CHEMICAL CHARACTERIZATION OF SEAWEEDS FROM BIRI, NORTHERN SAMAR, PHILIPPINES

ABSTRACT

This research was carried in an attempt to ascertain the phytochemical screening on selected seaweed species from different barangays in Biri, Northern Samar, Philippines using a descriptive research approach. It also aimed to identify specifically the seaweed species in the study area and determine the three most and least-frequently appearing species respectively, which were subjected to phytochemical screening and the determination of PF extracts and its physicochemical constituents as conducted in the period of six months, from November 2022 to April, 2023. Seaweed samples were collected, identified, and authenticated by an expert. Specimens were preserved in jars containing 10% formaldehyde and seawater in equal volumes. Fresh samples of the three most- AMD the three least-frequently appearing species were used for the screening procedures. Results revealed a total of 44 seaweed species present in selected barangays of Biri, Northern Samar. The most-frequently appearing species were *Ulva reticulata, Hormophysacuneiformis*, and *Turbinariaconoides*, while the least-frequently appearing species were *Hydropuntia edulis, Laurenciapapillosa*, and *Tricleocarpafragilis.*Chemical characterization of these species confirmed the presence of alkaloids, saponin, phenolic compounds, and anthraquinones, although not all of them contained these metabolites. Lipids and proteins were absent in all species tested. Meanwhile, the ash content of the samples wasrelatively high, implying that high amounts of minerals may be found in seaweeds. Thus, the researchers recommend the replication of this research in other areas of the province to document seaweed species and their potential applications in the functional food and nutraceutical industries. This will help develop natural products with economic or commercial significance to the residents. Likewise, more specific tests for lipids and proteins in seaweeds may be used in future investigations.

KEYWORDS: *chemical characterization, seaweeds, physicochemical activity, chemical constituents, Biri, Northern Samar*

1.0 INTRODUCTION

Seaweeds, or marine algae, are non-flowering, primitive photo-synthetic macrophytes found in tidal areas of the seas and oceans that make up 71% of the world's surface [Rao, *et al.*, 2018]. The main groups of seaweeds are brownalgae (*Phaeophyta*), redalgae (*Rhodophyta*), and green algae (*Chlorophyta*) according to work done by [MacArtain, *et al.*, 2007]. Moreover, seaweeds can be found worldwide but are restricted by light, nutrition, and a suitable substrate, [Muth& Congdon, 2019]. Furthermore, a number of seaweed species are edible, and many are also of commercial importance to humans [Britannica, 2022].

Meanwhile, the increasing global population and human activities have negatively impacted the natural environment that leads to shortage of bioresources for the growing population [Jagtap&Meena, 2022]. This has sparked an interest in finding novel foods that will meet the needs of a growing population and offer some health benefits [Granato, *et al.*, 2020, ascited by Peñalver, 2020). Moreover, seaweeds represent a huge resource for mankind, and as the demands grow for special drugs, nutraceuticals, cosmetic products, and functional foods, there is a strong momentum for the exploration of marine biological resources in general, and seaweeds in particular, for novel compounds with health benefits [Qin, 2018].Thus, recent increased interest in seaweed is motivated by attention generated in their bioactive components that have potential applications in the functional food and nutraceutical industries [Nazarudin, *et al.*, 2021].

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Therefore, this present study focuses on the phytochemical screening of selected species of seaweeds in Biri, Northern Samar, specifically, to determine the active chemical constituents of three (3) most-frequently appearing and three (3) least-frequently appearing seaweeds in terms of: alkaloids, anthraquinones, cardiac glycosides, phenolic compounds, and saponin. Furthermore, it will determine the physicochemical activities of the three (3) most-frequently appearing and least-frequently appearing seaweeds in terms of: lipids, proteins, and ash content. No such investigation has yet been done in Biri, Northern Samar, hence, this study.

2.0 LITERATURE REVIEW

Seaweeds are found along the shore as well as in the subtidal zone up to a depth where 0.01% of the available light for photosynthetic activity is present [Dhargalkar&Kavlekar, 2004]. The intertidal area is where green seaweeds are most frequently found. Species of *Ulva* (sea lettuce), *Enteromorpha* (green string lettuce), *Chaetomorpha*, *Codium*, and *Caulerpa* are common green seaweeds. Brown seaweeds live in the upper subtidal or tidal zone, are are frequently represented by species of *Sargassum, Laminaria, Turbinaria,* and *Dictyota.*Subtidal waters are where red seaweeds grow, such as species of *Gracilaria, Gelidiella, Eucheuma, Ceramium*, and *Acanthophora*[Rao, *et al.,* 2018].

Seaweed distribution and variety are influenced by a multitude of environmental factors, including plant pigments, light, exposure, depth, temperature, tides, and shore characteristics [Dhargalkar&Devanand, 2004].

Green algae (Division Chlorophyta), comprises between 9,000 and 12,000 species, and have photosynthetic pigments (carotene, chlorophylls *a* and *b,* and xanthophyll) in the same proportions as those in higher plants [Britannica, 2022]. Green algae are present in both freshwater and saltwater habitats, coming in a variety of microscopic to macroscopic, unicellular to multicellular forms [Dhargalkar&Kavlekar, 2004].

On the other hand, brown algae vary from dark brown to olive green, depending upon the proportion of brown pigment (fucoxanthin) to green pigment (chlorophyll) [Britannica, 2022]. Brown algae are exclusively marine forms, coming in a variety of shapes; from simple, freely branched filaments to highly differentiated forms. Many species have enormous, massive thalli that are buoyant due to unique air bladders, vesicles or floats [Dhargalkar&Kavlekar, 2004].Meanwhile, red algae (Division Rhodophyta), have their usual red color as a result of its red pigmentphycobilin. Phycobilins are bilins that absorb light and are present in cyanobacteria, red algae chloroplasts, glaucophytes, and certain cryptomonads. Those pigments responsible for this are masking of chlorophyll by phycobilin pigments (phycoerythrin and phycocyanin) [Britannica, 2022]. Red algae are entirely marine algae and inhabit intertidal to subtidal to deeper waters [Dhargalkar&Kavlekar, 2004].

The phytochemicals from marine algae are extensively used in various industries such as food, confectionery, textile, dairy, pharmaceutical, and paper, mostly as gelling, stabilizing, and thickening agents [Mohy El-Din & El-Ahwany, 2016]. Seaweeds are the richest source of proteins, lipids, carbohydrates, minerals, vitamins (A, B, C, and Niacin), and antioxidants. They also serve as low-calorie food and are valued as food supplements for people [Rao, *et al*., 2007].Generally, seaweeds are known to contain medicinally rich metabolites that include steroids, phenols, tannins, saponins, flavonoids, terpenoids, and glycosides, which have been extensively studied and used in the pharmaceutical industry [Nazarudin, et al., 2021].

Alkaloids are important chemical compounds that serve as a rich reservoir for drug discovery. In plants, alkaloids serve as protection from predators and regulate their growth [Chik, *et al.*, 2013 as cited by Heinrich, *et al.,* 2021). Several alkaloids isolated from natural herbs exhibit anti-proliferation, antibacterial, antiviral, insecticidal, and anti-metastatic effects on various types of cancers both *in vitro* and *in vivo* (Qiu, *et al.*, 2014]. Moreover, alkaloids are particularly well known for their therapeutic uses as anesthetic, cardio-protectant, and anti-inflammatory drugs [Kurek, 2018, Heinrich, *et al.*, 2021]. Further, various biologically active seaweed alkaloids may directly affect inflammatory mechanisms [Souza, *et al.,* 2020].

Anthraquinones are active components of many plant blends used as medicines and exhibit laxative, diuretic, estrogenic, and immuno-modulatory effects. Many of them possess antibacterial, anti-parasitic, insecticidal,

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fungicidal, and antiviral properties. They are also used as anticancer agents [Khan, 2019].

One of the fundamental secondary biochemicals formed from plant metabolism are glycosides and glycosidic residues, which have a wide range of therapeutic benefits for conditions like cancer, inflammation, gastrointestinal disorders, and cardiovascular problems [Gangasani, *et al.*, 2022].

The most detectable secondary metabolite in plants are phenolics (Lin, *et al.*, 2016), which contain antioxidant, structural, attractant, signaling, and protective properties in addition to playing a significant role in regulating growth (Babenko, *et al.*, 2019). Due to their therapeutic potential, phenolic phytochemicals have attracted attention, especially for their anti-cancer, anti-inflammatory, hypolipidemic, and hypoglycemic activities [Alu'datt, *et al.*, 2017].

The anti-inflammatory, anti-fungal, antibacterial, anti-parasitic, anti-cancer, and antiviral characteristics of saponins make them useful in medicine reviewed by [Sparg, *et al.*, 2004, Podolak, *et al.*, 2020] as cited by Mugford & Osbourn, 2012). Saponins have surfactant properties vital in the beverage and cosmetics industries. Furthermore, some saponins are used as flavorings due to their intense sweetness or bitterness (Hostettmann& Marston, 1995 as cited by Mugford & Osbourn, 2012).

Seaweeds are used as human food, animal fodder, chicken (birds) and aqua (fishes) feed, manure, and liquid seaweed fertilizer for crops, besides their uses as phytochemicals (agar, agarose, alginate, and carrageenan). They also serve as medicines and antioxidants (Rao, *et al.,* 2009).

Furthermore, typical nutritional analyses of seaweeds have identified high levels of carbohydrates as well as minerals, vitamins, and trace elements, such as iodine (Morrissey, Kraan, & Guiry, 2001 as cited by MacArtain, *et al.,* 2007). Moreover, seaweeds contain up to 2% of dry weight of lipids, much of which is made up of polyunsaturated fatty acids (Sanchez-Machado, *et al.*, 2004 as cited by MacArtain, *et al.*, 2007). In addition, seaweeds contain many essential fatty acids, which may add to their efficacy as a dietary supplement or as part of a balanced diet (Dembitsky, *et al*., 2003, as cited by Rao, *et al.*, 2018).

On the other hand, some seaweeds, such as *Poryphyra spp.* (Nori) are relatively high in protein, which can be as high as 47% of the dry weight, but these levels vary according to the season and species (Rao, *et al.*, 2018). Meanwhile, red seaweeds contain a group of proteins called biliproteins, some of which are extracted for their valuable use as fluorescent markers (Whitehead & Hedges, 2005). Overall, reviews of seaweeds as sources of nutrients and proteins for dietary needs have been positive [Wong & Cheung, 2000, as cited by Rao, *et al.*, 2018].

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The nutritional quality of algae, due to its high content of protein, minerals, vitamins, dietary fiber, fatty acids, polysaccharides, and bioactive molecules with wide therapeutic potential, could further contribute to the improvement of the quality of human life and the increase of a balanced diet if consumed regularly. Different beneficial effects, such as anticancer, antiviral, anticoagulant, hypo-cholesterolemic, and antioxidant have been demonstrated. In addition, algae have characteristic technological properties, which allows their incorporation in dairy, fish, meat, and pasta products, among others, maintaining or improving its sensory, nutritional, and healthy quality [Peñalver, 2020].

Local studies on seaweeds show a diversity of species found in the island and coastal areas of Northern Samar. Abobo (2018) has cited the work ofDela Rosa and Calumpiano [2003] which revealed that Northern Samar is rich in seaweed resources. In his study of macrophytes in Palapag, Northern Samar, Abobo (2018) also indicated a total of 31 seaweed species, with red algae being the most dominant (13 species), followed by brown algae (11 species), and green algae (7 species).

In thethree (3) selectedlocations,barangays of Mondragon, Northern Samar, ten (10) different species of seaweeds wereidenfiedaccording to [Guasis, 2016].

A study in Biri, Northern Samar revealed that *Ulva lactuca*Linn. is the most abundant seaweed, found in all sampling sites and in large quantity. There were 45 species of seaweeds belonging to 17 genera and 14 families, where Phaeophytes consisted 44.44% (20 species); Chlorophytes 37.78% (17 species) and Rhodophytes 17.78% (8 species). Barangay San Antonio, an island barangay, has the largest number of, and most abundant species found [Galenzoga, 2019].

Furthermore, an assessment of macroalgae diversity, abundance, and distribution was done in two (2) islands of Northern Samar: Biri and Dalupirit. About 86 macroalgal taxa were gathered and identified for both islands. In Biri Island, 57 taxa were found with 35 being unique to the island. Meanwhile, in Dalupirit Island, 51 taxa were identified with 29 being unique to the island. Rhodophyceae showed dominance both in Biri and Dalupirit Islands, having 46% and 43% respectively, followed by Chlorophyceae with 33% in Biri Island and 39% in Dalupirit Island. Lastly, Phaeophyceae comprised 19% of seaweeds for Biri Island, and 20% for Dalupirit Island. In both islands, Phaeophyceae and Chlorophyceae were the most abundant. *Padina japonica* was the most evenly distributed in Biri Island, whereas it was *Ulva reticulata* in Dalupirit Island (Baldia, *et al.*, 2017)

3.0 METHODOLOGY

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This is the modern scientific term used.

3.1 Locale of the Study

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Northern Samar is situated in the Eastern Visayas region. Its capital is the municipality of Catarman. It is bordered, clockwise from the North, by the Philippine Sea, Eastern Samar, Samar, Samar Sea, and San Bernardino Strait. The province is composed of 24 municipalities (Phil Atlas, 2022).

The island of Biri, a 5th class municipality, is located in its northernmost tip, facing the Pacific Ocean to the east, the famous San Bernardino Strait to the north, and to either Lavezares or San Jose, both Northern Samar's coastal towns. (Phil Atlas, 2020).

The municipality comprises of eight (8) barangays, four (4) of which are located in separate islands.

3.2 Climate of the Study Area

The aggregate land area of Biri is estimated to be 34 square kilometers characterized by scattered islands and islets, rolling hills, mountain ranges with coastlines shifting from sandy to rocky. The coastal lowlands are verdant coconut plantations with sporadic ricefields partly surrounded by mangroves. Its natural resources consist mainly of fish and other marine products. About ninety percent (90%) of the inhabitants belong to the low-income group; sixty percent (60%) of which comprises the small and subsistent fishermen and the thirty percent (30%) are small farmers and laborers; the remaining ten percent (10%) is considered the higher earners group comprising the government employees, landowners, and business groups (MPDC, 2010).

In the 2020 census, Biri has a population of 11,274. Meanwhile, this study will only focus on Barangays Progress, San Antonio, Pio del Pilar, San Pedro, and McArthur. According to the 2020 census, Barangay Progress has a total population of 892, San Antonio has 1,798, Pio Del Pilar has 991, San Pedro has 1,173, and McArthur has 547 total population (Phil Atlas, 2020).

Barangay Progress, about 1.2 kilometers from the town center, is where the famous Biri rock formations lie. The inhabitants are engaged in rice farming, fishing, root crops, and coconut production (MPDC, 2010).

On the other hand, Barangay Pio Del Pilar is located in a separate island, about 2.5 kilometers from the town center, with only a small parcel of land. Farming and fishing are the two major occupations of the residents (MPDC, 2010).

Meanwhile, Barangay McArthur is also located in a separate island. Majority of the inhabitants are engaged in fishing while some are engaged in farming. This sampling site has abundant mangroves and with sandy and muddy areas. (MPDC, 2010).

Barangay San Pedro, on the other hand, is an island which lies on the eastern portion of the municipality, from which it is separated by the Hinablanan Channel and is almost 12 km from the center of the local government of Biri. The sampling site can be described as rocky with vast number of mangroves (MPDC, 2010).

Lastly, Barangay San Antonio is also located in a separate island, whose early settlers came from Eastern Samar to look for livelihood opportunities. The abundant natural resources in the area, such as fish, seashells, and other seafood made these people reside permanently, and residents are engaged in farming and fishing. This sampling site is sandy and with vast seagrass beds (MPDC, 2010).

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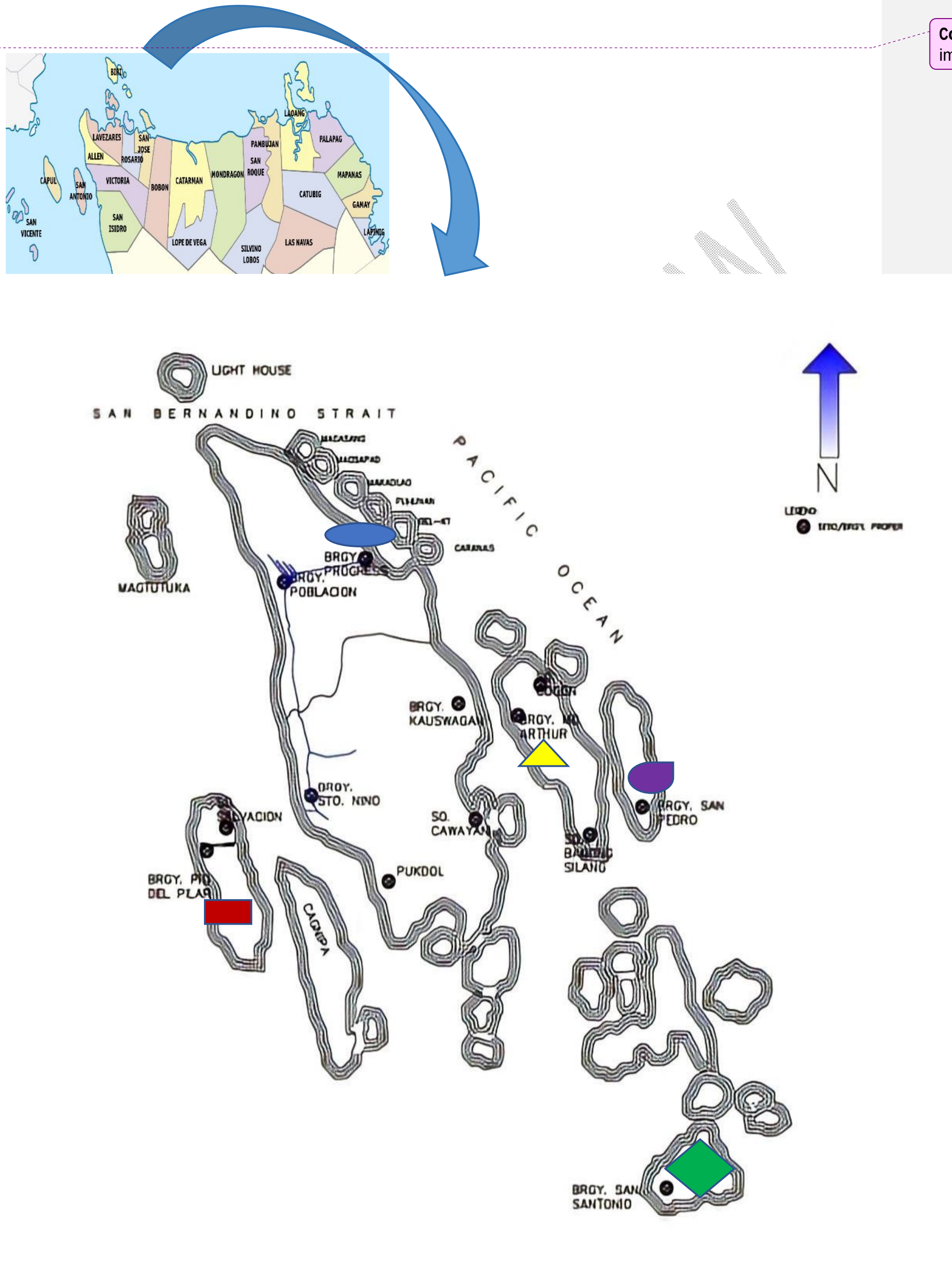

Figure 1. Map of the Municipality of Biri, Northern Samar, with

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sampling sites highlighted in color

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3.3 Research Design

This study utilized the descriptive method of research for the identification of seaweed species and experimental research for the phytochemical screening and determination of physicochemical activities.

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3.4 Sampling Technique

Purposive sampling was applied in the collection of seaweed species of seaweeds utilized for the phytochemical analyses.

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Present your sampling technique in a scientific way.

3.5 Data Gathering Procedure

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The researchers asked permission from the municipal mayor and the barangay captain of each sampling site to conduct the study in their area. The researchers went to each barangay for 2 weekends to collect seaweeds, and each was tallied to determine the three most and three least frequently appearing seaweeds.

3.5.1 Specimen CollectionProcedure

Specimens were collected by hand-picking and using a knife. Underwater camera for photo documentation and a field notebook were used to record the data for each specimen to serve as guide and baseline in identification. Specimens were washed with seawater to remove adhering sediments and impurities, stored in glass jars, and were brought to the College of Science for identification.

3.5.2 Preservation of the Specimens

Each specimen collected was stored in glass jars and soaked in formaldehyde solution at a ratio of 3.7% formaldehyde:96.3% seawater.

3.5.3 Identification of the Specimens

Samples of seaweeds were brought to the Botany laboratory for identification by thephytologist or plant Scientitistexperts, ethnobotanists, or biologists in the University of Eastern Philippines' College of Science for authentication of the species' pre-identification done by the researchers *in situ*.

3.6 Phytochemical Screening

The chemical constituents of the three most- and three least-frequently appearing seaweeds were determined using the following procedures:

3.61 Tests for Alkaloids

In this test, the Dragendorff's reagent and Mayer's reagents were used in determining the presence of alkaloids. A positive result was indicated by the presence of an orange precipitate in Dragendorff's reagent, and a white precipitate with the Mayer's reagent (Guevarra, 2005 as cited by Cruz, 2014). Confirmatory tests for alkaloids were also performed using the protocols of Guevarra (2005).

3.6.2 Tests for Anthraquinone

To 10mL of 10% ammonia solution, few milliliters of filtrate was added and shaken vigorously for 30 seconds. A pink, violet, or red color indicated a positive result of anthraquinone (Shaikh & Patil, 2020).

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3.6.3 Test for Cardiac Glycosides

Keller Killiani Test was performed wherein a solution of 0.5ml, containing glacial acetic acid and 2-3 drops of ferric chloride, was mixed with 2 mL of extract.The appearance of deep blue color at the junction of two liquids indicated the presence of cardiac glycosides (Kancherla, *et al.*, 2019).

3.6.4 Test for Phenolic Compounds

Ferric chloride Test was utilized, where ferric chloride solution was added drop wise in a test tube containing 3 mL of the given sample. The color blue, green, violet, or red indicates the presence of phenolic compounds (Vedantu, 2023).

3.6.5 Test for Saponin

An equivalent of 10 g of seaweed extract was loaded to a capillary tube by immersing the tube to a height of 10 mm in the seaweed extract. Likewise, another capillary tube was loaded with distilled water. After sometime, the heights of the liquids in the two tubes were compared. If the level of the seaweed extract in the capillary tube is half or less than in the other tube containing water, then the presence of saponin may be inferred. To confirm its presence in the extract, the frothing test was administered, and a layer of foam of approximately 1cm indicated the presence of saponin (Guevarra, 2005 as cited by Cruz, 2014).

3.7 Physicochemical Activities

The different physico-chemical activities of the three (3) most and least frequently appearing seaweeds were determined using the following procedures:

Test for Lipids

Utilizing the emulsion test, a sample was added to 2cm^{3}of ethanol, and was shaken well, allowed to settle in a test tube rack for 2 minutes, then, any clear liquid was emptied into a test tube containing 2cm^3 of distilled water. A layer of milky-white emulsion at the top of the solution indicated the presence of lipids (Biology Notes, 2022).

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3.7.1. Test for Proteins

The Biuret test was utilized. One to two milliliters of the seaweed solution, egg albumin, and de-ionized water was added in clean and dry test tubes. Then, 1-2 mL of Biuret reagent was added to all the test tubes, shaken well, and allowed to stand for 5 minutes. If the solution turns from blue to deep purple, proteins are present (Aryal, 2022).

3.7.2. Ash content

Oven-dried samples were weighed, and 3 grams of sample was placed in each of 3 separate crucibles. The crucibles were then heated using a portable gas stove until the sample became completely ash. It was allowed to cool in a desiccator and weighed [Patilan, 201]. Ash content was calculated using the formula below:

$$\text{Ash content} = \frac{\text{weight of ash (g)}}{\text{weight of sample (g)}} \times 100$$

RESULTS AND DISCUSSION

Species Composition of Seaweeds in Biri, Northern Samar

There were forty-four (44) identified species of seaweeds classified into three (3) classes (Chlorophyceae [17 species], Phaeophyceae [13 species], and Rhodophyceae [14 species]). Moreover, the seaweeds were also classified into twenty-one (21) families.

Of this number, the three (3) most-frequently appearing and widely distributed in all of the sampling sites were chosen as samples by the researchers, and they were *Ulva reticulata, Hormophysacuneiformis,* and *Turbinariaconoides*. On the other hand, the three least-frequently appearing or those found in only one

Table 1. **Species Composition of Seaweeds in Selected Brangays of Biri, Northern Samar, Philippines**

Class	Seaweed Species	Sampling Sites				
		1	2	3	4	5
Chlorophyceae	*Anadyomeneplicata* C. Agardh	×	×	×	/	/
	Avrainvilleaerecta(Berkeley) A. Gepp& E. Gepp	/	×	×	×	×
	Boergeseniaforbesii (Harvey) J. Feldmann	/	/	×	×	/
	Bornetellasphaerica (Zanardini) Solms-Laubach	/	/	×	×	/
	Caulerpabrachypus Harvey	×	×	×	×	/
	Caulerparacemosa (Forsskål) J. Agardh	/	/	×	/	×
	Caulerpaserrulata (Forsskål) J. Agardh	/	/	×	/	×
	Caulerpa taxifolia (Vahl) C. Agardh	/	/	×	×	×
	Chaetomorphacrassa (C. Agardh) Kutzing	/	/	/	/	/
	Dictyosphaeriaversluysii Weber-van Bosse	×	/	×	×	/
	Halicorynewrightii Harvey	×	×	×	×	/
	*Halimedamacroloba*Decaisne	/	/	/	/	/
	Halimeda opuntia (Linnaeus) Lamoureux	/	/	/	/	/
	Ulva clathrata (Roth)	/	/	×	×	×
	Ulva intestinalis Linnaeus	×	/	×	×	/
	Ulva lactuca Linnaeus	/	/	/	/	/

	*Ulva reticulata*Forsskål	/	/	/	/	/
Phaeophyceae	*Canistrocarpuscervicornis* (Kutzing) De Paula and De Clerk	/	/	×	/	/
	Dictyotadichotoma (Hudson) Lamoureux	×	/	×	×	×
	Hormophysacuneiformis (J.F, Gmelin) P.C. Sliva	/	/	/	/	/
	Padinagymnospora (Kützing) Sonder	/	/	/	×	/
	Padina minor Yamada	/	/	/	/	/
	Sargassumaquifolium	×	/	×	/	/
	Sargassumcinctum	/	/	×	/	/
	*Sargassumgracillimum*Reinbold	×	/	×	×	/
	Sargassumhemiphyllum (Turner) C. Agardh	/	/	×	×	×
	Sargassumoligocystum Montagne	/	/	/	/	/
	Sargassumpolycystum C.A. Agardh	/	/	/	×	×
	Sargassumsiliquosum J. Agardh	/	/	×	×	/
	Turbinariaconoides (Turner) J. Agardh	/	/	/	/	/
Rhodophyceae	*Acanthaporaspicifera* (Vahl) Borgesen	×	/	/	×	/
	Amphiroafoliacea J.V. Lamouroux	/	/	/	/	/
	Coelothrixirregularis (Harvey) Borgessen	/	×	×	×	×
	Eucheumadenticulatum (N.L.Burman) Collins and Harvey	×	×	/	/	×
	Euthoracristata (C. Agardh) J. Agardh	×	×	×	/	×
	Gelidiellaacerosa (Forsskål) Feldmann and Hamel	/	/	×	/	×
	Gracilariasalicornia (C. Agardh) Dawson – with four (4) haplotypes	/	/	/	/	/
	Hydropuntia edulis (S.G. Gmelin) Gurgel&Fredericq	/	/	×	×	×
Rhodophyceae	*Hypneaservicornis* J. Agardh	×	/	/	×	×
	Laurenciapapillosa (C. Agardh) Greville	×	/	×	/	×
	*Laurenciatronoi*Ganzon-Fortes	/	/	×	/	×
	Mastophorarosea (C. Agardh) Setchell	/	×	×	×	/
	Portieriahornemannii (Lyngbye) P.C. Silva	/	/	×	×	×
	Tricleocarpafragilis (Linnaeus) Huisman & R.A. Townsend	×	/	/	×	×

Legend:
/ - present
× - absent

Sampling sites:
1 - Barangay Progress
2 - Barangay Pio del Pilar
3 - Barangay McArthur
4 - Barangay San Pedro
5 - Barangay San Antonio

or two of the sampling sites, were likewise chosen to undergo phytochemical screening and test for the physicochemical constituents. The least frequently appearing seaweed species were *Hydropuntia edulis, Laurenciapapillosa,* and *Tricleocarpafragilis.*

Phytochemical Screening Results

Results of the phytochemical screening reveal that phenolic compounds were present in all species tested, while saponin was present only in 4 if the samples. Moreover, alkaloids were detected only in *Hormophysacuneiformis* and *Turbinariaconoides*. On the other hand, anthraquinones were present only in *Tricleocarpafragilis,* while all 6 seaweed species tested negative for cardiac glycosides. These results imply that the coastal waters of the municipality of Biri, Northern Samar, specifically the sample barangays, has a diversity of seaweed species which could be harnessed economically through their possession of phytochemicals that could be the bases for drug discovery and development aside from the common use as food or source of alginates.

Table 2. Summary result of phytochemical screening of the three most- and three least-frequently appearing seaweeds in Biri, Northern Samar

SECONDARY METABOLITE TEST	SEAWEED EXTRACTS					
	1	2	3	4	5	6
ALKALOID						
Dragendorff's Test	+	+	+	+	+	+
Mayer's Test	-	+	+	-	-	-
Confirmatory Test	-	+	+	-	-	-
ANTHRAQUINONE	-	-	-	-	-	+
CARDIAC GLYCOSIDES	-	-	-	-	-	-
PHENOLIC COMPOUNDS	+	+	+	+	+	+
SAPONIN						
Capillary Test	-	-	+	+	+	+
Frothing Test	-	-	+	+	+	+

LEGEND:

+ = Tested compound is present in the seaweed extract
- = Tested compound is absent in the seaweed extract

1 = *Ulva reticulata*
2 = *Hormophysacuneiformis*
3 = *Turbinariaconoides*
4 = *Hydropuntia edulis*
5 = *Laurenciapapillosa*
6 = *Tricleocarpafragilis*

Physicochemical Activities of Seaweed Extracts

The six identified seaweed species were subjected to tests to determine their physicochemical activities or constituents, specifically lipids, proteins, and ash content. Results reveal that lipids and proteins were absent in all of the species tested. However, test for the ash content revealed a relatively high percentage of ash content. This

result implies that there is a potentially high amount of minerals.

Table 3. Summary result of the determination of physicochemical activities of three most and three least frequently appearing seaweeds in Biri, Northern Samar

PHYSICOCHEMICAL ACTIVITIES	SEAWEED EXTRACT					
	1	2	3	4	5	6
LIPID EMULSION TEST	-	-	-	-	-	-
PROTEIN BIURET TEST	-	-	-	-	-	-
ASH CONTENT	22.60%	29.20%	33.07%	33.96%	38.37%	63.17%

LEGEND:

+ = Tested compound is present in the seaweed extract
- = Tested compound is absent in the seaweed extract

1 = *Ulva reticulata* 6= *Tricleocarpafragilis*
2 = *Hormophysacuneiformis*
3 = *Turbinariaconoides*
4 = *Hydropuntia edulis*
5 = *Laurenciapapillosa*

CONCLUSION

Utilizing the purposive sampling technique, this descriptive research to set to assess the seaweed resources in the Municipality of Biri, Northern Samar, Philippines. From the results, the three most - and the three least-frequently appearing seaweeds were collected, identified, and subjected to phytochemical screening and determination of its physicochemical constituents.

There were 44 species of seaweeds in five sampling sites in Biri, Northern Samar. These belong to three classes, and 21 families, implying that Biri, Northern Samar harbors a diversity of species of seaweeds.

The three most-frequently appearing seaweeds are: *Ulva reticulata, Hormophysacuneiformis,* and*Turbinariaconoides*. Meanwhile, the three least-frequently appearing seaweeds are: *Hydropuntia edulis, Laurenciapapillosa,* and *Tricleocarpafragilis.*

Although not all secondary metabolites were present in any one seaweed species, the most commonly recorded secondary metabolite were phenolic compounds, while the least common metabolite was anthraquinone, which was present in only one sample. This implies that seaweed species available in the study area contain several chemical constituents or secondary metabolites which could have economic significance or potential applications for drug discovery and development.

In terms of the physicochemical activities of the seaweed samples, lipids and proteins turned out to be negative in all samples; however, the ash content of all the samples were relatively high, which implies that the seaweed species tested have a potentially rich mineral content.

Considering the limited tests done in this research, it is recommended that the seaweed extracts may be subjected to further testing to verify the existence of other chemical constituents or secondary metabolites that could have potential medical applications and/or can be used to create natural products.

The use of other methods of preparations, tests, and analyses for phytochemical screening and physicochemical constituent determination should be done to further test the availability of secondary metabolites and physicochemical constituents on seaweeds.

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