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Chemical Screening of Some Himalayan Bryophytes

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Eight bryophyte species collected from Kumaon (North-Western Himalayas) have been screened for their chemical constitutions. The present communication reports the detection of terpenoids (mono-, sesqui- and tri-) steroids, glycosides and flavonoids present in them. Alkaloids were not noticed in any of the material investigated. The wide variety of terpenoids and flavonoids offer considerable scope for the use of these plants. These chemical markers can be used in chemosystematics and biosynthetic studies.

INTRODUCTION

Bryophytes are accredited with various medicinal activities and have been used as folk medicines in different parts of the world since ages. Research in the past two decades has established that bryophytes possess a variety of chemical structures and demonstrate various biological activities such as antibacterial, antifungal, antipyretic, antifeedant and insect repellent activity and are used to cure snake bites, gall stone, scalds and bruises[1]. Many bryophytes are also known to have a characteristic odour due to the presence of terpenoids stored in the oil bodies[2]. An unexpectedly wide range of often complex flavonoids also has been reported in them[3]. The bis (bibenzyl) derivatives possess cytotoxicity and inhibitory activity due to which they show strong antitumour/anticancer property[4].

Bryophytes are an important part of the vegetational mosaic in the Himalayas spread practically over all the substrates from the foothills to the alpine region. Compared to the research work on bryophytes elsewhere in the world, systematic chemical analysis of bryophytes from the Himalayas has never been attempted extensively. The present communication deals with the phytochemical screening of eight bryophyte species for different classes of organic compounds.

EXPERIMENTAL

For the present study eight species, *Asterella wallichiana* (Lehm. et Lindb.) Grolle, *Conocephalum conicum* (L.) Dum., *Plagiochasma appendiculatum* L. et L., *Targionia hypophylla* (L.), *Wiesnerella denudata* (Mitt.) St., *Porella densifolia* (Steph.) Hatt., *Ptycanthus striatus* (Lehm. et Lindb.) Nee and *Cryptoleptodon pluvinii* (Brid.) Broth. (= *C. flexuosus* (Harv.) Renscard.) were collected from different localities in and around Nainital (Kumaon, Himalayas) during April-October 1995 (Table-1). The plant material was first thoroughly

cleaned and dried in the laboratory for 3–4 days. The dried samples were powdered and Soxhlet extracted with hexane, ether, ethyl acetate and methanol respectively. The extracts were concentrated and used for phytochemical analysis. The essential oil was extracted by steam distillation method. The extract of each plant was tested for alkaloids, terpenoids, steroids, flavonoids and glycosides.

TABLE-1
BRYOPHYTE SPECIES SELECTED FOR CHEMICAL SCREENING

Bryophyte species	Family	Date of collection and locality	Characteristic odour
Thalloid Liverworts			
Asterella wallichiana) Lehm. et Lindb.) Grolle	Aytoniaceae	Oct. 1995; on way to Government House, Nainital (2000 m)	Rotten fish-like
Conocephalum conicum (L.) Dum.	Conocephalaceae	Oct. 1995; Dhobighat (2150 m) Nainital	Sweet mushroomy
Plagiochasma appendiculatum (L. et L.)	Aytoniaceae	Sept. 1995; on way to Snowview (2100 m), Nainital	Pleasant mossy
Targionia hypophylla L.	Targionaceae	Oct. 1996; Tallital, Nainital (2000 M)	Olive like
Wiesnerella denudata (Mitt.) St.	Wiesnerellaceae	Oct. 1995; Dhobighat (2150 m), Nainital	Sweet mushroomy
Leafy Liverworts			
Porella densifolia (Steph.) Hatt.	Porellaceae	April 1995, Aberfoyal (2000 m) Nainital	Terpentine like
Ptycanthus striatus (Lehm. et Lindh.) Nees	Lejeuneaceae	-do-	-do-
Moss			
Cryptoleptodon pluvinii (Brid.) Broth. {= *C. flexuous* (Harv.) Ren scard.}	Neckeraceae	-do-	None

TLC of the extracts was carried out on silica gel G plates with suitable solvent systems and visualizing agents. The GC and GC-MS of the steam distilled extracts was done on OV-101 fused silica capillary column at temperature programming from 60–210°C at 3°C/min. Identification of the components was done as follows:

TABLE-2
CHEMICAL CONSTITUENTS OF EIGHT HIMALAYAN BRYOPHYTES

S. No.	Species	Alkaloids	Monoterpenoids	Sesquiterpenoids	Diterpenoids	Triterpenes/ Steroids	Flavonoids	Glycosides
1.	*Asterella wallichiana*	–	linalool	+	+	+	+	+
2.	*Conocephalum conicum*	–	α-pinene β-pinene *p*-cymene bornyl acetate	β-elemene elemol selina-11-en-4-ol	+	+	+	+
3.	*Plagiochasma appendiculatum*	–	β-pinene	β-elemene thujopsene β-caryophyllene	+		+	+
4.	*Targionia hypophylla*	–	α-pinene β-pinene β-phellandrene	cuparenne	+	+		
5.	*Wiesnerella denudata*	–	bornyl acetate α-pinene *p*-cymene	β-caryophyllene	+	+	+	+
6.	*Porella densifolia*	–	α-pinene β-pinene limonene camphene	β-elemene β-caryophyllene spathulenol	+	+	+	+
7.	*Ptycanthus striatus*	–	+	+	+	+	+	+
8.	*Cryptoleptodon pluvinii*	–	–	–	+	+	+	+

+ indicates presence; – indicates absence

Alkaloids: tested with Dragendorff and Marquis reagent[5].
Monoterpenoids/Sesquiterpenoids: detected with Vanillin -H_2SO_4.[5]
Diterpenoids: detected as suggested by Harborne[6].
Triterpenoids/Steroids: using the Liebermann-Burchard test[5].
Flavonoids: detected as suggested by Harborne[6].
Phenolic compounds: detected as suggested by Harborne[6].
Glycosides: detected by procedure of Harborne[6].

RESULTS AND DISCUSSION

The results of chemical screening are given in Table-2. Except for *Cryptoleptodon pluvinii*, a moss, all bryophytes tested were liverworts. All the liverworts contained mono- and sesquiterpenoids, which account for their odour. The GC-MS screening of the steam volatile material showed α-pinene, β-pinene, limonene, bornyl acetate and *p*-cymene as the most common monoterpenoid constituents, while the prominent sesquiterpenoids were β-elemene, β-caryophyllene, thujopsene and several isomeric sesquiterpene alcohols. *Cryptoleptodon pluvinii* (a moss) lacked mono- and sesquiterpenoids. Almost all the species tested were found to contain diterpenoids, steroids/triterpenes, flavonoids and glycosides whereas alkaloids were not noticed in any of the material investigated so far.

This is the first screening report for Himalayan bryotaxa (Kumaon) that would form a base for further studies. The wide variety of terpenoids and flavonoids offer considerable scope for the use of these plants in chemosystematic and biosynthetic studies.

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REFERENCES

1. Y. Asakawa, Progress in the Chemistry of Organic Natural Products, Springer, Wien-New York, Vol. 65, p. 464 (1965).
2. Y. Asakawa, Bryophyte Development: Physiology and Biochemistry, CRC Press, Boca Raton, Florida, p. 259 (1990).
3. K.R. Markham, The Flavonoids: Advances in Research, Chapman and Hall, London, Vol. 2 (1988).
4. R.G. Powell, D. Weisleder and C.R. Smith, *J. Org. Chem.*, **46**, 4398 (1981).
5. E. Stahl, Thin Layer Chromatography, Springer-Verlag, Berlin, p. 855 (1969).
6. J.B. Harborne, Phytochemical Methods, Chapman and Hall, London, pp. 34, 52 (1973).

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