Microalga of genus *Chara* (class Charophyceae) in area of Universitas Indonesia, Depok: An effort of in situ and ex situ conservation

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**Abstract.** Exploration of *Chara* microalgae has been carried out in the waters of Universitas Indonesia, Depok. The area of Universitas Indonesia has body of water consisting of several small lakes and water springs. The research aims to determine the existence of *Chara* and is anywhere in the waters of Universitas Indonesia. The method used was purposive random sampling by exploring all bodies explored (6 situ and 1 spring) and carried out 2 times. *Chara* was not found in all small ponds (*situ*) at Universitas Indonesia. The only place where that microalgae can be found is in a stagnant water spring located to the northwest of the FMIPA UI building commonly called *Lab. Alam* (Nature Laboratory). Descriptions of *Chara* found in the Nature Laboratory are as follows. *Chara* found is a Monoecious organism. The height of *Chara* thallus is between 10 to 50 cm. The axis is 400–500 mm in diameter and 10–30 mm long, quite encrusted, gray to dark green. Oogonia size (nucule) up to 0.5 mm long, 0.35 mm wide, while antheridia (globule) up to a diameter of 300 μm. Furthermore, a deeper identification must be done. The identification and culturing of the *Chara* UI strain is still being processed. Meanwhile, efforts to settle outside the habitat (ex situ) have not been successful.

**Keywords:** Microalgae, *Chara*, identification, culturing, ex situ conservation

1. Introduction

*Chara* is a microscopic algae (microalgae) that is classified into the class of Charophyceae or even classified as its own division, namely Charophyta. According to Bold et al. Charophyta is an algae division, separated from the Chlorophyta division, because it has different vegetative and reproductive organisms [1]. Meanwhile, the classification became one of the classes of Chlorophyta (Chlorophyceae) based on chlorophyll a and b, and chloroplasts of double membranes it possessed as in Chlorophyta [2]. Some members of Charophyceae are often also referred to as “giant algae” because they are microscopic algae but have thallus parts similar to tall plants, so they often appear macroscopic. Class members are thought to be ancestral plant-based organisms, because they have a lot in common with terrestrial plants, especially in the double membrane character in their chloroplasts as in plants [2]. Their habitat is distributed in fresh water and some live in brackish waters. These algae often grow in sandy or muddy waters, submerged in rhizoid. Nevertheless, very few findings observed from the lake [3].

Many Charophyceae members are listed as extinct species or endangered species. Therefore, to save the microalgae many countries around the world have tried to do ex situ conservation. For example, in...
Japan some Charophyceae species have been collected as endangered Charophytes, among others *Nitella furcata* var. *fallosa* (extinct species), *Nitellopsis obtusa* (extinct in nature), *Lamprothamnium succinctum*, *Chara braunii*, *Chara globularis*, *Chara coralina*, *Nitella flexilis*, *Nitella frucata*, *Nitella gracilens*, and *Nitella hyaline* (NIES, press comm.).

Reproduction of Charophyceae can occur vegetatively and sexually [1, 2]. Vegetative reproduction is carried out by tubers, starch and secondary protonema. Meanwhile, the fructifications for sexual reproduction are nucule or archegonium (female) and globule or antheridium (male). The sex organs can be used as characters to identify the members of Charophyceae quickly.

The waters in the Universitas Indonesia are mostly small lakes. There are 6 small lakes on the Universitas Indonesia Campus and all of them are artificial. The names of these small lakes are Situ Kenanga, Situ Agathis, Situ Mahoni, Situ Puspa, Situ Ulin, and Situ Salam [4] (figure 1a). Before being developed into small lakes, the campus area of Universitas Indonesia is shallow and narrow valley, with a small river that has a water discharge between 0.25–0.5 m³/sec in the middle. The small lakes development aims to increase the number of places located in the southern part of DKI Jakarta, as a means of raw water reservoirs, recreation, water sports, hydrological balance support, and aquatic study facilities [5]. In addition to the six small lakes in the Universitas Indonesia, there are several puddles that one of them is a water spring. Among them, there is a water spring that located in the northwest of FMIPA UI. These springs are often referred to as Nature laboratory (Laboratorium Alam) (figure 1b and figure 1c). The water spring is separated from the ones located in UI, however, during a continuously rainy season then the waters from nearby Situ Agathis often found overflowed to the Lab. Alam.

![Figure 1](image-url)

**Figure 1.** Location of Nature Laboratory FMIPA UI, (a) Satellite image of UI campus area with 6 small lakes (Situ), (b) Location of Nature Laboratory and (c) Photograph of Nature Laboratory.
There are two kinds of conservation in the preservation of organisms. In situ conservation is the conservation of organisms in their natural habitat and is considered the most appropriate way to conserve biodiversity. Meanwhile, ex situ conservation is the preservation of biodiversity components outside their natural habitat. In order to support the preservation of Chara as a rare microalga, conservation efforts in the original habitat (in situ) and outside the original habitat (ex situ) need to be carried out.

This research was conducted to explore the existence of Chara microalgae in the waters of the Universitas Indonesia, Depok. This study is an effort to provide information on the Indonesian indigenous microalgae, and part of the exploration and conservation efforts in Indonesia, especially convenient for extinct microalgae.

2. Methodology
This research is a descriptive study. Exploration was carried out by examining each of the waters at the Universitas Indonesia. Samples were taken using equipment commonly used in algal sampling that grows on the ground in water or on the water's edge, including small shovels, spatulas or spoons, scissors, cutters, dipper, large tweezers, large pipettes (25 mL), sample bottles with various sizes, and zip lock plastic bags with various sizes. The research locations were at all UI waters consisting of 6 small lakes (situ) (Kenanga, Agathis, Mahoni, Puspa, Ulin, and Salam) and other water puddles, such as water puddle which is a water spring located in the northwest of FMIPA UI (Nature Laboratory).

Chara samples taken with purposive random sampling. The purposive sample is a non-probability sample selected based on the characteristics of the population, habitat, and research objectives. Purposive sampling is also known as judgmental, selective, or subjective sampling based on the environmental conditions of the sampling location.

Samples suspected of being Chara were taken using equipment as mentioned above. Samples were taken with a small hook, spoon, or small shovel. The sample taken consists of samples suspected of being Chara with a small amount of water from their natural habitat. Samples were inserted into zip lock plastic without preserving. Plastics were labeled with the identity of the sample number, location of collection, time of collection, and weather conditions during sampling. Upon arrival in the laboratory, samples were immediately photographed using a camera microscope, and identified using the book of [1, 6, 7].

3. Results and discussion
3.1. Observations of microalgae Chara in the waters of Universitas Indonesia
Among the six (6) small lakes and one water spring in the Universitas Indonesia area of Depok that were observed, Chara was only found in a water spring near FMIPA UI called Nature Laboratory (figure 1). Chara found in the waters of the Nature Lab. were thrived. The waters of Nature Laboratory are puddles of water which seem to be still clean from the influence of pollution in the vicinity. The waters are also thought to have not been eutrophied. In addition, the dominance of one of the microalgae such as cyanobacteria that often arises when a water is eutrophied is not found in these waters. Together with Chara, the composition of other microalgae is diverse in the waters of Nature Laboratory. Chara is known to be vulnerable to environmental changes, so Chara is often found in waters that are still clean and free of pollutants. Chara can be used as a simple and inexpensive additional tool to determine suitable habitats for the introduction of crayfish in closed waters protected from species and exotic invasive diseases [8]. Visualization of Chara found in the waters of Nature Laboratory can be seen in figure 2.

3.2. Description of the Chara strain from Nature Laboratory Universitas Indonesia
Chara found in the Nature Laboratory UI has the following characteristics. The main axis is corticalised or not corticulated. Stipulodes (secondary lateral), present, regular and prominent. The size of the
organism ranges from 10 to 50 cm high, axes to 400–500 μm in diameter and 10–30 mm long, moderately to heavily encrusted, often gray to dark green in color (figure 2a and figure 2b). The sex organs appear in the primary growth limited or lateral branches, nucule above the globule (figure 2c). The position of the nucule above the globule is characteristic of the genus *Chara* [1]. Globule is a large, round, red or yellow structure (A; figure 2c). The size of oogonium (nucule) is up to 0.5 mm long, 0.35 mm wide, while the antheridium (globule) is up to 300 μm in diameter (B; figure 2c). In nucule, cells oogonial or corona crowns are in single tier/row/line (C; figure 2c). *Chara* found is a Monoecious organism (figure 2c). Until now the species of *Chara* is still unknown. The identification process is still underway.

3.3. In situ and ex situ efforts for *Chara* found at Universitas Indonesia

As a conservation effort outside its habitat (ex situ), attempts to culture the *Chara* is being tried in the Algae culture room of the Department of Biology FMIPA UI. Nevertheless, the growth of the *Chara* culture in the algae culture room was not maximal yet. This is probably caused by the lack of standard algae culture room in the Biology Department of FMIPA UI for the culture of *Chara* microalgae. Meanwhile, the *Chara* UI strain was entrusted to be maintained in another laboratory (Microbial Culture Collection, National Institute for Environmental Studies, Tsukuba, Japan) (figure 3).

In addition to ex situ conservation, *Chara* should also be preserved in its natural habitat and examined in its original environmental conditions. Data about the condition of the organism in its natural environment can facilitate identification and culture. In connection with the things mentioned above, more detailed research on *Chara* contained in the Nature Laboratory will be carried out. This will include the ecology and physiology of the *Chara* in its natural habitat and in culture.

![Figure 2. Chara strain from Nature Laboratory FMIPA UI (UI strain), (a) Macrosopic visualization of Chara strain, (b) Thallus of Chara strain, and (c) Position of nucule above globule. A: Globule, B: Nucule; C: Single tier of corona crowns in nucule (red arrow).](image-url)
Figure 3. The culture of *Chara* strain UI stored at NIES, Japan; (a) *Chara* strain in culturing and (b) Culture room for members of Charopyceaean.

4. Conclusion

From the research results that were obtained it can be concluded that in the waters of the Universitas Indonesia, *Chara* microalgae can only be found in the Nature Laboratory (Lab. Alam) located in the Northwest FMIPA UI. In order to continue the identification process requires good culturing and maintenance of *Chara* in its natural habitat, therefore the location of the Nature Laboratory near FMIPA UI should be preserved.

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