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(RESEARCH ARTICLE)

Comparison of the phytochemical characteristics of *Batis maritima* with traditional uses

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Abstract

Batis maritima, commonly referred to as Saltwort, is a halophyte found in coastal regions of various parts of North America, South America and Africa. It has historically been used in traditional medicine in the treatment of ailments such as eczema and cutaneous infections, among others. Since many of these ailments are known to be caused by fungal and bacterial pathogens, it is highly likely that extracts of *B. maritima* possesses strong antimicrobial properties, and, as such, may contain phytochemicals which have been known to display these phytochemical properties. Therefore, the aim of this study was to perform a phytochemical screening of alcoholic extracts of *B. maritima* leaves and compare these to the traditional uses of the herb.

Alcoholic crude extracts of leaves of the *B. maritima* shrub were subjected to a series of phytochemical analyses. The results of these analyses indicated the presence of glycosides, alkaloids, flavonoids, saponins, sterols, tannins and terpenoids.

Upon a comparison of the phytochemicals detected and the documented traditional uses of the herb, a correlation may be seen between the two. Many of the phytochemicals present in the extract have been previously noted to be used in medicine to treat many diseases that are similar to those that have historically been treated with *B. maritima*.

Keywords: *Batis Maritima*; Saltwort; Crabgrass; Phytochemical Screening

1. Introduction

The *Batis maritima* commonly referred to as saltwort, turtleweed, beachwort and herbe-à-crâbes (crab grass) [1], is a halophytic shrub [2] within the *Bataceae* family, of the order, Batales [3]. It is a low-lying shrub which may reach a height of 1 m, and the stem, usually around 5 cm in diameter. The leaves retain large amounts of water and are thus highly succulent. The flowers are pollinated via wind [1]. The plant is perennial and dioecious and has pistillate inflorescences that have several pollen receptors over the surface which may also function as units for dispersal, using the movement of the tidal waters [4].

Saltwort is not widely used in Guyana, limited only to local use as a remedy/treatment for chickens feeding on their eggs. However, there are documented uses of the shrub in other regions of the world. The foliage is used as a common animal feed and/or supplement [4]. It is also used as a food source by humans. The seeds and leaves were used by the Native Americans as an additive in salads [5]. The stem was also used as a sweetening agent before the introduction of processed sugar [4] and can also be chewed similarly to sugar cane [5]. The seeds may also be toasted and popped,

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similar to popcorn, and was found to be highly nutritious as it is rich in protein and unsaturated fats [4]. The oil from the seed was also used in making salad dressings and in making margarine [5].

In addition to food, Saltwort has other uses. It was used in herbal medicine [5], especially in the treatment of skin and blood disorders [4]. This was seen particularly in Puerto Rico where it was used in the treatment of gout, eczema, psoriasis, rheumatism, and blood and thyroid disorders [6], as well as in Mexico, where it was also used in the treatment cutaneous infections (fungal) in the Yucatan peninsula [6]. Additionally, the ashes from the plant were also used in the production of glass and soaps [4]. Further, *B. maritima* is also noted to have been used in herbal medicine in Puerto Rico to treat against eczema [6].

Analyses of the seeds of *B. maritima* confirmed the presence of carbohydrates, proteins and fats in significant quantities. The total carbohydrate content was found to be 46.5% by mass while total protein and fats were determined as 17.3% and 25.0% respectively. The analysis also revealed the presence of ash content (3.6%) as well as moisture percentage (7.6%) [7]. This moisture content is also marked by the use of the seeds in making a food similar to popcorn [5], since it is the moisture content in the seed that is responsible for the popping effect [8].

In other studies of the *B. maritima* shrub, it was also found that flavonoids were present in the seeds [9]. These compounds have antioxidant and anti-inflammatory properties [10], which may further contribute to the plant being used in herbal medicines [6].

Although much phytochemical work has not been done on the plant itself, it has been noted that the oil from the seed of *B. maritima* is similar to safflower oil [4]. Safflower plant (*Carthamus tinctorius*) extracts have been shown to possess antibacterial, antifungal and antioxidant properties [11]; very similar to what is known and/or suggested by studies of *B. maritima*. It may be inferred that the phytochemicals that lead to these properties are very similar in both plants. Analyses of the phytochemistry of the *C. tinctorius* plant revealed that its extracts contain flavonoids, phenylethanoid glycosides, fatty acids, and polysaccharides [12] further supporting the finding that were previously mentioned to have been noted in extracts of *B. maritima*. In addition, some coumarins and steroids have also been found in *C. tinctorius* [12].

Besides the similarity with *C. tinctorius*, there are other indications which hint at the phytochemistry of *B. maritima*. The roots and stem of the plant were noted to have been chewed like sugar cane [6] and used as a sweetener before the introduction of refined sugar [4]. This suggests the presence of glucose, fructose and/or sucrose, which is consistent with previously mentioned evaluation of the plant as all three of these sugars were found in the seeds of the plant [7].

Since the stem and leaves of *B. maritima* were eaten in the pickled form [7], this suggests that the salt and sugars found in the stem and leaves are in a relatively high concentration. This is due to the fact that sugar or salt is needed in the pickling process for taste and fermentation [13] [14] and, as this was before the introduction of sweeteners, one may surmise that the sugars and salts were present in the raw plant to begin with.

Other evidence of the phytochemical properties of *B. maritima* may be deduced from the usage of the plant as herbal remedies and treatments for various illnesses. Extracts of the plant have been used by the natives of Puerto Rico in the treatment of eczema [6]. One of the main treatments of eczema in modern medicine is with the use of steroids [15]. From this, it may be reasoned that steroids are present in a relatively high concentration in the extracts of *B. maritima*. This is consistent with other medicinal uses of the plant. Concoctions made from it have also been used by the natives in the treatment of psoriasis as well as blood disorders [6]. Psoriasis has also been noted to be treated with mainly steroids in modern medicine [16]. This is also the case for certain blood disorders that are as a result of an autoimmune condition [17].

Another condition for which *B. maritima* has been recorded to have been used as a treatment by the natives of Puerto Rico, is gout [6]. Since one of the major symptoms of gout is an inflammation of the joints, a common method to ease the pain is with the use of steroids, common anti-inflammatory medicines [18]. This further indicates the likely presence of steroids in *B. maritima*.

From the literature on the phytochemical characteristics of *B. maritima*, it may be seen that, while some work has been done in a few areas, the majority of information in this regard is still unknown. Most of the phytochemicals that were tested were of primary compounds present in the extracts [7]. However, the full use of the plant will not be appreciated until a detailed phytochemical assay is done, particularly on the secondary metabolites present in the plant extracts. The importance of this is seen when considering that it is these secondary metabolites, which are most often the

biologically active components of the plant, that contribute to the antimicrobial characteristics of the plants themselves [19].

2. Methodology

Samples of this study were obtained from the areas of Rose Hall Town Reef Section, Johns Village and Wellington Park Village, all along the Lower Corentyne Coast. These samples were then taken to the University of Guyana Johns Science Centre. All analyses were done at this location. Solvent removal from the crude extract by the rotary evaporator was done at the University of Guyana Turkeyen Campus.

2.1. Plant test materials

The present study utilized the leaves of the plant *B. maritima*.

2.2. Collection of Samples

Leaf samples of the *B. maritima* were obtained from the three previously mentioned locations. This was done using a 1 m^2 quadrat via a Stratified Random method. The plant was identified in the Division of Biology at the Johns Science Centre of the University of Guyana Berbice Campus. The specimen collected was used for the purpose of phytochemical screening.

2.3. Sample Preparation and Extraction

Following sample collection, the leaves were stripped and oven-dried, between 40 to 50 ^oC, for 5 days. Following this, the dried leaves were mill ground to a powder, which was added to 90% alcohol and left for 1 week. The extraction mixture was then filtered using Whatman Filter Paper No. 1. The filtrate was then collected and divided to be used in the antifungal assay.

2.4. Phytochemical Assay

The crude extract obtained was tested for alkaloids, terpenoids, anthocyanins, saponins, tannins, sterols, glycosides, flavonoids, amino acids and reducing sugars. This was done in accordance with the techniques outlined by Banu and Cathrine [20], along with other sources [21] [22] [23].

3. Results and discussion

The results of the phytochemical screening may be seen outlined in the following table (Table 1).

In this study, an alcoholic extract of the leaves of *B. maritima* was produced and subjected to the analyses. Ethanol of 90% (v/v) concentration was used in the cold extraction process to draw the active metabolites from the macerated leaf tissues into solution. Ethanol was chosen as the extraction solvent due to the fact that it is miscible with, and therefore dissolves, a wide range of compounds [24]. This is because ethanol has a polar hydroxyl group (-OH) which forms hydrogen bonds with polar compounds as well as an organic carbon chain, which is non-polar and binds to non-polar molecules [25]. Thus, a relatively high concentration of different phytochemicals was obtained using ethanol.

This alcoholic extract of the *B. maritima* obtained was subjected to ten (10) different phytochemical tests. Of the 10 tests carried out, seven (7) classes of phytochemicals were positively identified as being present in the extract. Present in the alcoholic extract of *B. maritima* were alkaloids, glycosides, saponins, sterols, and terpenoids. Flavonoids and tannins (both belonging to the polyphenol class of compounds) were also detected, although anthocyanins, a sub-class of flavonoids, were not. The other two phytochemicals tested for, but not detected, were amino acids and reducing sugars.

The presence of these phytochemicals provides further insight into the medicinal properties of this plant. Alkaloids in general, have been shown to possess a wide range of medicinal properties, ranging from anesthetics [26] and muscle relaxants [27] to chemotherapeutic agents [28]. This is a class of phytochemicals, characterized by the presence of nitrogen bases in the molecular structure [29].

Table 1 Presence of Phytochemicals in Crude Extract of *B. maritima*

Phytochemicals	Present/Not present
Alkaloids	✓
Amino acids	-
Anthocyanins	-
Flavonoids	✓
Glycosides	✓
Reducing sugars	-
Saponins	✓
Sterols	✓
Tannins	✓
Terpenoids	✓

Flavonoids are a class of polyphenol phytonutrients that are commonly responsible for various pigmentations in some fruits [30]. They have been noted to be extremely beneficial as they have exhibited anti-inflammatory, antithrombogenic, antidiabetic, anticancer, anti-mutagenic and neuroprotective properties, as well as proving useful in scavenging free radicals, enzyme receptor systems, enzyme inhibition, cyclo-oxygenase inhibition and lipoxygenase inhibition, among others [10].

Saponins are a group of phytochemicals whose molecules are composed of a triterpene or steroid aglycone connected to one or more sugar chains [31]. They easily form foamy aqueous solutions and, like the previous phytochemicals, display a wide range of beneficial uses [32]. Studies have shown that saponins affect the immune system in beneficial ways: they can help protect the body against cancer and help to lower cholesterol. Additionally, these compounds have been found to decrease blood lipids, lower blood glucose response, inhibit dental caries and platelet aggregation, treat hypercalciuria and prevent renal stones. They have also been used as an antidote against acute lead poisoning [32].

Sterols are another type of phytochemicals which has been noted to possess beneficial properties to humans. These are a class of 4-cyclic compounds with a cyclopentane perhydrophenanthrene nucleus [33]. They have been seen to treat heart diseases and help lower cholesterol by reducing its absorption in the small intestines [34].

Tannins, the next class of phytochemicals detected, are water-soluble polyphenols that are present in a wide range of plants and plant structures [35]. They are also referred to as tannic acids and are derived from phenolic acids [36]. Tannins have been attributed with anticarcinogenic and antimutagenic properties through the reduction of oxygen, peroxide and superoxide free radicals [35]. They have also been proven to prevent urinary tract infection, reduce the incidence of stomach ulcers, as well as reduce low-density lipoprotein cholesterol and improve cardiac health [36].

Terpenoids are by far, the largest and most diverse class of phytochemicals and as such, have been seen to display a wide range of pharmaceutical and medicinal properties [37]. These compounds are produced from isoprene units, which are 5-carbon hydrocarbon units, and their derivatives [38]. The medicinal range of these compounds, as mentioned, is quite wide, and includes pain relieving, analgesic effects, psychoactive, anxiolytic and anesthetic effects, as well as anti-inflammatory and anti-oxidant properties [39].

It may therefore be surmised from this information, that *B. maritima* extracts, containing alkaloids, flavonoids, glycosides, saponins, sterols, tannins and terpenoids may display many of the medicinal benefits noted from these compounds. A few of these medicinal uses have already been established by literature: the treatment of gout, eczema, psoriasis, rheumatism, and blood, and thyroid disorders as well as cutaneous infections [6].

4. Conclusion

From the study conducted, it may be seen that the crude extract of *B. maritima* was found to contain several phytochemicals. The phytochemicals that were detected were glycosides, alkaloids, flavonoids, saponins, sterols, tannins and terpenoids. The presence of these phytochemicals correlates with the documented use of the plant in traditional medicine, as many of these phytochemicals have been observed to be effective in the treatment of the conditions noted in literature.

Compliance with ethical standards

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Disclosure of conflict of interest

We hereby state that there exists no conflict of interest among the authors of this research.

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