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Research Article

PRELIMINARY PHYTOCHEMICAL SCREENING OF *BRACHYTHECIUM BUCHANANII* (HOOK.)A. JAEGER AND ITS MEDICINAL VALUES

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ABSTRACT

Phytochemicals are novel biomolecules produced by plants and are important as medicinal for curing many ailments. Bryophytes are ideal life forms for morphogenetic, genetic, biochemical, physiological and molecular studies due to their simple structural organization. They have been traditionally used for curing various skin disorders and injuries due to the pool of bioactive compounds. The biological activities of bryophytes are due to lipophilic monosesqui and diterpenoids, aromatic compounds and acetogenins. The phytochemical analysis of *Brachythecium buchananii* thallus extracts in petroleum ether, chloroform, ethyl acetate, methanol and water extracts to validate the medicinal important of the species was investigated. The phytochemical analysis revealed the presence of alkaloids, tannins, flavonoids, terpenoids, triterpenoids, and cardiac glycosides in varying levels. The moss contains essential amino acids such as isoleucine, phenylalanine and tyrosine. Terpenoid showed significant level compared to flavonoids and phenols. These molecules exhibit many pharmacological activities like anti-inflammatory, anti-malarial, anticancer, inhibition of cholesterol synthesis, anti-viral and bactericidal activities. Thus, the present study provides evidence that different solvent extracts contains medicinally unique bioactive molecules and this justifies the use of the moss as traditional medicine for treatment of various disorders.

Keywords: Solvent extracts, phytochemical analysis, moss, bryophytes, terpenoids

INTRODUCTION

Bryophytes, the non-vascular plants represent the second largest group of land plants after the angiosperms. 25,000 species are recorded and distributed across the earth. These comprise three distinct groups: liverworts, hornworts and mosses. Evolutionary records suggest that these plants had originated during the Carboniferous period while; Sporogonites was recorded from the lower Devonian. It is estimated that India abode about 2,884 bryophytes and Kerala 465 species. It is common knowledge that bryophytes are not attacked by pest and pathogens, even though dominates in close proximity with decomposing matters. They possess numerous useful biomolecules like amino acids, fatty acids, oligosaccharides, phenolic acids, flavonoids, alkaloids and terpenoids. Relatively little attention has been paid to correlate secondary metabolites of bryophytes with therapeutic uses. Chinese, Indians, and Native Americans used bryophytes as drugs for curing many ailments. Perhaps, the most popular example of the Doctrine of Signatures is *Marchantia polymorpha* to treat liver ailments; *Riccia* species were used in the Himalayas to treat ringworm problems. Saxena and Harinder[1] reported the importance of certain bryophytes such as *Chiloscyphus polyanthus, Diplophyllum albicans, Polytrichum juniperinu* for curing deadly cancer while *Marchantia ploymorpha, M.stellata, Diplophyllum taxifolium, D. albicans, Polytrichum commune, Wiesnerella denudata* as tumor suppressors and *Sphagnum* spp. as bandages. Singh[2] reviewed the importance of bryophytes as pharmaceutical products, in horticulture, for household purposes, and also potential in the biomapping of atmospheric precipitation. Hence, the present investigation was undertaken to unravel the secondary metabolites of the moss *Brachythecium buchananii*.

MATERIALS AND METHODS

Plant material

Brachythecium buchananii, yellowish green coloured moss, grows as dense mats belong to Brachytheciaceae. Stem grows upto 6 cm long with rigid branches. Mostly found growing along moist soil, rocks or as epiphytic on trunks.

Hot continuous soxhlet extraction

Fresh *B. buchananii* were collected, chopped, air dried and sequentially extracted with 100 ml of petroleum ether, chloroform, ethyl acetate, methanol and water for 8 h by continuous hot extraction using soxhlet method.

Preliminary qualitative phytochemical analysis

The different solvent extracts from soxhlet method were evaluated for the presence of secondary metabolites according to the protocol of Khandelwal[3].

Quantification of total free amino acids

Total free amino acids were determined using ninhydrin reagent[4]. The absorbance was read at 570 nm.

Estimation of soluble proteins

The soluble proteins were estimated by using Folins reagent[5]. The absorbance was read at 670 nm after 30 min using proper blank and the amount of protein was calculated.

Estimation of sugars

Sugar content was estimated by using DNS reagent[6]. The absorbance of the reaction mixture was measured at 540 nm with spectrophotometer.

Estimation of total phenols
Total phenol content was estimated as per the protocol of Mayr[7].

Estimation of terpenoids
Terpenoids was determined by the method of Ferguson [8].

Total flavonoids
Aluminium chloride colorimetric technique was used for flavonoid estimation [9].

Table 1: Phytochemical screening of various solvent extract of *Brachythecium buchananii*

	Petroleum ether	Chloroform	Ethyl acetate	Methanol	Water
Reducing sugar	-	+++	+++	++	+
Glycosides	++	+	++	+	-
Flavonoids	++	-	-	++	-
Alkaloids	-	-	-	+	++
Tannins	+	+	+	+++	-
Phenol	+	+	+	++	-
Terpenoids	++	-	+	+++	++
Triterpenoids	+++	-	+	+++	+
Steroids	++	++	++	-	-
Coumarins	+	-	++	-	-
Saponin	+	+	-	++	+++
Phlobatanins	-	-	-	-	+++

Table 2: Amino acid profile in *Brachythecium buchananii*

Sl.no	Amino acid	Concentration(µg/g)
1	Tyrosine	1683.06
2	Phenylalanine	115.61
3	Serine	269.22
4	Glycine	120.68
5	Aspartic acid	809.30
6	Proline	1145.83
7	Cysteine	1026.66
8	Isoleucine	139.49

Table 3: Primary metabolites in *Brachythecium buchananii*

Sl.no	Compound	Concentration
1	Protein	2.2 ± 0.976 mg/g
2	Sugar	41.94 ± 0.43 µg/g

Table 4: Secondary metabolites in *Brachythecium buchananii*

Sl.no	Compound	Concentration(mg/g)
1	Flavonoid	4.43 ± 0.56
2	Terpenoid	34.75 ± 0.45
3	Phenol	1.69 ± 0.87

RESULTS AND DISCUSSION

The result of the preliminary phytochemical screening of *Brachythecium buchananii* thallus extracts shows the presences of different phytochemicals in different solvent extracts (Table 1). Cholesterol was not detected during the present investigation. Qualitative assessments of the different phytochemicals detected from methanolic extract were flavanoids, saponins, tannins, phenols, glycosides and terpenoids in methanol extracts. High amount of flavonoid and terpenoids was also found in petroleum ether. Aqueous extract contains saponins and Phlobatanins. Subsequently, the major phtochemicals were quantified. Amino acids were also found in considerable level in the moss (Table 2). Sugar and protein present in substantial levels i.e., 41.94 µg/g and 2.2 mg/g respectively (Table 3). The phytochemicals like flavonoid, terpenoid and phenol were 4.43 ± 0.56, 34.75 ± 0.45, 1.69 ± 0.87 respectively (Table 4). The remarkable level of terpenoids requires special attention in the moss.

The alkaloids present in the moss thallus can be used as precursors for the synthesis of many potential compounds which may be used for improving fertility related issues[10]. Saponins are useful microbicidal molecules and can be modified to produce effective antibiotics against multiple resistant pathogens in plants and human beings[11]. The biological properties of flavonoids are proven in many plant based drugs as antioxidant, anti-inflammatory agents, microbicidal, antiallergic, nutraceutical, antimetastatic and other ailments [12]. Glycosides are reported in the solvent extracts of the moss suggests its use in many cardiac related issues as blood pressure regulator [13]. Triterpenoids noticed in the present study are potential antibacterial agents[14]. Thus, over all the diverse secondary metabolites noticed in the different solvent extracts justifies its use by the locals for curing many human disorders.

The polyphenols are also act as a good antioxidant, inhibiting lipid per oxidation and scavenge superoxide. Additionally, flavonoids also exhibited anti-inflammatory properties and could interact with cyclooxygenase (COX-2) as selective inhibitors.

Alam [15] screened Indian bryophytes for their biologically active compounds. Bioactive new compounds were reported from bryophytes[16]. Further, they also emphasized the importance of bryophytes for biotechnology[17]. Subhisha and Subramoniam [18] revealed antifungal activities of a steroid from *Pallavicinia lyellii*. Asakawa[19] evaluated phytochemistry of bryophytes acetogenins, terpenoids and bis(bibenzyl) from selected Japanese, Taiwanese, New Zealand, Argentinean and European liverworts. Reportes suggest that bryophytes were potential against fungal diseases of crop plants [20]. Thus, the present output in bryophyte phytochemicals substantiates its need as medicinal.

CONCLUSION

The present study reveals the diverse secondary metabolites present in the moss *Brachythecium buchananii*. Bryophytes are transient plant group originated earlier in the inhospitable environment. In order to tide over the adverse environmental conditions, the plants are in an active phase of secondary metabolic pathways. Most of the reported compounds are pharmaceutically important. Therefore, further studies are planned to isolate, purify the lead molecule and to analyze its biological potentialities.

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