

Charophytes from the Ponichala Reserve, Georgia

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Abstract. The Ponichala Reserve (Krtsanisi Park) located near Tbilisi, Georgia, is a protected area established to preserve one of the last remnants of riparian tugay forests in the Mtkvari River valley. A key feature of the reserve is its irrigation system, which maintains soil moisture during the dry summer period and creates a network of ponds and channels suitable for aquatic vegetation. During field surveys conducted in 2023 and 2024, the diversity of charophytes was investigated for the first time in the reserve's restored ponds and in shallow gravel-extraction quarries within the adjacent Mtkvari River floodplain. Five charophyte species were identified: *Chara hispida*, *C. papillosa*, *C. contraria*, *C. vulgaris*, and *Tolypella glomerata*. Two species, *C. hispida* and *T. glomerata*, represent new national records for Georgia, and *C. hispida* constitutes the first confirmed record of this species for the entire Caucasus. Charophytes occurred locally abundantly in clear, shallow waters with sandy or silty substrates, forming distinct monospecific and mixed communities. The Ponichala locality of *C. hispida*, a rare perennial species, is notably isolated from the main distribution range in Western Europe and represents one of its southeasternmost known occurrences. *Tolypella glomerata*, an annual species restricted to spring development, was found forming dense communities in floodplain quarries. These findings highlight the importance of semi-natural and artificial water bodies in protected semi-urban landscapes as refugia for rare charophytes in the South Caucasus. Effective management of the reserve's waterbodies should consider charophyte habitat requirements to ensure long-term persistence of their populations. All records are confirmed with voucher specimens deposited to the IBIW, LE, ROST, and TBI herbaria. © 2026 Bull. Georg. Natl. Acad. Sci.

Keywords: aquatic flora, cryptogam diversity, Characeae, new records, rare species, South Caucasus

Introduction

The Charophytes (Characeae) are an important group of macroalgae that often form extensive communities and play a key role in the structure and functioning of aquatic ecosystems. Although the study of charophytes in Georgia has a relatively long history, dating back to the 19th, not a lot of data has accumulated since then: in total, 11 species

are known according to published records (Nakhutsrishvili, 1986; Romanov et al., 2025). Several of these records need to be confirmed due to the lack of voucher specimens or precise locality data. This study presents an addition to the charophyte flora of Georgia based on the recent field studies in the Ponichala Reserve.

Material and Methods

The Ponichala Reserve (also known as Krtsanisi Park) is located on the right bank of the Mtkvari (Kura) River in the southeastern surroundings of Tbilisi, Kvemo Kartli region. Established to protect the remaining fragment of riparian tugay forests the reserve despite its small size and urban surroundings, supports diverse birdlife, amphibians, and plant species, making it an important refuge for biodiversity within the Tbilisi metropolitan area. A notable feature of the reserve is its irrigation system designed to divert water from the Mtkvari River. This system consists of several ponds, pumps, and an extensive network of channels, and play an important role in maintaining soil moisture during the dry summer months. The restoration of the Ponichala Reserve in recent years has benefited significantly from initiatives supported by the Kura II Project, a regional program focused on improving water governance and ecological health within the Kura River basin during 2017-2020. As part of this effort, the project promoted the revitalization of the park's irrigation system (according to information boards in the park).

In April 2023, the Ponichala ponds were studied for charophyte diversity for the first time. Some of these ponds had been cleared and restored in previous years as part of a rehabilitation project. They were up to several meters deep, with sandy and gravelly substrates that were not fully overgrown, and are characterized by a relatively high water transparency – conditions highly suitable for charophyte vegetation. In addition, several shallow (0.5-1.5 m) quarries remaining from past gravel extraction along the adjacent Mtkvari River bank were studied, which also supported dense charophyte growth. These quarries can be completely flooded by the river during periods of high spring discharge, as observed during fieldwork in May 2024. The studied waterbodies usually do not freeze in winter and also support vascular macrophyte communities typical of the freshwaters of the Tbilisi area, with notable role of *Ceratophyllum*

demersum L., *Potamogeton crispus* L., *Myriophyllum spicatum* L., *Ranunculus rionii* Lagger, and *Zannichellia pedunculata* Rchb.

Localities and habitats:

1. Kvemo Kartli region: Gardabani municipality, SE surroundings of Tbilisi, Ponichala Reserve (Krtsanisi park), surface water intake pumping station for irrigation of the Krtsanisi forest, shallow water storage; 41.62361°N, 44.93234°E, *Chara-Tolypella* community on sandy pebble, depth 10-60 cm, water conductivity 828 $\mu\text{S}\cdot\text{cm}^{-1}$, 18 IV 2023; *ibid.*, 41.62372°N, 44.93238°E, depth 20-60 cm, water conductivity 461 $\mu\text{S}\cdot\text{cm}^{-1}$, 6 V 2024.

2. *Ibid.*, large pond near the Mtkvari River, 41.624912°N, 44.93057°E, depth 50-70 cm, silty pebble, water conductivity 786 $\mu\text{S}\cdot\text{cm}^{-1}$, 18 IV 2023.

3. *Ibid.*, pond for irrigation in the Mtkvari River floodplain, 41.62207°N, 44.93414°E, depth 1 m, 6 V 2024.

4. *Ibid.*, small waterbodies in the floodplain of the Mtkvari River, right bank, 41.631683°N, 44.931572°E, dense communities of *Tolypella* and *Chara* with more than 90% projective cover on black silt, depth 10-70 cm, water conductivity 1,160 $\mu\text{S}\cdot\text{cm}^{-1}$, 1,220 $\mu\text{S}\cdot\text{cm}^{-1}$, 18 IV 2023.

The specimens were collected by hand and a hand-made metal anchor, then preserved as herbarium vouchers. After identification under stereomicroscopes, the specimens were labeled and deposited in the Georgian National Herbarium at the Institute of Botany, Ilia State University (TBI). Duplicates are stored in the herbaria of the Papanin Institute for Biology of Inland Waters RAS (IBIW), the Komarov Botanical Institute RAS (LE), Rostock University (ROST), and the author's collection. The micrographs used in this study were taken with an NSZ818 Nexcope stereomicroscope (Ningbo Yongxin Optics Co., Ltd., China).

Results and Discussion

In total, five species from the genera *Chara* L. and *Tolypella* (A. Braun) A. Braun were identified,

including *Chara hispida* L. (Figs. A, B) and *Tolypella glomerata* (Desv.) Leonh. (Figs. C, D), both newly recorded for Georgia. *C. hispida* and *C. papillosa* Kütz. (Figs. E, F) were found exclusively in ponds (localities 1-3), where they were locally abundant and formed distinct communities. In some parts of the ponds, especially in shallows, they were accompanied by *C. contraria* A. Braun ex Kütz. (Fig. G), *C. vulgaris* L. (Fig. H), and *Tolypella glomerata*. However, these three species were more abundant in the quarries (locality 4), where they often formed monospecific and mixed communities.

From a biogeographical perspective, the most significant finding is the record of *C. hispida*, which represents the first confirmed occurrence of the species in the Caucasus. Previously, it had only been reported from Nakhchivan, Azerbaijan (Boissier & Buhse, 1860). However, the species

concept has changed considerably since the original description, during which time this name was often applied to several similar taxa, and the original voucher specimen from Nakhchivan is likely lost (Romanov et al., 2025). *Chara hispida* is otherwise widespread in West Europe, with a few confirmed records from North Africa and West Asia (Blindow et al., 2024). The closest locality belongs to Western Anatolia, Turkey (Barinova et al., 2014). The Ponichala localities are notably disjunct from the main distribution range and represent the southeasternmost known occurrences of the species. *C. hispida* is a perennial species that resumes growth in spring from overwintered plants. In Georgia, it was already found in a richly fertile condition in spring.

Tolypella glomerata, despite its wide Eurasian distribution, was previously known in the Caucasus only from a few localities in eastern Azerbaijan



Fig. 1. Charophytes from the Ponichala Reserve: A – *Chara hispida*, compact upper whorls of branchlets with relatively long abaxial bract-cells; B – *C. hispida*, detail of diplostichous aulacanthous cortex with long, solitary and geminate (arrows) spine cells; C – *Tolypella glomerata*, fertile branchlets grouping into head; D – *T. glomerata*, rounded terminal cells of branchlet (arrow); E – *C. papillosa*, upper whorl of branchlets; F – *C. papillosa*, detail of diplostichous tylacanthous cortex with solitary spine cells; G – *C. contraria*, upper whorls of branchlets; H – *C. vulgaris*, upper whorls of branchlets. Scale bars: A, C, H – 3 mm, B, D, F – 1 mm, E, G – 2 mm.

(Aliyev, 1961). In Georgia, as in many regions of Europe, this annual species likely appears in spring (Troia & van de Weyer, 2024). By late April, mature and partially decaying specimens of *T. glomerata* had already been collected in Ponichala. This evidently explains why the species is absent from the otherwise extensive Georgian charophyte collection at TBI (checked by the author), which was assembled mainly during the summer months.

Chara papillosa is a rare species throughout the Caucasus and was previously recorded in Georgia from a single locality, Lake Lisi (as *C. intermedia* A. Braun; Jibladze, 1949). The species is perennial.

Chara contraria and *C. vulgaris* are widespread generalists, commonly found across various habitats across the Caucasus (Romanov et al., 2025). In Ponichala, these species are also represented by *C. contraria* var. *hispidula* A. Braun and *C. vulgaris* f. *longibracteata* (Kütz.) H. Groves.

Conclusions

The study of water bodies in the Ponichala Reserve was conducted as part of broader investigation of charophytes across Georgia in recent years. Although this region remains poorly studied in

terms of the species composition and distribution of charophytes, the new findings suggest that the Ponichala Reserve, with its artificial water inputs supporting semi-natural hydrological conditions, serves as an important refuge for charophyte species that are rare in the Caucasian context. The new records significantly expand the known distribution of *Chara hispida* and *Tolypella glomerata* and confirm the continued presence of *C. papillosa* in the Tbilisi area after many decades. It is highly desirable that the management of the reserve's water bodies, particularly vegetation clearance, takes into account the ecological requirements of charophytes to ensure the long-term persistence of their populations.

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ბოტანიკა

ფონიჭალის ნაკრძალის ქაროფიტები, საქართველო

ვასილ ვიშნიაკოვი

რუსეთის მეცნიერებათა აკადემია, შიდა წყლების ბიოლოგიის პაპანინის ინსტიტუტი, ბოროკი, რუსეთის ფედერაცია

(წარმოდგენილია აკადემიის წევრის თინათინ სადუნიშვილის მიერ)

თბილისთან ახლოს მდებარე ფონიჭალის ნაკრძალი (კრწანისის პარკი) დაცული ტერიტორიაა. იგი შეიქმნა მტკვრის ხეობაში, ტუგაის ტყეების ერთ-ერთი უკანასკნელი ნაშთის შესანარჩუნებლად. ნაკრძალის მთავარი მახასიათებელია მისი სარწყავი სისტემა, რომელიც ინარჩუნებს ნიადაგის ტენიანობას მშრალი ზაფხულის პერიოდში და ქმნის ტბორებისა და არხების ქსელს, სადაც შესაფერისი გარემოპირობებია წყლის მცენარეულობისთვის. 2023-2024 წლებში ჩატარებული საველე კვლევებისას, პირველად იქნა შესწავლილი ნაკრძალის ადგილობრივი ტბორებსა და მტკვრის ჭალების მიმდებარე არსებულ არაღრმა ხრეშის მოპოვების კარიერებში ქაროფიტების მრავალფეროვნება. გამოვლინდა ქაროფიტების ხუთი სახეობა: *Chara hispida*, *C. papillosa*, *C. contraria*, *C. vulgaris* და *Tolypella glomerata*. ორი სახეობა, *C. hispida* და *T. glomerata*, ახალია საქართველოსთვის. *C. hispida* ამ სახეობის პირველი დადასტურებული ნიმუშია მთელ კავკასიაში. ქაროფიტები უხვად გვხვდებოდა სუფთა, არაღრმა წყლებში ქვიშიანი ან ლამიანი სუბსტრატით, სადაც ისინი ქმნიდნენ გამოხატულად მონოსპეციფიკურ და შერეულ თანასაზოგადოებებს. იშვიათი, მრავალწლიანი სახეობის *C. hispida*-ს, ფონიჭალის ადგილობრივ რეობა შესამჩნევად იზოლირებულია დასავლეთ ევროპის ძირითადი გავრცელების არეალიდან და წარმოადგენს მის ერთ-ერთ ყველაზე ცნობილ სამხრეთ-აღმოსავლეთით გავრცელების წერტილს. ერთწლოვანი სახეობა *Tolypella glomerata*, რომელიც მხოლოდ გაზაფხულზე ვითარდება, მჭიდრო თანასაზოგადოებებს ქმნიდა ჭალის კარიერებში. მიღებული მონაცემები ხაზს უსვამს ნახევრად ბუნებრივი და ხელოვნური წყალსაცავების მნიშვნელობას დაცული ნახევრად ურბანულ ლანდშაფტში, როგორც თავშესაფარს, სამხრეთ კავკასიაში იშვიათი ქაროფიტებისთვის. ნაკრძალის წყალსაცავების მართვისას, ყურადღება უნდა დაეთმოს ქაროფიტების ჰაბიტატებს, რათა ხანგრძლივი დროით შენარჩუნდეს მათი პოპულაციები. შეგროვებული კოლექციების საჰერბარიუმო ნიმუშები ინახება IBIW, LE, ROST და TBI-ს ჰერბარიუმებში.

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