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Phytochemical evaluation of two brown seaweeds from Muttom and Rasthacaud coasts of Tamil Nadu, India

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ABSTRACT

Seaweeds are one of the most important marine resources of the world that contain various biologically active compounds which serve as a component for nutraceutical and pharmaceutical industry. Recently there is a growing interest on the discovery of natural phytochemicals which are generally safer than synthetic chemicals. Hence the present investigation was carried out to screen bioactive compounds from different extracts of Padina boergesnii and Padina tetrastromatica collected from the coasts of Rasthacaud and Muttom, Tamil Nadu, India. The phytochemical analysis showed the presence of quinones, coumarins, terpenoids, steroids and phytosterols in both the algae. Proteins and tannins were found to be absent in Padina boergesnii and Padina tetrastromatica. The phytochemical analysis showed better result in the alga Padina boergesnii in chloroform extract. Among the five solvents namely aqueous, petroleum ether, chloroform, ethanol and acetone, chloroform was found to be the better solvent for phytochemical screening.

Key words: phytoconstituents, solvents, seaweeds extracts.

INTRODUCTION

Marine algae have attraction as an important resource of bioactive compounds as they are able to produce a great variety of secondary metabolites characterized by a broad spectrum of biological behaviour such as antibacterial, antioxidant, anticancer, anticoagulant and antiviral properties [1-2]. The ability of seaweeds to produce secondary metabolites of potential interest has been extensively documented [3]. The structure of most the sterols [4] isoprenoids, aminoacids, terpenoids, phlorotanins, steroids, phenolic compounds, halogenated ketones and alkanes, cyclic polysaccarides, fatty acids and acrylic acid are well characterized [5]. The brown seaweeds have cell wall polysaccarides, most of which are the sulfated polysaccaride, fucoidan [6]. *Padina* is the only genus of brown algae that is calcified [7-9]. A few species of *Padina* have been traditionally used as food source in some coastal cultures for e.g. as a gelatin-like sweetmeat [10] seasoning as dry flake forms or as salt replacement for high blood pressure patients [11] and for treatment of goiter and scrofula [12]. There are about 50 taxa of *Padina* distributed worldwide, although most are poorly known and many would prove to be synonymous [13]. According to [14] only 30 of these are currently accepted. Among them *Padina boergesnii* and *Padina tetrastromatica* are seen distributed in the coasts of Kanyakumari district of Tamil Nadu. Therefore these two algae were selected for the phytochemical screening in the present study.

EXPERIMENTAL SECTION

Collection of samples

The marine algae *Padina boergesnii* and *Padina tetrastromatica* were collected from Rasthacaud and Muttom coastal waters by handpicking. The collected samples were washed thoroughly with seawater and immediately transported to the laboratory, rinsed with sterile distilled water and shade dried and grounded into fine powder in a

mixer grinder [15]. The powdered samples were packed in polytene bags and stored in a refrigerator until the experiments were carried out.

Preparation of Extracts

The powdered samples (50g) were taken in Soxhlet apparatus and the extracts were prepared using the solvents aqueous, chloroform, ethanol, petroleum ether and acetone for 8 hours. The crude extracts were weighed and deep frozen until tested. The preliminary phytochemical screening was performed using standard methods [16].

RESULTS AND DISCUSSION

***Padina tetrastromatica*:** The results of preliminary phytochemical screening for thirteen different chemical compounds (steroids, alkaloids, saponins, tannins, flavonoids, quinones, coumarins, proteins, terpenoids, phytosterols, carboxylic acid, glycosides and carbohydrates) using five different solvent extracts are given in Table 1. Totally sixty five (1×5×13=65) tests were performed to screen the presence or absence of phytochemicals. The presence of following compounds namely glycosides, quinones, coumarins, terpenoids, steroids, phytosterols and carboxylic acid were recorded. The results were found to negative for flavonoids, alkaloids, saponins, proteins, carbohydrates and tannins in all the five solvent extracts.

Table 1. Phytochemical screening of two brown seaweeds *P.tetrastromatica* and *P.boergesnii*

Solvents	Seaweeds	Glycosides	Alkaloids	Flavonoids	Quinones	Coumarins	Carbohydrates	Proteins	Terpenoids	Steroids	Phytosterols	Carboxylic acid	Saponins	Tannins
Aqueous	*P.tetrastromatica*	–	–	–	+	+	–	–	–	+	–	–	–	–
	P.boergesnii	–	–	–	–	+	–	–	–	–	–	–	+	–
Petroleum ether	*P.tetrastromatica*	–	–	–	–	+	–	–	–	+	+	–	–	–
	P.boergesnii	–	–	–	–	+	–	–	–	–	–	–	–	–
Chloroform	*P.tetrastromatica*	–	–	–	–	+	–	–	+	+	+	+	–	–
	P.boergesnii	–	+	–	–	+	+		+	+	+	–	+	–
Ethanol	*P.tetrastromatica*	+	–	–	–	–	–	–	+	+	–	–	–	–
	P.boergesnii	–	–	–	–	–	–	–	+	+	+	–	–	–
Acetone	*P.tetrastromatica*	–	–	–	–	+	–	–	+	+	–	+	–	–
	P.boergesnii	–	–	+	+	+	–	–	–	–	+	–	–	–

+ = Present, − = Absent

During the screening tests, the results were found to be positive for the compound steroid in all the five solvent extracts. It was positive for coumarins in four solvent extracts except ethanol; quinones answered only to aqueous extract. The results also confirmed that chloroform was the best solvent to screen most of the compounds present in most of the algae than the acetone extract for which four compounds answered positive. Similarly the results were positive for three compounds while using aqueous and petroleum ether solvents.

Padina boergesnii: The phytochemical analysis of *Padina boergesnii* revealed the occurrence of different metabolites with varying degrees in five different extracts. Thus out of sixty five (1×5×13×=65) tests concluded to ascertain the presence or absence of the above mentioned compounds, 17 test showed the presence of alkaloids, flavonoids, quinones, coumarins, carbohydrates, terpenoids, steroids, phytosterols and saponins. Similar to *Padina tetrastromatica* coumarins didn't show the positive result while using ethanol extract. The algal extract prepared using the solvents chloroform and ethanol had shown the positive result for steroids. The compound phytosterol showed positive result in acetone extract.

Among the five solvents used for the preparation of algal extract and the subsequent screening test, chloroform was found to be the best solvent to screen the maximum of five bioactive compounds than acetone by which four compounds were screened; ethanol for which three compounds answered positive result and while using petroleum ether it was possible to test only one compound.

The result of the phytochemical analysis of various solvent extracts revealed the presence of various secondary metabolites with various degrees. The presence of alkaloid was recorded only with the chloroform extract of *Padina boergesnii* in the present study. Alkaloids are secondary metabolites known to be produced by plants and over 800 have been isolated and identified. They are of considerable pharmaceutical importance since they are used as drugs for the treatment of several diseases of mankind [17].

Flavonoids found in chloroform extract of algae *Padina boergesnii*. Flavonoids are known as nature's tender drug since it is having numerous biological and pharmacological activities. Recent findings regarding the activities of flavonoids such as antiviral, antifungal, antioxidant, anti-inflamatory, antithrombic, anticarcenogenic, hepatoprotective and cytotoxic have generated interest in studies of flavonoids containing plants [18-19]. The presence of quinone was observed in *Padina tetrastromatica.* Similar result was earlier reported by [20] in the same alga *Padina tetrastromatica.* Coumarins were recorded in four solvent extracts except ethanol in both the algae. Instead [20] reported the presence of coumarins in *Padina tetrastromatica*.

Macroalgae are rich in carbohydrates [21-22]. In the present study carbohydrates was found to be present in the alga *Padina boergesnii.* This result coincides with the reports of [23] in *Panina fernandiziana*. Terpenoids are found in *Padina boergesnii.* Steroids may serve as an intermediate for the biosynthesis of downstream secondary natural products and it is believed to be a biosynthetic precursor for cardenolides in plants. Marine algae have shown to be a good source of unsaponifiable, non toxic sterols that have medicinal value [24]. Phytosterols and carboxylic acid were found in both the algae. Saponins were present only in *Padina boergesnii*. Saponins possess numerous biological properties which include antimicrobial, anti-inflammatory, antifeedent and hemolytic effects [25]. Proteins and tannins were found to be absent in both *Padina tetrastromatica and P. boergesnii*. Earlier reports of [26] also find confirmity with this result who reported that the protein content of macroalgae is much dependent on season and environmental growth condition. The presence of various secondary metabolites in these seaweeds is a clear indication of their pharmaceutical potential. The secondary metabolites may be useful in containing infection, act as hypoglycemic agents, reduce blood pressure and regulate cholesterol levels [27].

CONCLUSION

In this study chloroform extract were more active than the other acetone, aqueous, petroleum ether, and ethanol extracts of algae *Padina tetrastromatica and P. boergesnii* . From the study it may be concluded that *P.tetrastromatica and P. boergesnii* have a good source of phytochemicals. The finding of current works appears to be useful for the further investigations and suggest that the seaweeds may be used as alternative source for anti-bacterial, anti-inflammatory, anti-oxidant and anti-cancer agent in the near future.

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