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Submission date: 20-Sep-2022 12:30PM (UTC+0700)
Submission ID: 1904312573
File name: 31_2018.pdf (211.37K)
Word count: 2532
Character count: 13650

International Journal of
Science and Engineering Investigations
vol. 7, issue 79, August 2018
ISSN: 2251-8843

The Dalugha (Cyrtosperma Merkusii (Hassk) Schott) Adaptation to Open and Shaded Light Conditions on the Nitu Island, Tatoareng District, Sangihe Regency

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Abstract-This article describes the adaptation of the Dalugha plant on Nitu Island, Tatoareng District, Sangihe District which grows in open light, open-shaded, and shaded conditions. This study relates to the development of Dalugha plants as an alternative food crop seen from its adaptation to open and shaded conditions which is indicated by the content of chlorophyll in the leaves. This study aims to analyze differences in chlorophyll content in conditions of open-growing, open-shaded, and shaded areas. The method used is an observational method where the response of plants is observed in a range of conditions held by nature. Chlorophyll content was observed using absorban measurement method for plant leaf extract using a spectrophotometer. The results showed that the chlorophyll content in the leaves of the Dalugha plant that grew in open light conditions was lower than in the open-shaded conditions and sheltered conditions.

Keywords- *Dalugha, Chlorophyll, Sangihe Regen*

I. INTRODUCTION

Giant swamp taro (Cyrtosperma merkusii (Hassk.) Schott) is the only species in the Cyrtosperma genus that is edible [1], both tubers and leaves [2]. The local name for the crop in Sangihe regency for the giant swamp taro (Cyrtosperma merkusii (Hassk.) Is Dalugha. Other names are C. edule, C. chamissonis, and C. lasoides, [3]. It belongs to the Family Araceae and thought to be a native Indonesian that has spread in the Philippines, Papua New Guinea, and several islands in the Pacific Islands [4], can live on wetlands that are inundated or saturated with water throughout the day can live on wetlands (wetland) which is inundated or saturated throughout the day or temporarily with salinity ranging from 0.59 to 1.991 ppt and the pH of the inundation water ranges from 6.9 to 9.8 [5]. Habitat which is the focus of this research is wetlands classified in swamp habitats located in coastal areas and the habitat of Dalugha plants (Cyrtosperma merkusii (Hassk.) Schott) on Nitu Island, Tatoareng District, Sangihe Islands Regency. The extent of wetlands in the world has been reduced by more than half the area of wetlands that exist because of the increasing threat to their existence which has increased [6]. Information about wetlands, including physical and biological components is interesting because it is still under-investigated [7], [8].

The existence of Dalugha on Sangihe Island was reported by van Dinteren 1899 and Vorderman in 1899 [9]. This plant has become one of the important food crops for people in the Sangihe Islands and its surroundings. Dalugha tubers can be used as flour as a base or additional material for making various kinds of cakes [5].

Dalugha in wetlands in coastal areas has the potential to be developed in conjunction with efforts to increase food availability and anticipate the effects of climate change, especially sea level rise. Dalugha usually grows in wetlands, is salinity-tolerant, tolerant to shade, and is tolerant of low-nutrient soils [10]

Dalugha development requires information about the adaptation of this plant under growing conditions with open and shaded light conditions. One indicator that is related to adaptation to light is chlorophyll content.

Between one type and another type has a different response to different growing conditions. Adaptation of each type of plant to a growing place can produce growth and yield of different plants. Certain plants will show better growth and yield if grown in shaded conditions rather than open places, and vice versa. This is because the ability of plants to adapt to the environment is determined by the genetic properties of plants [11].

Dalugha's biological characteristics related to its adaptation to the complexity of habitat variation in swamp ecosystems are still less researched. The results of this study can be a reference for other researchers about the adaptation of Dalugha to various growing conditions related to the cultivation and conservation efforts of these plants.

II. RESEARCH METHODS

The study was conducted on Dalugha swamp habitat that exists in the Nitu Island in Tatoareng District, Sangihe Regency, part of Sulawesi Island (Figure 1).

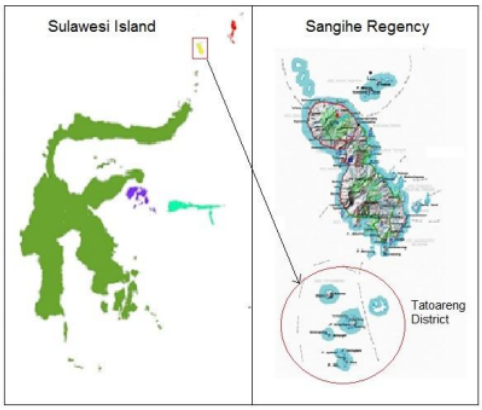

Figure 1. Research location in Tatoareng District, Sangihe Regency

The ingredients used, namely Dalugha plant leaves, 80% acetone. The tools used are machetes, scissors, cutter blades, plastic containers, markers, labels, digital scales, Biochrom Libra S12 spectrophotometers, mortars, erlenmeyers, measuring cups, glass cups, pipettes, tissue paper, and Whatman 42 filter paper.

The study used an observational approach method in which the response of an organism was observed in a range of conditions held by nature [12. Leaf samples obtained from Dalugha plants that grow on three conditions that are chosen intentionally, namely: 1. Open 2. Partially open, partially shaded, and 3. Shaded.

The steps taken for leaf sampling are:

1. Taking a sample of adult leaves based on three conditions on which plants grow, each location is taken from eight individual plants.
2. Enter the sample of leaves in a plastic container and give a sample code label.
3. Store leaf samples in a cooler bag.
4. Bring to the laboratory for analysis of chlorophyll content.

Activities to analyze the chlorophyll content in the laboratory are carried out by the following steps:

1. Samples of fresh leaves without leaf bones were cut into small pieces, taken as a composite as much as 1 gram then put into a mortar. The leaf pieces are crushed using mortar until smooth or paste-shaped.
2. Add enough 80% acetone until the tissue becomes homogeneous and then stirred, then put into a measuring flask using a funnel coated with filter paper.
3. Add 80% acetone to a measuring flask to reach 50 ml.
4. For dilution, the chlorophyll extract in a volumetric flask was taken as much as 1.0 ml and transferred to a 10 ml measuring flask and added 80% acetone until the volume reached 10 ml.5.
5. The diluted chlorophyll extract measured the absorbance using a spectrophotometer with a wavelength of 645 nm and 663 nm. Determination of chlorophyll levels of a and b using the calculation method [13], namely:

Chlorophyll a = (0.0127 D663 - 0.00269 D645)

Chlorophyll b = (0.0229 D645 - 0.00468 D663)

Total chlorophyll = chlorophyll a + chlorophyll b

For the amount of chlorophyll per weight of fresh leaves is calculated by the equation:

Chlorophyll a = (0.0127 D663 - 0.00269 D645) x 1 / ws x vs / 1000 x FP

Chlorophyll b = (0.0229 D645 - 0.00468 D663) x 1 / ws x vs / 1000 x FP

where: D 663 = absorbance at λ 663 nm

D 645 = absorbance at λ 645 nm

vs = sample volume (ml) = 50 ml

ws = sample weight (g) = 1 g

FP = dilution factor = 10 x.

Each individual plant leaves used as chlorophyll measurement samples were taken three samples (3 replications) measuring 5 x 5 cm. All three samples were taken at the bottom of leaf, middle and leaf tips. Observation variables consisted of: 1. Chlorophyll a, 2. Chlorophyll b, and 3. Total chlorophyll was based on three conditions in which the Dalugha plant grew, namely open light, partially exposed and partially shaded, and shaded. Data were analyzed using Variance Analysis. If the results of the analysis show a real difference then proceed with the Least Significance Difference Test (LSD 5%).

III. RESULTS AND DISCUSSION

A. *The content of Chlorophyll a*

Chlorophyll a contained in the leaves of Dalugha which grow three different light conditions indicate a difference. Table 1 shows that the chlorophyll a content obtained from the leaves of the Dalugha plant which grows in open conditions is lower than in the open-shaded and sheltered condition.

TABLE I. CONTENT OF CHLOROPHYLL A

Where to Grow	Average Chlorophyll a (mg / l)	Notation *
Open	2.525	a
Shrouded	2.931	b
Insulated	2.941	b

Description * Numbers followed by the same letter indicate no significant difference (LSD 5% = 0.276)

B. *Content Chlorophyll b*

Chlorophyll b contained in Dalugha leaves that grows in three growing conditions indicates a difference. Table 2 shows that the chlorophyll b content obtained from the leaves of the Dalugha plant which grows in open conditions is lower than the open-shaded and sheltered condition.

TABLE II. CONTENT OF CHLOROPHYLL B

Where to Grow	Chlorophyll Average b (mg / l)	Notation *
Open	1.354	a
Shrouded	1.778	b
Insulated	1.805	b

Description * The numbers followed by the same letter show no significant difference (LSD 5% = 0.383)

C. *Content Total Chlorophyll*

Total chlorophyll is the sum of chlorophyll a and chlorophyll b. Table 3 shows that the lowest total chlorophyll content was obtained from the leaves of the Dalugha plant which grew in open conditions.

TABLE III. CONTENT OF CHLOROPHYLL TOTAL

Where to Grow	Chlorophyll Average b (mg / l)	Notation *
Open	4.153	a
Shrouded	4.709	b
Insulated	4.746	b

Description * The numbers followed by the same letter show not significantly different (LSD 5% = 0.383)

Results obtained showed the adaptation of Dalugha in three different light conditions, the lowest chlorophyll a, chlorophyll b, and total chlorophyll content produced from Dalugha leaves which grew in open light conditions compared to open-shaded conditions and sheltered conditions. In the shade conditions the chlorophyll content of a and b increases. And the changes in the characteristics of the leaves in shaded conditions are the leaves being wide and thin [14]. Each type of plant has adaptations to different growing conditions. In shaded conditions, the growth and yield of certain plants will show better growth and yield if grown in shaded conditions rather than open spaces. This is because the ability of plants to adapt to the environment is determined by the genetic properties of plants [11].

Based on the results of this study, Dalugha is a plant that is able to adapt and grow well in shaded conditions. Plant growth in shade conditions means that the light intensity received by the leaves is low [15] causing photosynthesis and carbohydrate synthesis to decrease [16]. To increase the photosynthesis rate and carbohydrate synthesis in conditions of low light intensity, the leaves of Dalugha plants become wider and there is an increase in the content of chlorophyll a and b so that the light captured and transferred to the photosynthetic reaction center is increasing. States that chlorophyll b functions to capture and collect light to be transferred and used in the reaction center [17]. The reaction center occurs in chlorophyll a where light energy is converted into chemical energy used in photosynthesis. The increase of chlorophyll b is related to the increase of chlorophyll protein so as to increase the efficiency of photosynthetic antennas [18]. Furthermore, it is said that the plants adjust to low light conditions characterized by enlarged antennas for photosystem II. The enlargement of the antenna for photosystem II will increase light harvesting. Increased chlorophyll a and b in taro plants (Colocasia esculenta) is the ability of these plants to grow under low light conditions [19]. Increased chlorophyll a and b is one form of plant tolerance mechanism to shade [20].

IV. CONCLUSION

Adaptation of Dalugha plants, which can be seen from the differences in chlorophyll content in various growing places, indicates that the open conditions affect the chlorophyll a, chlorophyll b, and total chlorophyll content. Chlorophyll content in open conditions is lower compared to open-shaded conditions and sheltered conditions.

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