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Pharmacognostical and phytochemical investigations of the whole plant of *Swertia chirata* and *Hemidesmus indicus*

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Abstract

Swertia chirata and *Hemidesmus indicus* have been used in traditional and folklore medicine for the treatment of several critical diseases and disorders. The present study was themed to preliminary pharmacognostic and phytochemical investigations for determining and establishing the identity, purity and quality of these plants. This will provide an appropriate guidance for future exploration. The plants were subjected to determination of various physicochemical parameters including ash values (total ash, water soluble ash) and extractive values (alcohol soluble extractive, water soluble extractive). The powdered crude drugs were extracted successively with various solvents with increasing polarity and the methanolic extracts were subjected to phytochemical screening for the identification of various phytoconstituents. The results of these phytochemical examinations revealed the presence of carbohydrates, glycosides, alkaloids, phenols, flavonoids and tannins. Thus various pharmacognostic and phytochemical characters observed in this study may help in standardization, identification and for carrying out further research on these medicinally valuable plants.

Keywords: Swertia chirata, *Hemidesmus indicus,* adulteration, phytochemical screening, tannins.

INTRODUCTION:

The use of herbs, herbal extracts or plant derived pure chemicals is a new therapeutic approach to treat different diseases, which has gained immense popularity[1]. Especially in Asian countries and mostly in India, plants have been traditionally used for human and veterinary health care. World population uses around 35,000-70,000 species of plants for medicinal, neutraceuticals and/or cosmetic purpose[2]. At present all over world, there is an increased interest in plant drug extracts, and this is due to several reasons, specifically, synthetic medicine can be inefficient, abusive and or incorrect use of these drugs results in deleterious side effects whereas drugs obtained from natural plant origin are non-narcotic, having no or fewer side effects and are cost effective[3,4]. These plants contain wide array of chemical compounds which play an important role in health care. The Indian system of medicine including Ayurveda, Siddha, Unani and even Homeopathy rely on plant based crude materials and their formulations[4].

There is increased demand for herbal drugs and/or their principal chemical constituents by pharmaceutical, phytochemical and perfumery industries. Hence these medicinal plants are often adulterated by foreign organic matters resembling the standard drugs or are substituted by inferior quality crude drugs. Therefore, it is essential to study and establish a systematic pharmacognostic and phytochemical profile of such medicinally valuable plants [3,4]. *Swertia chirata* and *Hemidesmus indicus* are such important plants which are well known for their unique medicinal properties.

Swertia chirata Buch-Ham (Family- Gentianaceae) is an extremely bitter,erect, about 2-3 ft long herb found in Meghalaya and Himalayan regions. The stems are orange brown or purplish in colour. The root is simple, tapering and stout, short, about 6-7 cm long and on an average half inch thick. Traditionally *S. chirata*is used for fever, malaria, anemia, bronchial asthma, hepatitis, constipation, skin diseases, worm infection and diabetes[5,6]. Herbal medicines viz Ayush-64, Diabecon, Mensturyl syrup,

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Melicon V ointment & *Mahasudarshan churna* contain *Swertia chirata* Powder and its extract in varied quantities are used for its antipyretic, hypoglycemic, antifungal and antibacterial properties[1,7].

Hemidesmus indicus R. Br. is commonly known as Indian sarasaparilla. It was formerly placed under the family Asclepiadaceae, but now based on the pollinial characters it was shifted to Periplocaceae family[2,8]. It is a perennial climbing herb having numerous slender wiry laticiferous branches with purplish brown bark. This plant is native of India, and is also found in Srilanka, Pakistan, Iran and Bangladesh [8,9]. In Ayurveda it is one of the Rasayana plants, as it possesses anabolic effect. The plant is also reported to be used in the treatment of syphilis, herpes, skin diseases, bronchitis, arthritis, gout, rheumatism, epilepsy, urinary diseases, chronic nervous diseases, loss of appetite, abdominal distention and intestinal gas [9,10].

Despite of extensive use of these plants in traditional medicine, sufficient scientific parameters or standards are not present to establish the quality of these crude drugs. The pharmacognostical and phytochemical parameters are most important and reliable criteria for the confirmation of the identity and determination of quality and purity of the crude drugs as each drug possess their own unique pharmacognostical and phytochemical standards [10]. As we observed, *Swertia chirata* and *Hemidesmus indicus* in local markets are often adulterated and substituted by inferior quality crude drugs. Thus, in the present work we have made an attempt to report various necessary pharmacognostical and phytochemical standards of *Swertia chirata* and *Hemidesmus indicus* so as to further strengthen the available standards for quality evaluation of these valuable herbs.

MATERIALS AND METHODS

Plant Material

The samples of *Swertia chirata* and *Hemidesmus indicus* (whole plants) were purchased from Munnalal Dawasaaz, Hyderabad, A.P., India. The Taxonomic evaluation was established by Prof. P. Jayaraman, Director, Institute of Herbal Botany, Plant Anatomy & Research centre, Chennai, T.N., India (Voucher numbers- *Swertia chirata* PARC/2012/1432 and *Hemidesmus indicus* PARC/2012/1434). The reference samples were deposited at Raw Drug Collection center of MESCO College of Pharmacy, Mustaidpura, Hyderabad.

Pharmacognostic evaluation

Determination of Physicochemical parameters

Determination of various physicochemical parameters such as total ash, water soluble ash, acid insoluble ash, alcohol soluble extractive, water soluble extractive, swelling index, foaming index and test for foreign matter were determined in accordance with standard methods as mentioned in Ayurvedic Pharmacopoeia of India and standard research papers[10,11,12].

Determination of Ash Value

The residue remaining after incineration of the crude drug is called as ash. The ash is determined by three different methods which measures, total ash, acid insoluble and water soluble ash. The total ash value of plant material indicates the amount of earthy material or inorganic composition and other impurities present along with the drug[11, 12,13].

Determination of Extractive Value

Extractive value provides information about the nature of constituents present in the crude drug. Water soluble extractive and alcohol soluble extractive values were calculated by standard methods [11, 12,13].

The results of physicochemical parameters are presented in **Table no 1.**

Preparation of extracts of *Swertia chirata* and *Hemidesmus indicus*

The plant materials were air dried under sunshine, cleaned and pulverized using a mechanical grinder. Fines were collected by sieving (40#).Fines were stored in air tight container at room temperature. About 100 g of each powdered drug were extracted successively in different solvents by continuous extraction process (Soxhlet apparatus)[14,15]. After completion of extraction it was filtered through Whatman (no.1) filter paper and the solvent was removed by evaporation at room temperature. A dark brownish gummy mass of methanolic extract of both *Swertia chirata* (18.5% w/w) and *Hemidesmus indicus* (21.5% w/w) were obtained. Extracts were labelled and stored under refrigeration in screw cap bottles until further use.

Preliminary phytochemical evaluation[7, 13,16, 17]

The methanolic extract of *Swertia chirata* and *Hemidesmus indicus* was obtained by successive solvent extraction and subjected to preliminary qualitative phytochemical analysis using standard methods for the identification of alkaloids, carbohydrates, glycosides,

flavonoids, saponins, tannins, terpenes, and phenolic compounds as mentioned in the following text

Test for Alkaloids

The extracts were treated with dilute (10%) hydrochloric acid and filtered. The filtrates were treated with various alkaloidal reagents.

Mayer's test

The extracts were treated with Mayer's reagent (Potassium mercuric iodide) and observed for appearance of cream colour. Which indicated the presence of alkaloids in methanolic extracts of the plants under study.

Dragendorff's test

The extracts were treated with the Dragendorff's reagent (Potassium bismuth iodide) and observed for the appearance of reddish brown precipitate. This indicated the presence of alkaloid in methanolic extracts of the plant under study.

Hager's test

The extracts were treated with the Hager's reagent (Picric acid). The appearance of yellow colour precipitate indicated the presence of alkaloids in methanolic extracts.

Wagner's test

The extracts were treated with the Wagner's reagent (Iodine solution). The appearance of brown colour precipitate indicated the presence of alkaloids in methanolic extracts.

Test for carbohydrates

Molisch's test

2 drops of 1 % alcoholic a-Naphthol was added to the extracts, then 2 ml of conc. sulfuric acid was added through the sides of test tubes and examined for the presence of carbohydrates. A violet colour ring at the junction of two layers was observed which indicated the presence of carbohydrates in methanolic extracts.

Barfoed's test

Small portions of the extracts were treated with Barfoed's reagent. The red colour precipitate was observed in the mixture that indicated the presence of monosaccharides in methanolic extracts.

Fehling's test

Extracts were treated with Fehling's solution A and B, warmed on a water bath for 5 minutes. A brick red precipitate was formed in methanolic extract indicating the presence of reducing sugar.

Test for glycosides

Keller-Killani test

A pinch of each of the extracts were separately dissolved in glacial acetic acid and few drops of ferric chloride solution was added, followed by the addition of concentrated sulphuric acid, formation of red ring at the junction of two liquids indicated the presence of glycosides in methanolic extracts.

Test for Flavonoids

Shinoda's test

The extracts were dissolved in alcohol, and a piece of magnesium chip was added to it. This was followed by addition of conc. hydrochloric acid in a drop wise manner and the resultant mixture was heated. The appearance of magenta color indicated the presence of flavonoids.

Ferric chloride test

Few drops of neutral ferric chloride were added to the extracts, a blackish red colour was observed in methanolic extracts. This indicated the presence of flavonoids.

Test for saponins

Foam test

The extracts were diluted to 20 ml with distilled water and shaken well in a graduated cylinder for 15 minutes. Formation of foam in the upper part of the test tube indicated the presence of saponins.

Test for tannins

Lead acetate solution

The extracts were treated with 10% lead acetate solution. The white precipitate was appeared in the solution that indicated the presence of tannins.

Ferric chloride test

The extracts were treated with neutral ferric chloride solution. The formation of blackish red colour indicated the presence of tannins.

Test for terpenes

The extract was treated with tin and thionyl chloride and examined. Formation of pink colour indicated the presence of terpenes.

Test for Phenolic compound

The extracts were treated with neutral ferric chloride solution. The appearance of violet colour indicated the presence of phenols.

The extracts were treated with 10% sodium chloride solution. The appearance of cream colour indicated the presence of phenols.

RESULTS AND DISCUSSION

Physicochemical parameters

Determination of physicochemical parameters of a crude drug is necessary as it helps in identification and estimation of mishandling, substitution, adulteration and also in setting of appropriate standards. Various physicochemical parameters like total ash, water soluble ash, acid insoluble ash, alcohol soluble extractive, water soluble extractive, swelling index, foaming index and test for foreign matter were investigated. The obtained results are presented in Table 1 for *Swertia chirata* and *Hemidesmus indicus* respectively.

Table-1 Physicochemical evaluation of *Swertia chirata* (S.C) *and Hemidesmus indicus* (H.I)

Sr. No.	Parameters	*S.C*	*H.I*
1	Foreign matter	<0.69% w/w	<0.71% w/w
2	Total ash	4.89% w/w	4.53% w/w
3	Acid insoluble ash value	0.96% w/w	1.25% w/w
4	Water soluble ash value	1% w/w	2.73% w/w
5	Methanol extractive	12.39% w/w	13.20% w/w
6	Water extractive	13.17% w/w	13.40% w/w
7	Foaming index	190U	220U
8	Swelling index	1.7% w/v	2.1% w/v

Preliminary phytochemical analysis

The methanolic extracts obtained after successive solvent extraction were subjected to preliminary qualitative phytochemical analysis for the presence of alkaloids, carbohydrates, glycosides, flavonoids, saponins, tannins, terpenes and phenolic compounds. This type of analysis helps in determining the presence of major secondary metabolites of the herbs, which are responsible for the specific biological or pharmacological activity. Results of these tests are presented in Table 2 for *Swertia chirata* and *Hemidesmus indicus* respectively. We found that the methanolic extract of *Swertia chirata* shows the presence of alkaloids, carbohydrates, glycosides, flavonoids, tannins, terpenes and phenolic compounds while saponins are absent. *Hemidesmus indicus* also indicated the presence of carbohydrates, glycosides, flavonoids, tannins and phenolic compounds while alkaloids, saponins and terpenoids are absent. Lignins and proteins are also present in *Hemidesmus indicus*.

Table 2: Qualitative chemical examination of methanolic extract of Swertia chirata (S.C) and Hemidesmus indicus (H.I)

Sr. No	Test/Reagent used	S.C.	H.I.
1.	*Alkaloids*		
	Mayer's reagent	+	-
	Dragendorff's reagent	+	-
	Hager's reagent	+	-
	Wagner's reagent	+	-
2.	*Carbohydrates*		
	Molisch's reagent	+	+
	Barfoed's test	+	+
	Benedict's reagent	+	+
	Fehling's reagent	+	+
3.	*Glycosides*		
	Keller-Kiliani test	+	+
4.	*Flavonoids*		
	Shinoda test	+	+
	FeCl3	+	+
5.	*Saponins*		
	Frothing test	-	-
6.	*Tannins*		
	Lead acetate solution	-	+
7.	*Terpenes/Terpenoids*	+	-
8.	*Phenolic compounds*	+	+
9.	*Proteins and Lignins*	-	+

(+) = *Present* (-) = *Absent*

CONCLUSION

A systematic approach is necessary in pharmacognostical and phytochemical study which helps in confirmation and determination of identity, purity and quality of crude drugs. Hopefully, the parameters which have been evaluated as per the standard norms and presented in this pharmacognostical and phytochemical study of *Swertia chirata* and *Hemidesmus indicus* will provide valuable information for future research work.

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