Iraqi Journal of Agricultural Sciences –2026:57(4):1319 -1327
P-ISSN: 0075- 0530 /E-ISSN: 2410-0862
DOI: https://doi.org/10.36103/wpcwz572

CHARA CONTRARIA BRAUN EX KÜTZ (1845) (CHARACEAE): A NEW RECORD FOR IRAQ

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ABSTRACT

The current study aimed to record and describes the alga *Chara contraria* moss for the first time in Iraq, where this algae was collected in Al-Ishaqi irrigation project and its small cement-lined branches north of Baghdad within the governorate of Salah Al-Din, Al-Sheikh Jameel village, for the year 2023-2024 during the winter. The exploratory method was used in order to obtain this algae, where the alga was placed in sterile plastic bottles, kept in formalin solution, extracted and placed on a white paper, measured the length of the alga, calculated the branches with the help of a digital camera, and measured some physicochemical changes on water samples. The results of the tests showed that the water of the project in which algae grows basal with a pH rate of 8.05 and total dissolved substances 189 mg/L and electrical conductivity of 351.5 microsimins/cm, while the total hardness recorded 140 included high concentrations of calcium 40 mg/L compared to magnesium concentration of 9.7 mg/L, while nutrients recorded high values ranging between (0.010-0.087) mg/L, (0.010-0.087), mg/L, (0.227-1.450) mg/L and (0.02-6.30) mg/L for both dissolved phosphates and sulfates, nitrates and silicates, respectively..

Keywords: Charophyte, algae Al-Ishaqi Irrigation, Salah Al-Din governorate, Physico-chemical parameters, Calcium, Magnesium.

***Part of MSc thesis of 1st author**

Received: 16/9/2024, Accepted: 11/12/2024, Published: 30/4/2026

INTRODUCTION

Algae differ in terms of their environment, as some of them prefer to exist in flowing water, while the other part prefers to exist in stagnant water inside lakes; some of them prefer salt water and the other part fresh. Some of them are also considered vital evidence of pollution, so the process of searching for Specific algae requires knowledge of the environment that each species prefers in terms of temperature, nature of water, and other physicochemical factors (Abdulsahib and Al-Magdamy, 2021, Al-Magdamy and Al-Salman, 2021). Studying algae in the laboratory requires identifying some of the physicochemical factors of the environment in which they are found (Al-Azawii *et al.*, 2015). It is possible to collect and classify algae from their various environments, study the environmental variables of their locations, and provide a suitable laboratory environment for the purpose of isolating, growing, and sustaining them in the laboratory, and obtaining pure living masses of specific algae, and thus investing them as sources for fuel production. Biotechnology and various life applications (Al-Ani *et al.*, 2019). Studies indicate that green algae have a common ancestor with plants, as they possess the same type of pigments and produce the same carbohydrates during the process of photosynthesis as in land plants (Naselli-Flores and Barone, 2009). Green algae are the most diverse group of algae within the biosphere, characterized by different shapes, sizes, and behavior. It has puzzled taxonomists throughout time (Saber *et*

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al., 2021). Green algae are divided into two types Chlorophyta and Charophyta. Chlorophyta are an ancient group of autotrophic macroalgae found in shallow areas, whose ancestors invaded and evolved into the present 450 million years ago (Palacio-López *et al.*, 2019). It lives in salt and freshwater ecosystems. The genus *Chara* can be found widely in water bodies such as shallow lakes, artificial ponds, sewage or sewage (Al-Ani *et al.*, 2019). Classifying the genus *Chara* is not easy, and this is mostly due to the overlapping morphological features of the individual specimens that belong to the different types (Urbaniak and Kwiatkowski, 2019). Charophytes forms (Including existing species or fossils) An ancient group of autotrophic macro algae found in shallow areas, whose ancestors invaded and evolved into the present 450 million years ago (Palacio-López *et al.*, 2019). Ecologically, members of the Characeae family are widely distributed in freshwater and brackish water, It is rare in marine waters (Torn *et al.*, 2015; Zalat *et al.*, 2020). Curry algae play a key role in maintaining the balance of the ecosystems they colonize. Therefore, it is important to study their types and methods of reproduction in the environment. It is known that Charophytes are sensitive to different levels of pollution, especially high levels of nutrients. Hence, it is one of the endangered algae groups (Mjelde *et al.*, 2020, Torn *et al.*, 2015). Most taxonomic studies were based on the morphology of charophyte plants until the end of the nineteenth century. During this initial phase, many researchers and scientists attempted to determine the degree of morphological variation in charophyte plants and to find characters to traditionally distinguish species, in the genus *Chara*, a narrow species concept has been used resulting in about 45 species being described in Europe (Corillion, 1957, Krause, 1997). But because of overlapping morphological differences in many characters, some scientists used a broader concept of species and interpreted the genus to be divided into fewer and more species with multiple forms (Zalat *et al.*, 2020). Thus, it was stated that there are only 18 species worldwide (Urbaniak and Kwiatkowski, 2019). Checklist of Algal Flora in Iraq (21) indicated that the Iraqi environment contains 8 species of the genus Chara, which are: *Chara canescens* Desvaux and Lois, *C. excelsa* Allen, *C. formosa* Robinson, *C. fragilis* Desvaux, *C. gloularis* Thuill, *C. shweinitzii* Braun, *C. vulgaris* Linnaeus and *C. vulgaris* var *vulgaris* fo. *exelsa* R.D. Wood . They are mentioned as diagnostic species only, without details of classification and diagnosis, as most local studies of algae are either environmental or taxonomic studies to mention the species and the interaction of their appearance with environmental variables only (Al-Hassany and AL Bayaty. 2017; Hassan *et al.*, 2023; Wahhab *et al.*, 2023) or using algae as environmental clues (Abu-Hadal and Hassany. 2020, Aljanabi *et al.* 2022). Therefore, the current research aims to study the ecology and classification of a species described for the first time in the Iraqi environment**.**

MATERIALS AND METHODS

Samples were collected from the Al-Ishaqi Irrigation Project located in Salah alDin Governorate, Sheikh Jamil village, north of Baghdad (N 16.36° 80' 33', E 42.16° 37' 44'). During the winter, this place was chosen to observe the presence of spherical algae within the Al-Ishaqi project and the small empties branching from it (Figure1). The moss was collected manually and stirred under water to remove the bulk of suspended materials and clays. Then it was placed in sterile plastic bottles and a little river water was added to it. Then it was transported to the laboratory, washed with distilled water, and preserved in FAA solution (Diba *et al.*, 2013). The samples were carefully extracted and arranged on a white sheet of paper to measure the length of the plant and the number of branches, and the parts were examined using a stereomicroscope or magnifying glass and under an optical microscope, Photomicrographs were also taken at 10x and 25x Reichert magnification (Nr.309209) with the help of a digital camera. Water samples were also collected from the same place where the sample was taken to measure some physicochemical variables based on APHA (APHA, 2017).

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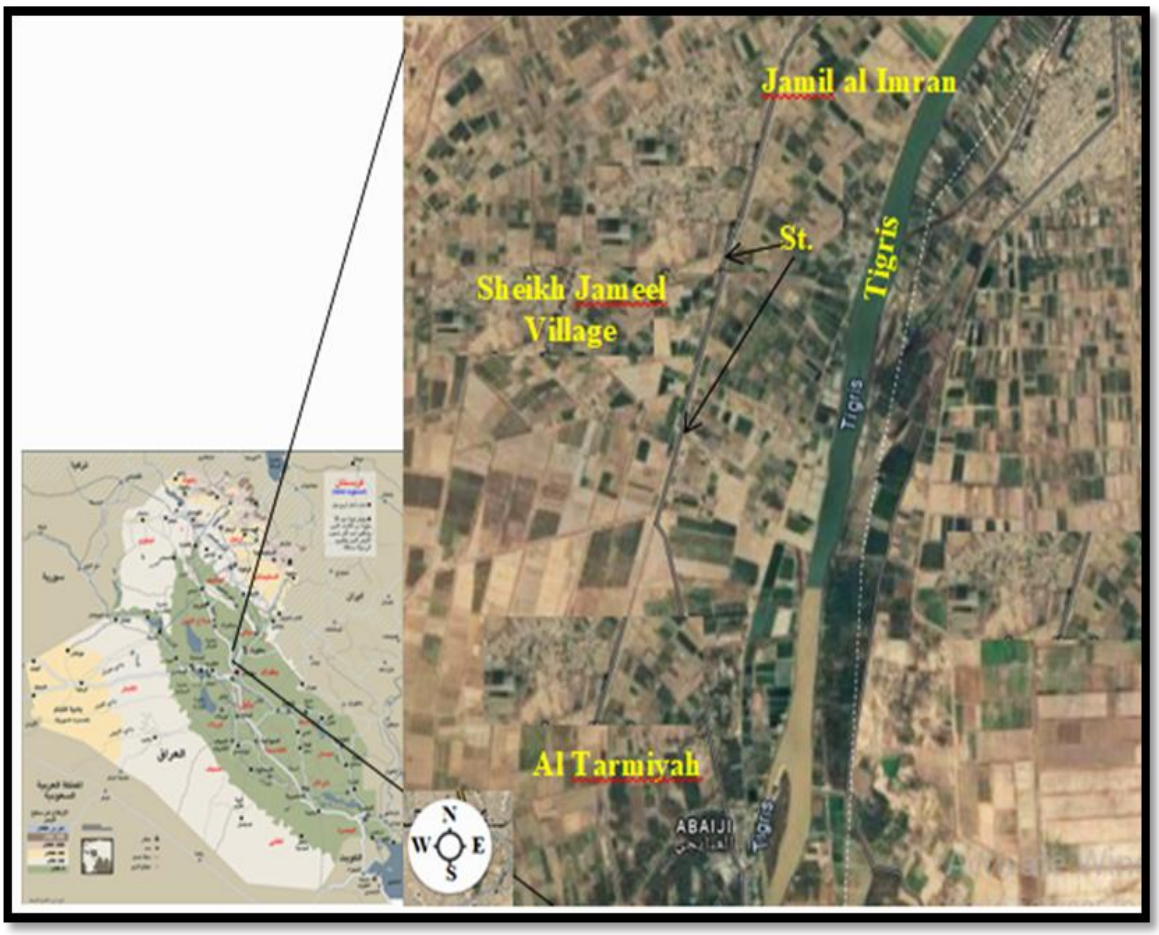

Figure 1. Map of study area and selected site (www.bing.com/maps , 2024).

RESULTS AND DISCUSSION

The Al-Ishaqi project is distinguished by being an irrigation project lined with cement, established within the agricultural reform system in Iraq, to irrigate the lands in the south of Salah Al-Din Governorate, north of Tarmiya. The depth of the water in it throughout the days of the year does not exceed 2.5 meters, and various types of algae grow in it because it is shallow and its flow is continuous (Talib *et al.*, 2014). The results of the physicochemical tests showed that the project water is alkaline with a pH rate of (351.5) EC and (189) TDS, while the total hardness was recorded at 140, including high concentrations of calcium (40) Compared to the magnesium concentration of 9.7 mg/L, while the nutrients recorded high values ranging between (0.010-0.087) (137.67-308.33) mg/L (0.227-1.450) (0.02-6.30) micrograms/g for dissolved phosphate, sulfate, nitrate and silica, respectively (Table 1). This is close to what many environmental studies have recorded regarding the quality of Iraqi water, especially in Salah al-Din Governorate (AL-Magdamy, 2019; Al-Magdamy and Al-Salman. 2021; Ibrahim *et al.*, 2020). The study found that algae is abundant in irrigation projects lined with cement Kadhim *et al.* (2024). This indicates that the moss works to withdraw calcium carbonate compounds resulting from environmental corrosion of cement and deposit them on the outer surface of the various parts of the moss (Urbaniak and Kwiatkowski, 2019).

Table 1. Physico-chemical parameters of the water canal

Parameters	Value
Water temperature	19.6
pH	8.05
EC	351.5
TDS	189
Total hardness	140
Ca	40
Mg	9.7
Total PO_4	0.087 - 0.010
SO_4	137-67-308.33
NoO_3	0.227 – 1.450
SiO_2	0.02 -6.30

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***Chara contraria* Braun ex Kütz. 1845**

Synonyms*: Chara vulgaris* var. *vulgaris* f. *contraria* (Braun ex Kütz.) Wood; *Chara vulgaris* var. *contraria* (Braun ex Kütz.) Moore. Common name: Opposite stonewort. Groves & Webster (19424), 36, Pl. 33, Figs. 1–9; Wood & Imahori (1965), 92, Icon 7; Pal *et al*. (1962), 103, Figure 243; Mann (1994), 413, Figure 2; Krause (1997), 83, Figure 26; Langangen & Leghari (2001), 63; Dekere (2003), 89, Figures 4.7.1:A–F). These algae are characterized by being large, eukaryotic, aquatic thallus plants that do not have true roots and are flowerless. The plant is monoecious, small, ranging in length between 5.5-15.5 cm, extending horizontally under water, attached to the bottom, grassy, green in color; it has a middle axis composed of nodes, and between the nodes there are phalanges whose length ranges between 10-15 cm. The middle axis of the plant is characterized by the fact that it has longer phalanges than those of the side branches. The length of the branches ranges between 7-8 cm (Figure 2). The phalanx consists of a central cell. Surrounded by a group of heterogeneous cortical cells diplostichous, tylacanthous, It has twists and rope-like spikes (Figure 3 A), cortical cells contain areas resembling holes in which they develop, spherical to cylindrical in shape, with variable length in the modern parts, which is clearer than in the older parts (Figure 3B). Each node carries a group of small branches, and short, leaf-like, squamous structures made up of a number of cells that stop growing after they reach a certain length, ending with a single, pointed end. These cells may be covered with cortical cells or not (Figure 3C). They arise. On the node at the base of the branches in two rows of similar length, shorter than the diameter of the axis (Figure 3 D).

Figure 2. *Chara contraria* Braun ex. Kütz whole mount

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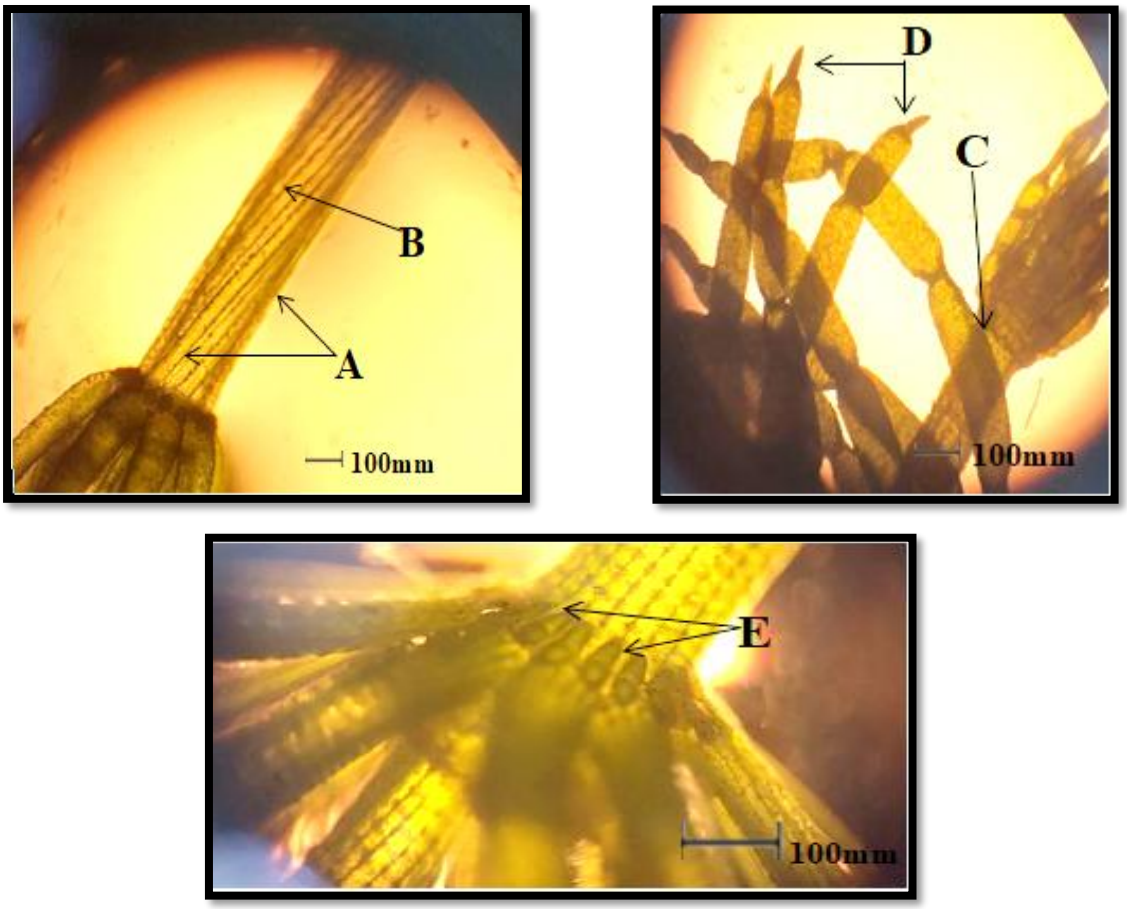

Figure 3. ***Chara contraria*** **Braun ex Kütz A: cortical cells, B: spin cells solitary, C:nod ,D: end for leaves, E: stipulodes**

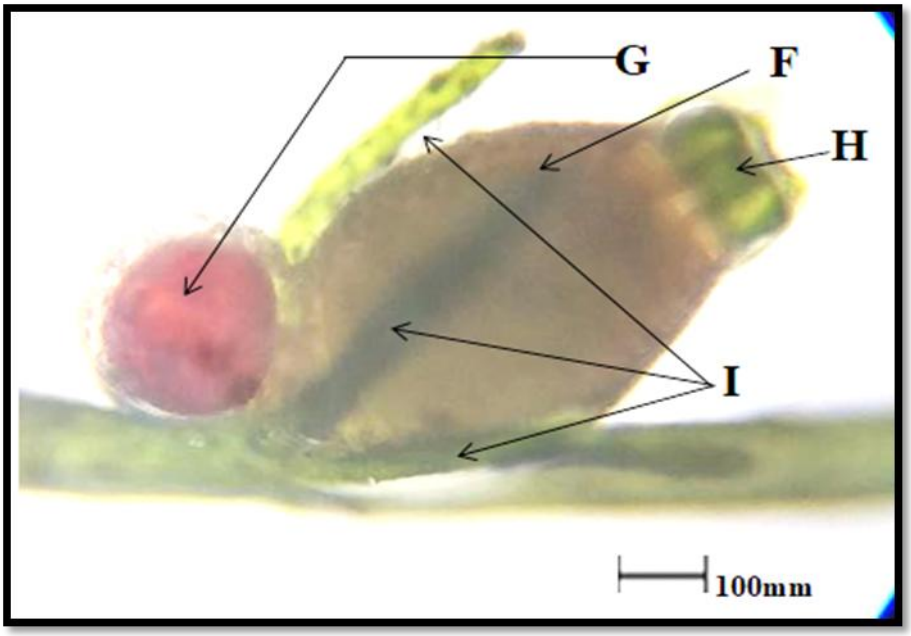

Figure 4. ***Chara contraria*** **Braun ex Kütz reproductive organs F: Oogonia (Nucule), G: Antheridia (Globule), H: Coronal cells, I: Bract cells**

The plant is monoecious. The female and male organs are located on the same plant, and in almost every node the reproductive organs are surrounded by short, cylindrical leaf structures called bract cells, numbering 4-5. The front is short and the back is clearly shorter than the oogonium. Oogonia oval, elongated, 645-975 mm long and 375-560 mm width, Figure

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(4F) surrounding by 5 elongated cells, spiral around from oogonia toward right to left, at their apices small cells form the little coronula or crown, corona 45–86 µm long, 95–142 µm wide, oospores upon ripeness dark brown with eight low ridges, hard, enlarged 570 µm long, 485 µm wide, membrane is granulate Antheridia Spherical in shape, small in size, orange in color, located at the bottom of the oogonia and are about 450-510 mm in diameter (Figure 4, G). It was found that this species is very similar to *C. vulgar* because it differs from it in that the cortical cells are bilateral and contain spine cells long and slender (Figure 5) and bracteols larger than mature oogonium.

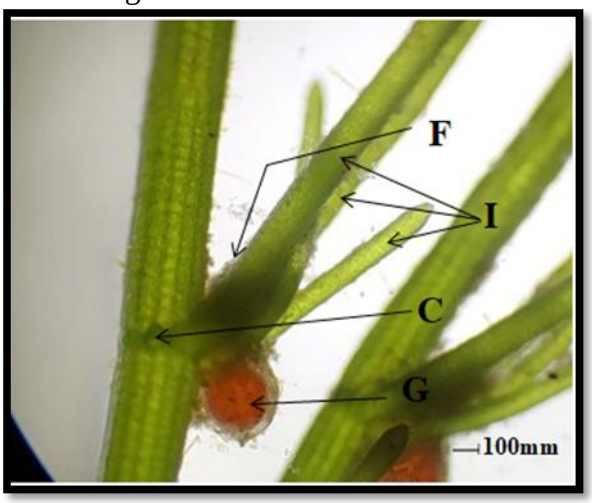

Figure 4. *Chara vulgaris* Linnaeus F: Oogonia (Nucule), G: Antheridia (Globule), D: Nod, I: Bract cells

CONCLUSION

This study recorded the alga *Chara contraria* for the first time in Iraq from the Al-Ishaqi irrigation project north of Baghdad. The physicochemical characteristics of the water indicated alkaline conditions with moderate mineral content and the presence of dissolved nutrients, which provide a suitable environment for the growth of this species. This finding contributes to expanding knowledge of freshwater algal diversity in Iraq and highlights the ecological importance of irrigation channels as habitats for charophyte algae.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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Iraqi Journal of Agricultural Sciences –2026:57(4):1319-1327
P-ISSN: 0075- 0530 /E-ISSN: 2410-0862
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الطحلب *CHARA CONTRARIA* BRAUN EX KÜTZ (1845) (CHARACEAE): تسجيل جديد في العراق

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المستخلص

هدفت الدراسة الحالية تسجيل ووصف طحلب *Chara contraria* لأول مرة في العراق، حيث جمع هذا الطحلب في مشروع الاسحاقي الاروائي وفروعه الصغيرة المبطنة بالاسمنت شمال بغداد ضمن محافظة صلاح الدين قرية الشيخ جميل، لسنة 2023–2024 خلال فصل الشتاء. واستخدمت الطريقة الاستكشافية لاجل الحصول على هذا الطحلب حيث وضع الطحلب في قناني بلاستيكية معقمة وحفظ في محلول الفورمالين واستخرج ووضع على ورقة بيضاء وقيس طول الطحلب وعدت الافرع بمساعدة كاميرا رقمية وقيست بعض التغيرات الفيزيوكيميائية على عينات الماء. أظهرت نتائج الفحوصات ان مياه المشروع الذي تنمو فيه الطحالب قاعدية بمعدل رقم هيدروجيني 8.05 واجمالي المواد الذائبة 189 ملغم/لتر وتوصيلية كهربائية 351.5 مايكروسيمنز/ سم في حين سجلت العسرة الكلية 140 شملت على تراكيز مرتفعة للكالسيوم 40 ملغم/لتر مقارنة بتركيز المغنسيوم 9.7 ملغم/لتر في حين سجلت المغذيات سجلت المغذيات قيماً مرتفعة تراوحت بين (0.010–0.087) ملغم/لتر، (0.010–0.087)، ملغم/ لتر، (0.227–1.450) ملغم/ لتر و(0.02–6.30) ملغم/لتر لكل من الفوسفات الذائبة والكبريتات النترات والسيلكا على التوالي.

الكلمات المفتاحية: كارا، كاروفيت، الاسحاقي الاروائي، العراق، محافظة صلاح الدين، العوامل الفيزيائية والكيميائية.

***جزء من رسالة ماجستير للباحث الاول.**