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Research Article

PHYTOCHEMICAL SCREENING AND ANTIFUNGAL ACTIVITY OF CERTAIN SPECIES OF *HYDROGONIUM* (C. MUELL.) JAEG. A MOSS

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ABSTRACT
The aim of present study was to determine the presence of bioactive phytochemicals and its antifungal activity of aqueous crude extracts of *Hydrogonium arcuatum* (Griff.) Wijk. Marg. and *Hydrogonium consanguineum* (Thwait.& Mitt.) Hilp. against fungus *Alternaria solani*. Phytochemical screening of crude extracts of both the plants revealed the presence of Flavonoids, terpenoids, cardiac glycosides and sterols. Antifungal study showed to reduce colony diameter with increasing concentration of aqueous crude extracts from 10 to 100 per cent. *H. consanguineum* extract was more potent than *H. arcuatum* to inhibit the fungal growth. Further this study also suggested that the presence of naturally occurring compounds in both the plants can be used treat various phytopathogenic fungal diseases.

INTRODUCTION
Lower plants possesses antimicrobial properties which could be attributed to chemicals including polygonal, norpiquisone and lunularin which constitute to phytochemical component of the lower plant (Smith and Reyanard, 1992). Toyota and Asakawa (1999) screened the extract of *Plagiochasma appendiculata* and evaluated that it possesses antimicrobial activity which was due to the presence of terpenoids. Deora *et., al* (2007) carried out studies on antibacterial effect of aqueous crude extracts of *Plagiochasma articulatum, Anthoceros longi* and *Fissidens bryoides* against test fungi *Xanthomonas citri in vitro* and suggested that P. articulatum extract was more active than *A. longi* and *F. bryoieds*. Antifungal activity of Bryum argenteum was reported against phytopathogenic fungus *Curvularia lunata*, a causal organism of leaf spot disease of *Zea mays* (Deora and Guhil, 2014). Deora and Guhil (2015) studied the antifungal potential of Bryum celluiare against mycelial growth of fungi Curvularia lunata and Drechslera maydis causal organisms of leaf spot of wheat and leaf spot of Zea mays respectively and suggested that higher concentrations (100%) completely inhibited mycelial growth of *Curvularia lunata* and partial in case of *Drechslera maydis.*

Keywords: *Phytochemical screening, Bioactive compounds, Hydrogonium, Crude extract, Phytopathogenic fungi.*

MATERIALS AND METHODS
Plant material and extract preparation:
Plant material was collected from Mt. Abu (Rajasthan) in rainy season. Collected material was thoroughly washed and kept in an oven at 50^{o}C for 24 hrs. The dried material then blended into powder by pastel and mortar. 10 gm dried powder plant material was grinded in pastel and mortar with 100 ml double distilled water. Then centrifugation was done at 2500 rpm for 20 minutes and filtered with Whattman filter paper no. 1. This filtrate was used for phytochemical screening and antifungal activity.
Test organism:
The test fungi Alternaria solani was cultured and sub cultured in the laboratory to obtain its pure isolates at 30^{o}C temperature.
Phytochemical screening:
Qualitative phytochemical screening was done by the standard method suggested by Trease and Evans (2002).

Screening of antimicrobial activity:

Antifungal activity of both the plant material fractions was determined by using agar pour plate method. 10 ml plant extract was first poured into Petri plates. Then 10 ml molten PDA was poured aseptically on the plant extract in the Petri plates and swirled round for even dispersion of the extract into agar. The extract was incorporated with different concentrations of 10 to 100 and control. A 5 mm mycelial agar disc of Alternaria solani was released into the poisoned agar. Incubation period was 72 hrs. The average diameter of mycelial colony was measured after incubation. The growth of test fungus without extract was used as control. The per cent inhibition of mycelial growth was calculated by using the formula given by Vincent (1927).

RESULTS AND DISCUSSION

Phytochemical screening of present study showed the presence of terpenoids, flavonoids, cardiac glycosides, saponins and sterols in the aqueous extracts of both *H. arcuatum* and *H. consanguineum.* Colors, precipitation formed and other parameters to determine the presence of secondary metabolites were comparatively more intense in *H. consanguineum* extract than H. arcuatum suggested that the possibility of presence of these secondary metabolites was more in *H. consanguineum.* (Table 1)

Results of antifungal activity against test fungus Alternaria solani (Table 2) suggested that *H. consanguineum* extract was more potent than *H. arcuatum* against the mycelial growth of *A.solani.* Minium colony diameter (3.612 mm) was reported in 100 per cent concentration of *H. consanguineum* in comparison to the control (51.467 mm). As concentration increased colony diameter decreased gradually. In case of H.arcuatum minimum colony diameter(4.210 mm) was reported in 100 per cent concentration of the extract where as it was maximum (49.150 mm) in the control.

Table-1: Phytochemical profile of *H.arcuatum* and *H. consanguineum*

Active compounds	**Phytochemical tests**	**Observations**	**Results**	
			Ha	Hc
Alkaloids	Mayers test Hagers test	No precipitation No precipitation	- 	-
Anthroquinin	Borntragers test	No layer formation	-	-
Cardia glycocides	Keller Killeni test	Brown ring	++	+
Flavanoids	Ferric chloride test Lead acetate Alkaline reagent test Sodium hydrochloride test	Green colour Yellow precipitate Yellow florescent test Yellow colour	++ ++ ++	+ ++ ++
Saponins	Froth test	No froth formation	-	-
Sterols	Salkowaski test Liebermann- Burchardt test	Reddish brown colour Brown ring	++ ++	++ ++
Terpenoids	Salkowaski test Liebermann- Burchardt test	Lower layer turned yellow Deep red colour	++ +	+ ++

Note: Ha= Hydrogonium arcuatum, Hc= Hydrogonium consanguineum,
Results based on mean of three replicates

Maridas *et al*., (2008*)* reported that plants and plant part have been provided a good source of valuable bioactive compounds of antioxidant, anti inflammatory, antimutagenic and antibacterial activity. Deora

and Guhil (2016) reported the presence of flavonoids, terpenoids, cardiac glycosides and saponins from crude methanolic extract of two liverworts and suggested that all these secondary metabolites showed antifungal activity against selected test fungi.

The results of the present study and the comparison with the previous literature suggested that bryophytes are the rich store house of bioactive compounds and they have potent against phytopathogenic fungi therefore these plant can be used as biocontrol for phytopathogenic diseases.

Table 2: Showing the effect of aqueous crude extract of plants on *Alternaria solani*

S.No.	Extract concentration %	Colony Diameter in mm	
		H. arcuatum	***H. consanguineum***
1	Control	49.150	51.467
2	10	34.3434	46.769
3	20	29.854	32.534
4	40	24.631	25.910
5	60	13.710	18.673
6	80	8.107	9.587
7	100	4.210	3.612

Note: Results based on mean of three replicates.

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