Article

Borziana 7: 171-182
https://doi.org/10.7320/Borziana.007.171
Version of Record published online on 5 August 2026

Kamil Mert Yücel & Serdar Gökhan Şenol

A new record for Türkiye: *Chara squamosa* (*Charophyceae*) with contributions to ecology and habitat characteristics

Abstract

Yücel, K. M. & Şenol, S. G.: A new record for Türkiye: *Chara squamosa* (*Charophyceae*) with contributions to ecology and habitat characteristics. — Borziana 7: 171-182. 2026 — ISSN: 2724-5020 online.

This article was conducted as part of the hydroelectric power plant project planned for the Dimçayı basin in the Dim Valley (Antalya-Alanya), with the aim of identifying *Chara* specimens collected during expert fieldwork for the purpose of determining possible new taxa belonging to this genus in Türkiye. According to the findings, *Chara squamosa* has been recorded for the first time in the macrophyte flora of Türkiye. The species' habitat within the river system has been identified as a Channelmire type from a geomorphological-hydrological perspective; it is characterized by eutrophic vegetation cover in fast-flowing rivers. In light of these data, a contribution has been made to the ecology and sociology of the species classified as "Data Deficient (DD)" by the International Union for Conservation of Nature (IUCN). Factors threatening the survival of the species include: the lack of comprehensive protection status for its habitat, tourism activities exceeding the area's carrying capacity, a significant decrease in the flow of natural streams reaching the sea due to the large amount of water retained by the dam, unconscious water use in agricultural activities carried out in the area, and the discharge of reservoir waste from the province of Alanya-Antalya into the stream. Sustainable conservation approaches to address these threats have been proposed. With the addition of the species *Chara squamosa*, the number of *Chara* taxon groups in Türkiye has increased to 16, while the number of taxon groups in Türkiye's stoneworts has risen to 19, belonging to three genera.

Key words: Dimçayı, *Chara*, Antalya, Anatolia.

Introduction

Türkiye is in a unique position in the world in terms of floristic diversity, located between 26–46 degrees longitude and 36–42 degrees latitude, and covering an area of 783.356 km². The main reasons for this rich plant biodiversity are: the country's location as a peninsula surrounded by seas on three sides; its position at the intersection of three distinct phytogeographic regions (European-Siberian, Iranian-Turanian, and Mediterranean); and its geographical location, which made it a common refuge point for species migrating from Asia to Europe and from Europe to Asia during the glacial and

interglacial periods experienced in the region, shape of the mountains extending towards the sea, and the elevation increase from west to east are of great importance (Güner & al. 2014). The country's sea borders, the deltas formed by permanent or seasonal wetlands that reach these frontiers, and the presence of various types of inland water systems, including water dynamics, sediment types, geomorphological formation elements, and hydrochemistry, provide a rich habitat for macrophyte species (Seçmen & Leblebici 1997). Türkiye's algal flora, as documented by Taşkın (2019), comprises a total of 2.994 species distributed across 828 genera and 314 families. When infraspecific categories such as subspecies and varieties are taken into account, the overall number of recorded taxa rises to 3.690. In terms of habitat preference, the majority of these taxa, 2.452, are associated with freshwater environments, while 1.097 occur in marine systems. A smaller contingent, consisting of 44 taxa, is found in brackish waters, and an additional 97 taxa are reported from both freshwater and marine habitats. Stonewort, a pioneer macrophyte, belongs to the Charophyta division; the closest relatives of terrestrial plants in the evolutionary process are found within this division (Karol 2004). They are also bioindicators that play a role in indicating the chemistry of the water they inhabit (Becker & al. 2015). As the primary members of macrophyte habitats, Characeae species generally prefer shallow, standing or slow-flowing freshwater systems. However, certain species of the genera *Chara* L. and *Nitella* C.Agardh prefer deep (attaching to sediments at the bottom) and/or fast-flowing (attaching to sediments on the walls of the riverbed) waters, while some species of the genus *Tolypella* (A. Braun) A. Braun have adapted to moderately or highly saline brackish waters (Yücel & al. 2026).

For an extended period, *Chara squamosa* Desf. was regarded as a synonym of *C. gymnophylla* A. Braun. This taxonomic confusion led to the widespread misidentification of specimens bearing a tylacanthous stem cortex, which were routinely assigned to *C. gymnophylla* or to *C. vulgaris* var. *gymnophylla* Nyman (Krause 1997; Blaženčić 2014; Romanov & al. 2024). However, a recent reappraisal—based on type material, an exhaustive literature survey, and extensive herbarium studies—has resolved this long-standing error. As a result, *C. squamosa* is now firmly reinstated as a distinct and valid species (Trbojević & al. 2024; Romanov & al. 2024). Wood (1965), examining Desfontaines' material stored in the Madrid (MA) ex-herbarium, described the *C. squamosa* species in his work, noting that this specimen's main axis cortex contained isostichous-tylacanthous types. The species *C. conimbrigensis* (A.G.Cunha) and *C. hungarica* (N.Filarszky), which have the same main cortex type, have also begun to be evaluated under the species *C. squamosa* (Schubert & al. 2024). The aim of this study is to (i) determine the current status of Characeae species in Türkiye, (ii) report a new locality for *C. squamosa*, (iii) detail the species' morphological characteristics and ecological preferences (within the context of wetland and habitat classification), and (iv) discuss the species' potential other localities in Türkiye and the possibility of confusion with *C. gymnophylla*. According to the literature, Characeae members in Türkiye are represented by a total of 19 taxa, comprising 15 species of *Chara*, three species of *Nitella*, and one of *Tolypella* (Aysel 2005; Barinova & al. 2014; Gönülol & Şahin 2024; Yücel & al. 2026). Our findings confirm this number, while contributing new data on the distribution and ecology of *C. squamosa*.

Materials and Methods

Description of the Study Site

Dimçay Valley, located in the Antalya section of the Mediterranean Region, is situated southeast of Alanya district in Antalya. The valley has an elevation ranging from 0 to 1,649 meters and covers an area of 9,490 ha. The Cebireis Mountain and Dimçay River within it are important natural areas (Eken & al. 2006). The Dimçay River, which originates from the southern slopes of the Taurus Mountains, near the Alacami district of Alanya, reaches the Mediterranean Sea south of the Tosmur district. The stream, fed by numerous springs and side branches along its narrow valley bed, passes through the Alanya Plain. The stream has a total length of 28 kilometers, and its average water flow is measured at 0.327 m^3 per second (Antalya Environment & Urbanization Directorate 2017). The Dim Dam and a hydroelectric power plant connected to the dam were built in the Dimçayı basin in 2009 (TÜBİTAK MAM ÇTÜE 2013). The area was designated a Wildlife Conservation Area in 2005. The general flora of the area is dominated by red pine (*Pinus brutia* L.) forests and Mediterranean maquis species. Among the mammals of the region's fauna, the mountain goat (*Capra aegagrus* Brisson) is the target species for the area's designation as a Wildlife Conservation Area; among the birds, the eagle owl (*Bubo Brisson*) breeds in the area; from an entomological perspective, the Ottoman blue butterfly (*Polyommatus ottomanus* Lefèbvre), the large brown butterfly (*Maniola megala* Oberthür), the orange-spotted eastern butterfly (*Anthocharis damone* Boisduval), Bavius butterfly (*Sinia bavius* Eversmann), and damselfly (*Onychogomphus assimilis* Schneider) are important for the conservation of the area (Eken & al. 2006). The valley is an important eco-tourism destination. It contains numerous cave formations (Dim Cave); conditions suitable for rafting and trekking sports; and tourism facilities and fish farms on the valley's river-facing sides and in the area where it flows into the sea (Koçyiğit & Sinanoğlu 2019).

Sampling

The *Chara* members were photographed in their natural habitat before sampling was conducted to determine the plant sociology of the stream. In the field, each sample was assigned a unique code, which was matched with the photographs taken. Since the samples were located in a fast-flowing water system, they were collected using a grapnel. The collected *Chara* samples were transported to the laboratory using three different preservation methods: in their natural water for pressing (in a cold chain), in a 5% alcohol solution for long-term storage, and in a 70% alcohol solution for anatomical measurements. The specimens were delivered to the Department of Botany, Plant Ecology and Conservation Biology Laboratory at Ege University. In the laboratory, specimens brought in habitat water and planned for pressing were washed three times for one minute each in pure water to remove microorganisms. After sterilization, the specimens were pressed between drying papers. Specimens stored in 5% alcohol were examined using a Euromex Nexius Zoom stereo microscope and an Olympus CX21 light microscope (100 and 1000 Ч); the structures identified were recorded as micrographs using the Image Focus Alpha program. "Charophytes of Europe" (Schubert & al. 2024) was used as the primary source for diagnosis. The samples that were diagnosed, pressed, and dried were delivered to the Ege University Botanical Garden - Herbarium Application and Research Center (EGE) and archived with a permanent herbarium number EGE45459.

Examained Specimens
EGE30601-*Chara hispida* var. *major*
EGE30436-*Chara globularis* var. *globularis*
EGE35601-*Chara globularis* var. *aspera*
EGE30482-*Chara vulgaris* var. *vulgaris* f. vulgaris
EGE30542-*Chara vulgaris* var. *vulgaris* f. crispa or f. Kieneri
EGE44584-*Tolypella salina*
Taxa recorded in my personal herbarium collection: [KMCH4]-*C. virgata* Kütz, [GEDCH1]-*C.aspera* Willd.

Results

Description of the* Chara squamosa *specimens

Chara squamosa Desfontaines, Flor. Atlant. 2: 331. 1799.
Lectotype (Wood, 1965: 108): Barbarie/[no date]/[no collector] (PC610826, ex herb. Maire).

Homotypic synonym
Chara vulgaris subsp. *squamosa* (Desf.) F.Hy 1913.
Heterotypic synonyms
Chara pseudogymnophylla N.Filarszky 1927
Chara hungarica N.Filarszky 1930
Chara conimbrigensis A.G.Cunha 1935
Chara vulgaris f. *conimbrigensis* (A.G.Cuhna) R.D.Wood 1962
Chara gymnophylla f. *conimbrigensis* (A.G.Cuhna) Raam 2010

Chara squamosa was collected during fieldwork conducted on; Antalya province, Alanya district, Dimçayı: 36°32’24.28“N/ 32°05’39.98”E, 315 m, fast-flowing streams, 03.10.2025, *Yücel & Şenol* (KMC-6) = (EGE45459) (Fig. 2-B.).
C. squamosa is a species that ranges in color from light green to grayish green and varies in size depending on the depth of the water it inhabits. In the specimens we collected from the locality, the species was found in shallow water sources, medium in size, with upper whorls largely unshortened, and a weak to medium shell structure. The species, which ranges in size from 8–19 cm, has a main axis diameter of 400–530 µm and is largely corticized (Fig. 1-A/C). Rarely, 1–2 basal internodes are not corticized. The axis cortex is complete, diplostichous (a few juvenile specimens are triplostichous), with the large majority of specimens in the examined population showing a tylacanthous, to a lesser extent isostichous, cortex formation. Spine cells are papillate in form, thick, and obtuse-terminated (Fig. 1-B). Stipulodes are arranged in two rows, both rows being nearly as long as the main axis (the upper row slightly longer than the lower) and ending in an acute point (Fig. 1-B). Branchlets number 8–10 and are 3–18 mm long. The branchlets are generally not corticized (rarely the lowest few segments

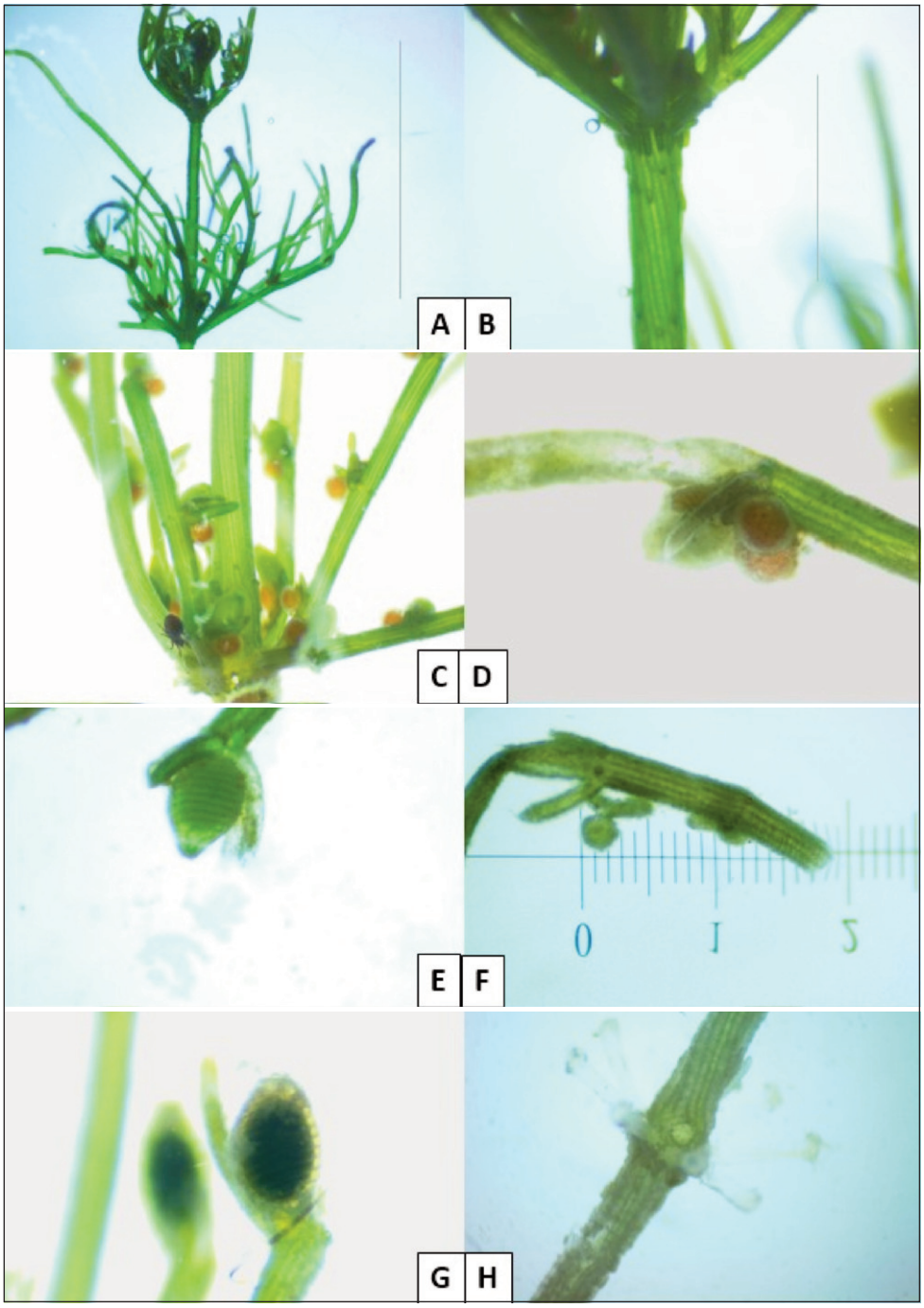

Fig. 1 A- main axis (0.4–0.5 mm) and branchlets general view (5 cm); B-stipulodes (1.2 cm); C-whorl of branchlets; D-monoicous gamentangia; E-oogonia; F-antheridia (0.3 mm); G-oospore; H-nodal bulbil.

are corticized). The branchlets consist of 3–4 non-differentiated segments, the terminal cells are short and conical/cylindrical in shape (Fig. 1-A/C). The bract-cells are clearly one-sided, the anterior bract-cells are long (slightly or several times longer than the ooganium*/short) and the posterior bract-cells are papilliform. Bracteoles are the same size as bract-cells or several times shorter (Fig. 1-C). The bractlet is in a compound gametangium position and is shorter than the oogonium (Fig. 1-E). *C. squamosa* is monoecious, with gametangia combined in 1–2 branchlet nodes. Gametangia occur in a single arrangement (usually antheridia, rarely oogonia). In the population we collected, examples of both sexuals occurring in a single arrangement were found. Oogonia are solitary (rarely two) and hold an antheridium below, length 500 µm / width 420 µm (Fig. 1-D/E). The oospore is black-dark brown in color, ellipse-shaped, and has acute spirals (Fig. 1-G). Antheridia are large (300–440 µm) (Fig. 1-F). The lowest axis node contains a multi-celled nodal bulbil (Fig. 1-H).

Habitat Description

For example, according to the grid prepared by Davis for his Flora of Turkey (Davis 1965), the area where the specimen was collected is classified as "C4," while according to the grid prepared for the new "Illustrated Flora of Türkiye" project under the NGBB-ANG Foundation (Güner 2014), it is classified as "6a" in the Mediterranean Region-Antalya Subsection (Fig. 2-A.). According to the wetland classification prepared by Semeniuk & Semeniuk (2011), the area where it was collected has geomorphological and hydrological characteristics (Fig. 3); for example, is of the *Macroscale, Fresh Water, Carbonate Mud, Vertical Grasses* covered Channelmire type. The species generally prefers freshwater, within freshwater ecosystems, prefers mesotrophic water bodies with neutral or slightly alkaline water, and also lives in hot spring waters. These water bodies include small- to medium-sized artificial or natural shallow rivers, streams, and thermal springs with high flow rates, and exposure to sunlight is important (Trbojević & al. 2024). As for sediment type, it prefers muddy or sandy bottom sediments, and sometimes gravelly systems. According to the European Nature Information System (EUNIS) Habitat Classification, the vegetation type of the inland water surface area that constitutes the species' habitat belongs to category C2.28 – Eutrophic vegetation of fast-flowing streams (Fig. 3).

Distribution of Chara squamosa

In this study, *Chara squamosa* Desf. —a species with only 35 scarcely verified records worldwide, listed as Data Deficient (DD) by the IUCN (Schubert & al. 2024), and exhibiting a highly restricted distribution in the Mediterranean—is reported for the first time from Türkiye. Its known distribution includes Mediterranean countries such as Portugal, Spain, Italy, Hungary, Serbia, Cyprus, Montenegro, North Macedonia, and Bosnia and Herzegovina, as well as extra-Mediterranean localities in North Africa (Tunisia, Morocco), Israel, and the Caucasus (Filarszky 1930; Cunha 1935, 1942, 1943; Mendes 1948; Wood 1965; Corillion 1977; Guerlesquin 1985; Sánchez 1984; Romanov & al. 2019, 2023, 2025; Blaženčić & Stevanović 2018; Trbojević & al. 2024, 2025) (Fig. 4).

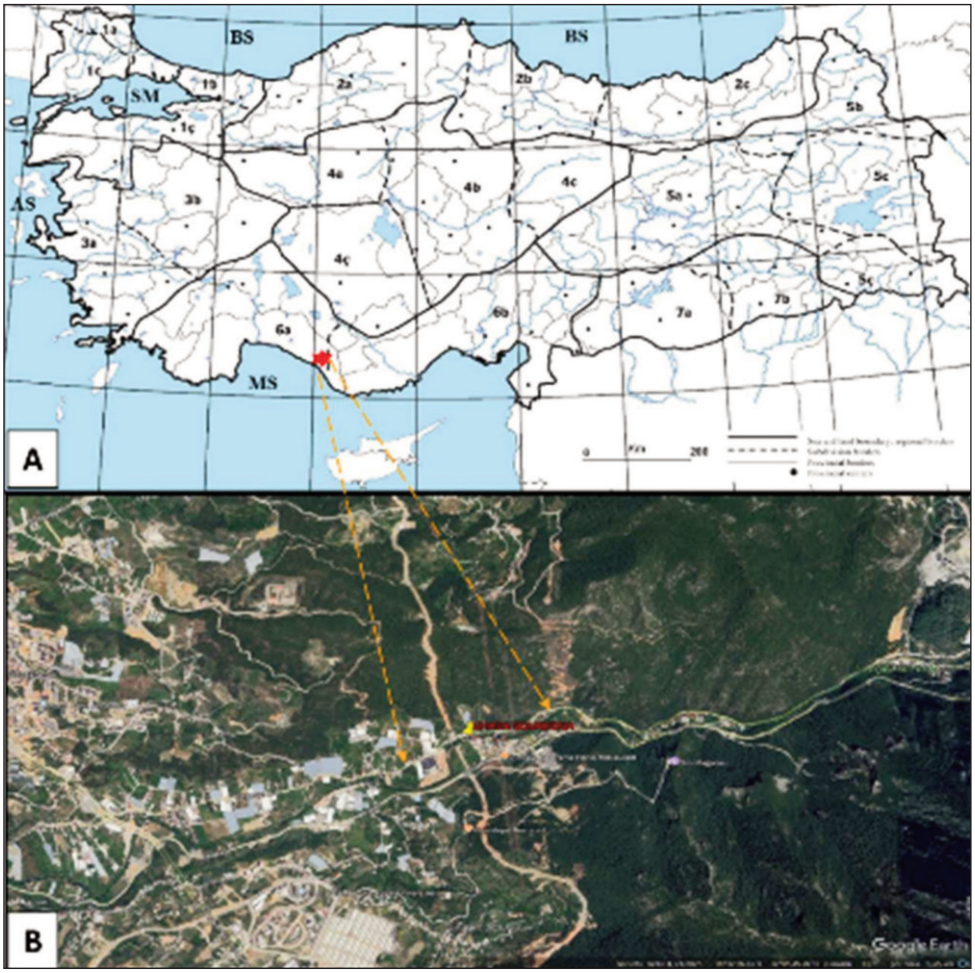

Fig. 2-A. Map showing the area where the *C. squamosa* sample was collected (Güner 2014), B. satellite image showing the stations where the *C. squamosa* sample was collected (© Earth.google.com).

Discussion and Conclusion

Having established the morphological and taxonomic identity of the Turkish material in Section 3.1, we now turn to the broader implications of these findings. Given that ecological, sociologial, hydrochemical, and genetic data for *Chara squamosa* Desf. remain extremely limited, it is highly probable that many populations previously assigned to *C. gymnophylla* A. Braun. in various countries—including Türkiye—actually belong to *C. squamosa*, thus perpetuating a cycle of misidentification. A prime example of this is supported by the study conducted by Trbojević & al. (2024) in Serbia. One of the main reasons for the species' IUCN category being assessed as "DD" is based on the high morphological

Fig. 3. Habitat of *C. squamosa* (original).

similarity between the species mentioned above. To solve this mystery, in addition to increasing the morphological-anatomical data between the *C. squamosa* and *C. gymnophylla* species, there is a need for comprehensive research supported by phylogenetic studies that does not overlook ecological factors.

Research on the *Characeae* in Türkiye is based on a rather limited amount of literature (Güner & al. 2014). This situation is primarily due to methodological obstacles encountered at various stages of the research process. Logistical difficulties encountered during fieldwork in sampling and transporting material to the laboratory, the lack of reference sources and equipment necessary for the taxonomic diagnosis stage and the unfavorable conditions for the long-term preservation of diagnosed specimens have led to limited knowledge accumulation in this field (Barinova & al. 2014). As a result of these limitations, there is a significant need to revise the species recorded in the literature using current taxonomic approaches. Furthermore, it is important to collect taxa that were previously collected but have not reached the present day, have been inadequately preserved, or for which no herbarium specimens exist and to add them to the scientific data set.

As a result of the negative factors mentioned in the previous paragraph, the species *C. gymnopylla* (Syn: *C. vulgaris* var. *gymnophylla* (A.Braun) C.F.Nyman) species in Türkiye; it was recorded in two stations between 1850-1920 and in 25 stations between 1920-2000 (Braun & Nordstedt 1882; Migula 1897; Aysel 2005). Herbarium records of the recorded specimens could not be accessed. Therefore, it is important to re-collect specimens from

Fig. 4. The distrubiton map: black circles) European records; red square) the new record.

the populations for which there are no herbarium specimens from the specified stations and to evaluate the possibility that the species identified as *C. gymnopylla* are *C. squamosa* in order to reveal the Turkish population of the species in detail.

C. squamosa produces less oospores than other *Characeae* members. Mature oospores and antheridia were found in population samples collected most recently in 2009 from Sardinia (Italy) (Becker 2019). The species' possession of bulbs and low fertilization rate increases the expectation of vegetative reproduction. Members of the *C. squamosa* population collected from Türkiye contain high levels of mature oospores, proving the species' high ecological adaptation and associated reproductive potential. The genetic repertoire of the Dimçayı population is relatively broad, and it is considered imperative that the only known population in Türkiye be rapidly protected under in-situ conservation measures.

The main factors threatening the Dim Valley are: the lack of comprehensive protection status for the region, tourism activities exceeding the carrying capacity, a significant decrease in the flow rate of the natural flow reaching the sea due to the barrier, unconscious practices in agricultural irrigation, and the discharge of reservoir waste belonging to the province of Alanya into the stream (Akkurt Gümüş 2020). The source of the Dim River and its surroundings are a Wildlife Development Area (1200 m), while there are no areas with any protection status at the lower elevations of the river. Hydroelectric power, the Dim Dam, and tourism activity areas are located on the river. The necessity of integrated management of river basins in the context of protecting biodiversity and water quality should not be overlooked.

Our findings indicate that the addition of the species *C. squamosa* to the Turkish Charophyceae has increased the number of taxa representing the family to 19. Advances in the fields of Molecular Biology and Genetics, the more detailed examination of aquatic systems in terms of macrophytes, and the increase in the number of researchers working in this field will lead to the recording of new taxa for members of the Charophyceae family in Türkiye and the addition of new station records to existing taxa.

Acknowledgements

I would like to thank my valued colleagues who supported me during the preparation of this article, as well as during the fieldwork and dissection phases: İlke ÇOBANYILDIZI, Anıl ADSIZ, Manolya TUNCER, Zelal AKTAN, İklim ERDEN, and İsmail ZENGİN.

References

Akkurt Gümüş, S. 2020: Manavgat Çayı-Dim Çayı Arasının Bitki Örtüsü ve Biyoçeşitlilik Analizi [Vegetation and Biodiversity Analysis in the Area Between Manavgat River and Dim Stream]. – PhD Thesis, İstanbul University.

Antalya Çevre ve Şehircilik Müdürlüğü, ÇED ve Çevre İzinleri Şube Müdürlüğü 2017: Antalya İli 2016 Yılı Çevre Durum Raporu [Antalya Province 2016 Environmental Status Report]. – Antalya.

Aysel, V. 2005: Check-list of the freshwater algae of Turkey. – Black Sea/Medit. Environ. **11(1):** 1-124.

Barinova, S., Romanov, R., & Solak, C. N. 2014: New record of *Chara hispida* (L.) Hartm.(*Streptophyta*: *Charophyceae*, *Charales*) from the Işıklı Lake (Turkey) and critical checklist of Turkish charophytes. – Nat. Res. Conserv. **2(3):** 33-42.

Blaženčić, J. & Stevanović, B. 2018: Rediscovery of the endemic species *Chara rohlenae* Vilh. 1912 (*Characeae*)—believed extinct—on the Balkan Peninsula. – Bot. Serbica **42:** 109-115.

Blaženčić J. 2014. Overview of the stoneworts (*Charales*) of Serbia with the estimation of the threat status. – Bot. Serbica **38:** 121-130.

Braun, A. & Nordstedt, O. 1882: Fragmente einer Monographie der Characeen. Nach den hinterlassenen Manuskripten A. Braun's herausgegeben von Dr. Otto Nordstedt. – Abh. Königl. Akad. Wiss. Berlin.

Becker, R., Doege, A., Schubert, H. & van de Weyer, K. 2015: Bioindikation mit Characeen. – Pp. 97-137 in Armleuchteralgen: Die Characeen Deutschlands. Berlin.

Becker, R. 2019: The *Characeae* (*Charales*, *Charophyceae*) of Sardinia (Italy): Habitats, distribution and conservation. – Webbia **74(1):** 83-101.

Corillion, R. 1977: Contribution à l'étude des Characées de Tunisie et bilan actuel de la flore charologique tunisienne. – Bull. Soc. Phycol. France **22:** 47-59.

Cunha, A. G. 1935: Quelques espèces nouvelles de Characées du Portugal. – Bull. Soc. Portugaise Sci. Nat. **12:** 41-58.

Cunha, A. G. 1942: Contribüção para o estudo dos Carofitos portugueses. – Rev. Fac. Ciênc. **2:** 227-357.

Cunha, A. G. 1943: Additions à la flore charologique du Portugal. III. – Bull. Soc. Portugaise Sci. Nat. **14:** 139-143.

Davis P. H. 1965: Materials for a Flora of Turkey X. – Notes Roy. Bot. Gard. Edinburgh **26(2):** 165-201.

Eken, G., Bozdoğan, M., İsfendiyaroğlu, S., Kılıç, D. T. & Lise, Y. (eds) 2006: *Türkiye'nin Önemli Doğa Alanları* [Important Nature Areas of Turkey]. – Ankara.

Filarszky, N. 1930: A Budai hőforrások nyílt vizeinek Chara-féléi és néhány más érdekesebb, ritkább algafaja [Characeae and some other more interesting, rarer algae species of the open waters of the Buda thermal springs]. – Mat. Természettud. Értes. **47:** 652-674.

Google 2024: Google Earth Pro (Version 7.3.6). https://www.google.com/earth/ [accessed 15October 2024].

Gönülol, A. & Şahin, B. 2024: Türkiye Suyosunları (Algler) Listesi'ne Eklentiler II – Bigyra (Sukamçılısı Bölümü), Charophyta (Suşamdanı Bölümü) ve Chlorophyta (Yeşilalgler Bölümü) [Additions to the Checklist of Turkish Algae II – Bigyra (Heterokonta), Char ophyta and Chlorophyta]. – Bağbahçe Bilim Derg. **11(2):** 175-209.

Guerlesquin, M. 1985: Les Characées du Maroc: bilan et répartition de la flore. – Verh. Int. Verein. Limnol. **22:** 2879-2884.

Güner, A., Kandemir, A., Menemen, Y., Yıldırım, H., Aslan, S., Ekşi, G., Güner, I. & Çimen, A. Ö. 2014: Resimli Türkiye Florası [Illustrated Flora of Turkey], **1.** – İstanbul.

Karol, K. G. 2004: Phylogenetic studies of the Charales: the closest living relatives of land plants. – PhD Thesis, University of Maryland.

Koçyiğit, H. & Sinanoğlu, F. 2019: Yüzeysel sularda pestisit kalıntısının araştırılması çalışma örneği; Alanya Alara Çayı [An example of pesticide residue investigation in surface waters; Alanya Alara Stream]. – Doğal Afetler Çevre Derg. **5(2):** 224-236.

Krause W. 1997. *Charales* (*Charophyceae*). – Pp. 1-202 in: Ettl, H., Gärtner, G., Heynig, H. & Mollenhauer, D. (eds), Süßwasserflora von Mitteleuropa, **18.** – Jena, Stuttgart.

Mendes, E. J. 1948: Notas criptogámicas. III. Carófitos I. – Portugaliae Acta Biol., Sér. B **2:** 432-435.

Migula, W. 1889–1897: Fünfter Band: Die Characeen. – Pp. [ADD PAGE RANGE] in: Fischer, A., Fischer, E., Hauck, F., Limpricht, G., Luerssen, C. & al. (eds.), Dr. L. Rabenhorst's Kryptogamenflora von Deutschland, Oesterreich und der Schweiz, **2.** – Leipzig.

Migula, W. 1897: Die Characeen Deutschlands, Oesterreichs und der Schweiz. Unter Berücksichtigung aller Arten Europas.– L. Rabenhorst – Kryptogamenflora von Deutschland, Oesterreich und der Schweiz, **2.** – Leipzig.

Romanov, R., Napolitano, T., van de Weyer, K. & Troia, A. 2019: New records and observations to the Characean flora of Sicily (Italy). – Webbia **74:** 111-119. https://doi.org/10.1080/00837792.2019.1609258

Romanov, R. E., Mallaliev, M. M., Nikulin, V. Yu., Gontcharov, A. A. & Barinova, S. S. 2023: The charophytes (*Charophyceae*, *Characeae*) from Dagestan aquatic habitats, North Caucasus: biogeographical and barcoding perspective. – Environments **10(9):** 153. https://doi.org/10.3390/environments10090153

Romanov, R., Biberdžić, V., Dragićević, S., & Bednár, F. 2025: New national species records of charophytes (*Characeae*) for Montenegro, Croatia, and Cyprus: Update of rare species distribution in Southeast Europe. – Hacquetia **24(2):** 159-170. https://doi.org/10.3986/hacq-2025-0012

Sánchez, P. M. 1984: Contribución al conocimiento del género *Chara* en Andalucía. – Acta Bot. Malac. **9:** 79-84.

Schubert, H., Blindow, I., Nat, E., Korsch, H., Gregor, T. & al. (eds) 2024: Charophytes of Europe. – Cham.

Seçmen, Ö. & Leblebici, E. 1997: Türkiye sulak alan bitkileri ve bitki örtüsü [Wetland Plants and Vegetation in Turkey]. – Ege Üniv. Fen Fak. Yayınları **158:** 700.

Semeniuk, C. A. & Semeniuk, V. 2011: A comprehensive classification of inland wetlands of Western Australia using the geomorphic-hydrologic approach. – J. Roy. Soc. Western Australia **94(3):** 449.

Taşkın, E. (ed.) 2019: Türkiye suyosunları listesi [Checklist of the algae of Turkey]. – İstanbul.

Trbojević, I., Marković, A., Šinžar Sekulić, J., Subakov Simić, G. & Romanov, R. 2024: *Chara squamosa* (*Characeae*, *Charophyceae*) in Serbia – insights from the taxonomic revision of the BEOU charophyte collection and recent field records. – Bot. Serbica **48(1):** 85-92.

Trbojević, I., Romanov, R., Milovanović, V., Subakov Simić, G., Stanković, M. & al. 2025: Charophytes (*Characeae*, *Charophyceae*) of Bosnia and Herzegovina—35 Years After the Last Systematic Overview. – Phycology **5(4):** 85. https://doi.org/10.3390/phycology5040085

TÜBİTAK MAM ÇTÜE 2013: *Havza Koruma Eylem Planlarının Hazırlanması Projesi Antalya Havzası 5118601 (ÇTÜE.13.152) Proje Nihai Raporu* [Basin Protection Action Plans Preparation Project Antalya Basin 5118601 (ÇTÜE.13.152) Project Final Report]. – Kocaeli.

Wood, R. D. 1965: Monograph of the *Characeae*. – Lehre.

Yücel, K. M., Fontes, H. & Şenol, S. G. 2026: A New Genus Record for Türkiye: *Tolypella* (*Charophyceae*), Contributions to the Ecology of *T. salina*. – Nat. Res. Conserv. **12(1):** 1-9. https://doi.org/10.13189/nrc.2026.120101

Address of the authors:
Kamil Mert Yücel* (https://orcid.org/0000-0001-7738-9366) & Serdar Gökhan Şenol (https://orcid.org/0000-0001-7738-9366),
Ege University, Institute of Science, Department of Biology, Izmir, Türkiye. E-mails: kmlmrtycl@gmail.com, serdar.gokhan.senol@ege.edu.tr