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Status of Caulerpa J. V. Lamouroux (1809) (Chlorophyta: Bryopsidales) in Sulangan, Guiuan, Eastern Samar, Central Philippines

Ma. Natalia A. Ciasico

Department of Biological Sciences, Eastern Samar State University, Borongan City, Philippines
Email: natciasico@yahoo.com

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Abstract

A descriptive survey was conducted in Sulangan, Guiuan, Eastern Samar to describe the status of Caulerpa as the potential for aquaculture. Identification of species with natural populations, species with massive natural populations and the edible species favoured by the local residents were the specific objectives of this study. The observed massive population with 85% cover in 100 sqm was a combination of the nine Caulerpa species, which are *C. racemosa*, *C. lentillifera*, *C. chemnitzia* var. *peltata*, *C. cylindracea*, *C. brachypus*, *C. macrophysa*, *C. microphysa*, *C. serrulata* and *C. sertularioides.* The majority, 98%, was composed of *C. racemosa* and *C. lentillifera*, while other species were observed in one to two feet of stolon length underneath the two species. *C. racemosa* and *C. lentillifera* were identified as the most locally consumed species by 100% of the respondents, but *C. lentillifera* was most preferred by 98% due to its thinner ramuli over *C. racemosa*. Results revealed that Sulangan is a potential area for Caulerpa aquaculture with reference to the specific location and specifically to *C. racemosa* and *C. lentillifera*. Preliminary trials on Caulerpa aquaculture can be initially introduced; however, seasonality should be validated.

Keywords

Caulerpa Species, Caulerpa Aquaculture, Guiuan, Eastern Samar

1. Introduction

The distribution of Caulerpa species in Philippines has been reported by several scientists. Six species were reported from the Eastern Islands of Guiuan [1], two species in Coron, Northern Palawan [2], 15 in Northern Philippines [3], eight

species in Solong-on, Siquijor [4], two species in Cagayan [5], and 20 taxa in Central Visayas [6]. Three species, namely *Caulerpa brachypus*, *Caulerpa serrulata*, *Caulerpa racemosa*, were recorded from Matarinao Bay and Guiuan of the Leyte Gulf [7], but not specific to Sulangan in the Calicoan Island of Guiuan, Eastern Samar.

Caulerpa species, locally known as "*lato*", is one of the common edible macroalgae. The seaweed is nutritious and contains substances potential for bioactive and medical applications [8] [9] [10]. The green seaweed is found in sandy-coralline-rubbles to sandy-muddy substrate, and from shallow intertidal to subtidal areas [2] [11] [12]. For a time, in Eastern Samar, similar to other coastal regions in the country, harvesting of *Caulerpa* remains a crop that has a specific niche in the market as a subsistence commodity in coastal communities [13] [14] [15]. Species like *C. lentillifera* have been recommended as a functional food item for the human diet [16] [17]. Other species are currently farmed in Tawi-Tawi, Philippines [14], Nangaramoan of Cagayan [5], Bohol [18], and Cebu [15] [19] [20] and the Indo-Pacific [17]. The three widely consumed species in Southeast Asia are *C. racemosa* var. *clavifera f. macrophysa* (Kützing) Weber-van Bosse, *C. racemosa* var. *laetevirens* (Montagne) Weber-van Bosse, and *C. lentillifera* J. Agardh [21].

With the existing market, several aquaculture studies have been conducted by various research institutions and individuals [22] [23] [24]. However, there is no aquaculture venture of Caulerpa in the area at present, despite its health benefits and market potential in the pharmaceutical industry. Hence, the source of stocks sold in the market is collected from the natural populations in the area. Generally, this study aimed to determine the potential of Caulerpa aquaculture in the area, with reference to the species with massive populations in the natural environment. Specifically, the study identified the species of Caulerpa based on morphological characters in terms of fronds and/or ramuli, the species with a massive population in terms of percent cover, and the most commonly consumed species. The results of the study were delimited to the observations from May to June 2022.

2. Materials and Methods

Sampling site, collection and morphological identification of samples. The area is on Calicoan Island on the eastern side of the Leyte Gulf. Guided by the Caulerpa collectors in the area, the Caulerpa site is located at 10˚58'31"N, 125˚48'03"E. The water depth is 1 to 3 meters, with 12 meters horizontal visibility, salinity of 35 ppt, exposed to waves and strong current, and no adjacent tributaries. Caulerpa was associated with the Halimeda species in a coral reef with rubbles and sand as the major compositions of the substrate.

The percent cover was measured in a 10 × 10 sqm quadrat. Samples were collected by hand through free diving, observing extra care to include the stolon [1]. Sand and other debris were cleaned from the samples before it was stored in

a container with seawater from the site. Identification of species was based on the morphological characters [2] [13] [14] [25] [26] [27] [28]. A random interview on the favoured species for diet and the reason for its specific preference was conducted with 50 individuals.

3. Results and Discussion

The Caulerpa community covers 85% of the 100 sqm Caulerpa site. The observed species displayed six variations of fronds, which revealed nine Caulerpa species. The list of species, as described with the type of fronds/ramuli, is presented in Table 1. The majority, 98% of the community was composed of the combined *Caulerpa racemosa* and *Caulerpa lentillifera* species. Other species were observed in one to two feet of stolon length growing underneath the two species.

C. racemosa and *C. lentillifera* were identified as the most locally consumed species by 100% of the respondents, but *C. lentillifera* was most preferred by 98% due to its thinner ramuli over *C. racemosa*.

The substrate, water parameters and other biological associations in the area support the massive population of Caulerpa. The natural habitat of this green seaweed is found in sandy-coralline-rubbles to sandy-muddy substrate, and from shallow intertidal to subtidal areas [2] [11] [12]. Distribution of Caulerpa species is attributed to the water parameters [29], specifically on salinity [30] [31]. Growth rate, biomass and productivity have a significant negative correlation with water temperature but a positive-significant correlation with salinity [32]. However, the levels of nitrate, phosphate and ammonia drive the distribution and growth of species [33]. Likewise, high species composition could be attributed to the depth. Patterns of diversity of macroalgae were observed to be different in shallow and deep assemblages, both in species composition and abundance of morphological groups. Deep assemblages have a greater number of species than shallow assemblages [34].

Table 1. The observed Caulerpa species in Sulangan, Guiuan, Eastern Samar.

	Caulerpa species	Type of fronds/ramuli	Reference
1	***C. sertularioides*** (S. G. Gmelin) M. A. Howe, 1905	Feather	[25] [28]
2	***C. peltata*** (*Synonym: C. chemnitzia* var. *peltata* J. V. Lamour.) Zanardini, 1858	Disc, peltate, fleshy,	[26] [27]
3	***C. racemosa*** (Forsskål) J. Agardh, 1873	Grape, vesiculate, radially crowded	[13] [25]
4	***C. cylindracea*** Sonder	Grape, spherical, complanate	[27]
5	***C. microphysa*** (Weber-van Bosse) Feldmann, 1955	Grape, globular, thin radially crowded	[25]
6	***C. macrophysa*** (Sonder ex Kützing) G. Murray, 1887	Grape, stout, vesiculate short fronds	[25]
7	***C. lentillifera*** J. Agardh, 1827	Grape, globose to turbinate, constricted at the base, radially crowded	[13] [25]
8	***C. brachypus*** Harvey, 1860	Flat	[25]
9	***C. serrulata*** (Forsskål) J. Agardh, 1837	Toothed	[25] [28]

The observed species in the area were common in Philippines except for *C. cylindracea.* Report on observations of *Caulerpa cylindracea* in Philippines is very limited to none. The species could be the first observation in the area. The species is a native of Australia and has spread its invasion to the Canary Islands [35], Great Barrier Reef [36] and the Mediterranean [37].

The locally consumed species *C. lentillifera* and *C. racemosa* are two of the widely consumed species in Southeast Asia [21], the world [17] and the common species locally sold in the local market of Tawi-Tawi, Philippines [14].

4. Conclusions and Recommendations

Sulangan, Guiuan, Eastern Samar is a potential area for Caulerpa aquaculture, specifically for *C. lentillifera* and *C. racemosa* species. Though the most preferred species for diet is *C. lentillifera*, both species are aquaculture potentials considering the local market for diet and for nutraceutical values in the pharmaceutical industry.

Preliminary trials on Caulerpa aquaculture can be initially introduced, though seasonality can likewise be verified. Validation and verification of species identification through molecular studies are highly recommended. The nutrient composition can likewise be studied to determine the variation of taste. Moreover, harvest and the introduction of species should be regulated to manage the resource.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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