors: habitat drying out

IUCN Threat status in Serbia: CR.

***Chara rohlena* Vilhelm 1912**

Syn: *Chara vulgaris* var. *gymnophylla* f. *rohlena* (Vilh.) R. D. W. 1962

Habitat: ponds; shallow water (to 0.2 m). In montane areas.

Distribution in Serbia: pond in the locality Ponor down from Kliniski peak (1600 m). (leg. P. Lazarević, 28.09.2010)

Threat factors: habitat fragility

IUCN Threat status in Serbia: CR (Ae, B).

***Chara tenuispina* A. Braun 1835**

Syn.: *Chara globularis* var. *tenuispina* (A. Braun) R. D. W. 1962

Habitat: lakes, rivers; shallow (to 0.3 m), meso to eutrophic waters in plains (pH = 7.2), on slime and muddy-sandy substrate.

Distribution in Serbia: lake by Kelebija, NW from Subotica (BLAŽENČIĆ 1995), river Čik by Tisa. (leg. G. Subakov-Simić, 09.05.2013).

**f. nitida Mig.** Crepuljnik Mt (between Ivanjica and Raška) (KOŠANIN 1907a, b; MILOVANOVIĆ 1949)

Threat factors: habitat drying out, eutrophication, zootechnics

IUCN Threat status in Serbia: CR (B2a, C2b).

***Chara tomentosa* L. 1753**

Syn.: *Chara latifolia* Willd. 1809; *Chara ceratophylla* Wallr. 1815; *Chara tomentosa* var. *tomentosa* L. Em R. D. W. 1962

Habitat: ephemeric ponds around streams

Distribution in Serbia: Spa Poklek (Kosovo) (as *Chara ceratophylla*) (MARINOVIĆ & KRASNIĆI 1970)

Threat factors: habitat fragility

IUCN Threat status in Serbia: CR (B2a).

***Chara virgata* Kützing 1834**

Syn.: *Chara fragilis* ssp. *delicatula* Braun et Nordstedt 1882; *Chara delicatula* Ag.1824;

*Chara globularis* var. *virgata* (Kütz.) R.D.W.1962

Habitat: ponds by rivers, fishponds, lakes; limnophyte in ephemeral ponds, 0.2-5.0m, in fresh mesotrophic to eutrophic waters (pH=7.4-7.8), on slim and sand substrate.

Distribution in Serbia: near Crnče, in ponds by Drina river between Mali Zvornik and Ljubovija. (*leg. P. Anđus*, 10. 1987); Veliko Nedžinatsko lake (Metohija) in Prokletije Mt (1850 m). (*leg. J. & Ž. Blaženčić* 12.06.1986); Fishpond, Južna lake, by Ečka (as *Chara delicatula* Ag., BLAŽENČIĆ *et al.* 1995a,b); Vlasinsko lake (1215 m). (as *Chara delicatula* Ag., BLAŽENČIĆ & BLAŽENČIĆ 1991; RANDJELOVIĆ & BLAŽENČIĆ 1996).

Threat factors: eutrophication, overgrowing, habitat drying out, water level variation, fish overpopulation, agrochemistry

IUCN Threat status in Serbia: EN (A2e, C2a).

### ***Chara vulgaris* L. 1815**

Syn.: *Chara vulgaris* L. 1753, emend Wallroth; *Chara foetida* Braun 1834; *Chara vulgaris* var. et f. *Vulgaris* R. D. W. 1965; *Chara vulgaris* f. *gymnophylla* (A. Br.) Hy 1914; *Chara vulgaris* var. et f. *gymnophylla* R. D. W. 1962

Habitat: lakes, streams, channels, fishponds, ponds, waterholes, swamps, peatlands, pools, meadow pools, inundation areas around rivers; limnophyte, in primary and secondary mesotrophic to eutrophic, mineral waters (pH = 6.4 – 8.7), on slime, detritus, sands (0.1 - 2.0 m)

Distribution in Serbia: Vranje (SIMIĆ 1895/96), ponds around Ždralice near Kragujevac. (KATIĆ 1898/99), Negotinski rit (MARINOVIĆ 1953, as *Chara foetida*), Belgrade surroundings (Velika Bara, Viliman, Džajine Bare, Dubovske Mlake, Bele Vode, Petrec channel, MARINOVIĆ 1955, as *Chara foetida*), Poklek (Kosovo, MARINOVIĆ & KRASNIĆI 1970, as *Chara foetida* A. Br.), Senta (GUELMINO 1973, as *Chara foetida*), Petrovaradinski rit (VUKOJE 1979; BLAŽENČIĆ *et al.* 1995a,b), in Mrtva Tisa by Senta (GUELMINO 1973), Belgrade, pond Dubovske Mlake (MARINOVIĆ 1955; BLAŽENČIĆ *et al.* 1995a,b), Belgrade, in channel Petrec (MARINOVIĆ 1955, BLAŽENČIĆ *et al.* 1995a,b), Veliko Blato by Belgrade (JANKOVIĆ 1953; BLAŽENČIĆ *et al.* 1995), Sušički stream by Kragujevac (BLAŽENČIĆ & RADOTIĆ 1982), village Vračevšnica near Kragujevac (BLAŽENČIĆ & RADOTIĆ 1982), Drenovac, Jelina pond near Kragujevac (BLAŽENČIĆ & RADOTIĆ 1982), Kostolac (CVIJAN, 1985), Dobroselica surrounding in Zlatibor Mt, near Borova glava (*leg. Božana Milijašević*, 10.06.1983), Gostilje in Zlatibor Mt. (*leg. B. Milijašević*, 10.06.1983), Muhader Babuš by Prištine (*leg. J. & Ž. Blaženčić*, 29.06.1985), ponds along r. Drina near Crnče (between Zvornik and Ljubovija, *leg. P. Anđus* 10.1987), at spring in village Ljubić near Kragujevac (*leg. Milenko Stefanović*, summer 1987), in locality Makova sedmica by Graničar near Subotice (BLAŽENČIĆ *et al.* 1995 [Is that a or b?]), in locality Tresetište near Subotica, (BLAŽENČIĆ *et al.* 1995a,b), Paličko jezero (BLAŽENČIĆ *et al.* 1995a,b), river Kereš near Hajdukovo (BLAŽENČIĆ *et al.* 1995a,b),

Channel Danube-Tisa-Danube by Stara Palanka (*leg. D. Lakušić*, 6.05.1995), Košutnjak in Belgrade (in pool by the restaurant Milošev konak near Hajdučka česma, *leg. J. & Ž. Blaženčić*, 25.05.1993), river Pčinja by the monastery Prohor Pčinjski, (*leg. J. Blaženčić*, 4.06.1995), Channel near Srebrno lake near Veliko Gradište (*leg. J. & Ž. Blaženčić*, 09.06.1983, 30.09.1983, 20.07.1985, 11.06.1986), Danube, ponds near Pančevački bridge (*leg. Z. Romčević*, 22.07.1999), Palić near Subotica (*leg. J. Blaženčić*, 10.1978), Banatska Palanka, “Jaruga”. (*leg. V. Stevanović*, 15.10.2002), Banatska Palanka, river bay Dolnice. (*leg. V. Stevanović*, 27.07.2003), Grlšte near Zaječar (*leg. Zorica Svirčev*, 16.06.2006), Banatska Palanka, Dolnice, in ponds around r. Danube (*leg. V. Stevanović*, 18.07.2004), Beli Rzav near Mokra Gora (*leg. Marina Drndarski*, 07.2009), Special Nature Reserve “Zasavica” near Sremska Mitrovica (VESIĆ *et al.* 2011), Kolubara, open mine (*leg. P. Lazarević*, V. Stojanović, 17.05.2013), Lalinačke slatine near Niš, ponds in saltlands (*leg. B. Zlatković*, 02.06.2013)

**f. *nidifica* Mig.** Sava near Jakovo in Srem (FILARSZKY 1931, BLAŽENČIĆ *et al.* 1995a,b), r. Sava near Kupino in Srem (FILARSZKY 1931, BLAŽENČIĆ *et al.* 1995a,b).

**f. *pseudocontraria* Mig.** Kupinovo (FILARSZKY 1931; BLAŽENČIĆ *et al.* 1995a,b).

**f. *normalis* Mig.** (KOŠANIN 1907a, b; MILOVANOVIĆ 1949)

**f. *vulgaris* Mig.** Karaburma near Belgrade (KOŠANIN 1907a, b; MILOVANOVIĆ 1949), in ponds along r. Sava (KOŠANIN 1907a, b), in river Pek near Majdanpek (KOŠANIN 1907 a, b; MILOVANOVIĆ 1949), in Porečka river (KOŠANIN 1907 a, b), in stream Crnica (KOŠANIN 1907 a, b).

**f. *pulchella* Mig.** Kladovo (KOŠANIN 1907 a, b; MILOVANOVIĆ 1949), Sisevac in Mlačac (KOŠANIN 1907 a, b; *leg. J. Blaženčić*, 19.05.1978).

**f. *cuspidata* Mig.** In swamp meadows around pond Ljutice in Zlatibor Mt. (KOŠANIN 1907 a, b; MILOVANOVIĆ 1949).

**f. *aequistriata* A. Br.** In the Mlava river valley, Stig. (KOŠANIN 1907 a, b).

**var. *nitelloides*,** Sušički stream in Park Šumarice near Kragujevac. (*leg. J. Blaženčić & S. Radotić*, 17.05.1976, 24.05.1976, 02.08.1976).

**f. *gymnophylla* (A. Br.) Hy 1914** (*Chara gymnophylla* A. Br.), Banjica, mineral water near Bela Palanka (as *Chara gymnophylla* A. Br., BLAŽENČIĆ 1980), river Lugomir (*leg. M. Cvijan & R. Laušević* 1993), in stream near village Trudovo (*leg. Z. Krivošej*, 25.07.2001), Vrujci spa source and streams of mineral waters (as *Chara gymnophylla* A. Br., BLAŽENČIĆ 1980), pool of mineral water in front of hotel Radon in Niška spa (as *Chara gymnophylla*

A.Br., BLAŽENČIĆ 1980, *leg. P. Anđus*, 20.11.1989), ponds in swampy meadow by the river Uzovnica in Uzovnica (*leg. Marina Karakašević*, 07.1978), channel near Ždrelo between Ljuberadja and Gorčinci by Svodja, E Serbia, (*leg. J. & Ž. Blaženčić*, 7.07.1982), Svrliške Mts near village Kozje (940m) (*leg. Lola Djurdjević*, 03.09.1983), Pond Bara near Bela reka in Zlatibor Mt (Vodice, 750 m) (*leg. B. Milijašević*, 10.06.1983), river Lugomir upstream from the village Glavinci by Svetozarevo [Jagodina] (*leg. R. Laušević*, 07.1984), ponds by Drina near Crnče (between Zvornik and Ljubovija (*leg. P. Anđus*, 10.1987), Zvonce spa (E Serbia) near Jerma (*leg. V. Randjelović*, 12.06.1991 and *J. Blaženčić*, 5.06.1993), Petničko lake near Valjevo (*leg. J. Nikitović*, 25.05.1996), Vrujci spa in the rivulet Toplica and in thermal stream (as *Chara gymnophylla* A. Br. BLAŽENČIĆ 1980; *leg. M. Živić*, 30.01.2001, *leg. Dobrina Temniskova*, 13.10.1990, *leg. J. Blaženčić*, 02.2007), Sušički stream in Šumarice near Kragujevac (*leg. J. Blaženčić & S. Radotić*, 01.11.1976), Grmija near Priština (*leg. ?*, 20.10.1989), Vračevšnica, near Gornji Milanovac, (*leg. J. Blaženčić*, 01.11.1976.), Bela Palanka, spring in the village Mokra (*leg. L. Djurdjević*, 05.01.1975, *leg. J. & Ž. Blaženčić*, 18.07.1982), Gamzigradska spa, in Crni Timok by the bridge (*leg. J. & Ž. Blaženčić*, 27.09.1979), Kotroman, Mokra Gora, Beli Rzav (*leg. B. Zlatković*, 16.04.2007), Mokra gora by Ribarići (Prokletije), Mojstirski stream by the confluence of r. Lim, 750m (*leg. P. Lazarević*, 28.09.2010), Stanjanska river by Kalna (*leg. S. Simić*, 25.08.1994), Tara Mt, between Batura and Kozulja, to Karaklije and Rzav (*leg. P. Lazarević*, 25.05.2011).

**f. subnudifolia Mig.** In Ibar river by Pavlica (as *Chara gymnophylla* A. Br., KOŠANIN 1907a, b; MILOVANOVIĆ 1949), Tiodže near Raška (as *Chara gymnophylla* A. Br. KOŠANIN 1907a, b), Staro selo near Ruzdina (Moravica), Mokra Gora (as *Chara gymnophylla* A. Br. KOŠANIN 1907a, b), in the river Beli Rzav near Kršanja by Mokra Gora (as *Chara gymnophylla* A. Br. KOŠANIN 1907a, b), in Rudnik Mt, 1875 (sensu *Chara gymnophylla* A. Br. KOŠANIN 1907a, b).

**f. paludosa F.** In stagnant water of the river Beli Rzav (W Serbia) (as *Chara gymnophylla* A.

Br., FILARSZKY 1931)

**f. subsegregata Nordst. Prizren.** (as *Chara gymnophylla* A. Br., FILARSZKY 1931)

**f. tenuissima Mig. Prizren.** (as *Chara gymnophylla* A. Br., FILARSZKY 1931)

**var. longibractea (Kutz.) J. Grov. Bull.-Web.** Ada Ciganlija in Belgrade, Malo savsko lake - fishpond Safari, (*leg. J. Blaženčić*, 5.11.1996).

Threat factors: Anthropogenic influence, eutrophication, agrochemistry, ephemeral habitat, fish over-stocking

IUCN Threat status in Serbia: LR (nt).

## CONCLUSIONS

Data on charophytes from Serbia (1851-2013) are given in this study. In total, 23 species of stoneworts belonging to the genera *Nitella*, *Tolypella*, *Nitellopsis* and *Chara* were recorded in Serbia. In addition to widespread species, some characteristic for the area (e.g. *Chara canescens*) were recorded as well as endemics of the Balkans, namely *C. rohlenae*. Charophytes can be found in many types of water habitats, though they prefer clean waters. Pollution and disturbance are among the main threats for stoneworts in Serbia. Apart from a few species (*Chara vulgaris*, *C. contraria*, *C. braunii*), all the other species are threatened.

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## Pregled hara (Charales) i procena njihove ugroženosti u Srbiji

Jelena BLAŽENČIĆ

U radu su dati floristički i taksonomski podaci o harofitama na prostoru Srbije za period od 1851. do 2013. godine. Za svaki takson navedena je sinonimika, tip i karakteristike staništa, rasprostranjenje, faktori i kategorija ugroženosti; gde, kada i ko je objavio podatak, a za ne publikovane podatke koji se nalaze u zbirci, navedeni su legatori i vreme uzorkovanja.

**Ključne reči:** hare, Charales, Srbija, rasprostranjenje, ugroženost