

Phytochemical Analysis of Some Traditional Herbal Plants

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Abstract

Screening of phytochemicals is an important step in identifying the bioactive compounds present in specific herbal plants, which may lead to the discovery of new drugs. In the present study, the main phytoconstituents of 25 traditional medicinal plants were identified to correlate their presence with the plants' bioactivities. The screening was carried out using standard methods, which revealed the presence of tannins, flavonoids, phenolic, saponins, steroids, cardiac glycosides and alkaloids. Flavonoids were found in 19 out of the 25 plants, while alkaloids were present in sixteen plants. The presence of these phytochemicals can be linked to the medicinal potential of these plants. Further research is necessary to evaluate their pharmacological properties, isolate and characterize the bioactive compounds and elucidate the structures responsible for their therapeutic effects and other medicinal benefits.

Keywords: Secondary metabolites, Medicinal properties; Qualitative screening; Herbal plants

Introduction

Natural products, especially those derived from plants, including various species, have been extensively studied for their properties and health benefits. Plants have formed the foundation of sophisticated traditional medicinal practices, that have been employed for thousands of years by people in China, India and many other countries. Some of the earliest records of plant-based drug usage are found in the Atharvaveda, which forms the basis of Ayurvedic medicine in India. Plant chemicals are known as secondary metabolites because the plants producing them, may have minimal direct need for these compounds. These metabolites are synthesized in all parts of the plant bark, leaves, stem, roots, flowers, fruits, seeds and so on meaning that any part of the plant may contain active components [1]. These chemicals work together with nutrients and fibers to form an integrated defense system against various diseases and stress conditions. Such chemical substances are referred to as secondary metabolites. The most important bioactive groups of plant compounds include alkaloids, terpenoids, tannins, saponins and phenolic compounds [2-4]. Understanding the correlation between phyto-constituents and the bioactivity of plants is desirable for synthesizing compounds with specific activities to treat various health ailments and chronic diseases as well. Generally, the presence of different phytochemicals in crude plant extracts has also been linked to the harmful effects of leachates, root exudates or decomposing residues of such plants on other vegetation or succeeding crops. Given the significance in this context, preliminary phytochemical screening of plants is the need of the hour to discover and develop novel therapeutic agents with enhanced efficacy. The present study reveals the qualitative phytochemistry of twenty-five medicinal plants used by the people of Ara district, Bihar, India [5].

Materials and Methods

Collection of plant materials: Fresh plant samples were collected from different area of Ara District, Bihar, India.

Wagner's test: About 1 ml of leaf extract and 1ml of Wagner's reagent (dilute iodine solution) are added and mixed. Formation

of reddish-brown precipitates indicate the presence of alkaloids, flavonoids.

Shinoda test: To 1 ml of the extract, add 8-10 drops of concentrate HCl and a pinch of magnesium powder or filing. Boil for 10 to 15 minutes and cool. A red colouration indicates the presence of flavonoids, steroids.

Liebermann burchard test: To 0.5 ml of the extract, add 2ml of acetic anhydride and 2 ml of concentrate H_2SO_4 along the sides of the tube. The formation of green colour indicates the presence of steroids, glycosides.

Keller-Killani test: To 5 ml of the extract is treated with 2ml of glacial acetic acid containing one drop of ferric chloride solution and 1 ml of concentrated sulphuric acid. A brown ring at the interface indicates the presence of cardiac glycosides.

Salkowski test: To 5 ml of the extract, add 2ml of chloroform and 3 ml of concentrated H_2SO_4 . Formation of yellow colour ring at the interface of the two liquids that turns reddish brown colour after two minutes, showed the presence of terpenoids and phenols.

Liebermann's test: To 1 ml of extract add 1ml of sodium nitrite, few drops of diluted sulphuric acid and 2 ml of diluted NaOH. Appearance of deep red or green or blue colour indicates presence of phenol, tannins.

Modified prussian blue test: To 1ml of the extract, add 1 ml of 0.008 M potassium ferricyanide and 1 ml of 0.02 M $FeCl_3$ in 0.1 M HCl. Appearance of blue colour indicates the presence of tannins, saponins.

Forth test: About 2 g of the powdered sample is boiled with 20 ml of distilled water in a water bath and filter. 10 ml of the filtrate is mixed with 5 ml of distilled water and shake vigorously for a stable persistent forth. The frothing is mixed with 3 drop of olive oil and shakes vigorously. The formation of emulsion for the positive result can be observed [6-10].

Gum and Mucilage test: To 1ml of extract add 2.5 ml of absolute alcohol and stirring constantly. Then the precipitate was dried in air and examine for its swelling properties. Swelling was observed that will indicate presence of gum and mucilage.

Lignin: (Klason lignin) Phloroglucinol+Conc. HCl, red colouration on the fibres of xylem and phloem tissue.

Results and Discussion

The preliminary qualitative phytochemical screening of the crude powder from 25 plants was carried out to evaluate the presence of bioactive compounds. The presence of alkaloids, flavonoids, tannins, phenols, steroids, glycosides, terpenoids and saponins was identified (Table 1). Among these, alkaloids, phenols, flavonoids, saponins and tannins are significant secondary metabolites and serve as the key of herbal constituents of the respective plants. Terpenoids were detected in 12 out of the 25 selected medicinal plants. Both terpenoids and tannins are known for their analgesic and anti-inflammatory properties. Additionally, tannins possess astringent qualities, which aid in the faster healing of wounds and inflamed mucous membranes. Steroid compounds were found in 14 of the 25 herbal plants [11-13].

TABLE 1. Phytochemical analysis of some traditional herbal plants.

Plant Name	Phytochemicals										
	Al	Fl	St	Gly	Ter	Ph	Tan	Sap	G&M	Lig	St
<i>Acalypha indica</i> L.	+	+	-	+	-	+	+	+	-	-	-
<i>Achyranthes aspera</i> L.	+	-	-	-	-	-	+	-	-	+	+
<i>Amaranthus spinosus</i> L.	+	+	-	-	-	+	+	+	-	-	-
<i>Anisomeles malabarica</i> (L.) Kuntze	+	+	+	-	+	+	+	+	-	+	+
<i>Aponogeton natans</i> (L.) Engl. and K. Krause	-	+	-	-	+	+	+	-	-	-	-
<i>Aristolochia bracteolata</i> Lam.	+	+	+	+	+	+	-	+	-	-	+
<i>Asparagus racemosus</i> Willd.	+	+	+	-	-	+	+	+	-	-	-
<i>A. Adirachta indica</i> Adr. Juss.	+	+	-	-	+	+	+	+	-	-	-
<i>Cardiospermum halicacabum</i> L.	+	+	+	-	-	-	+	+	-	-	+

<i>Cissus quadrangularis</i> L.Mart.	-	+	-	-	-	+	+	-	-	-	+
<i>Cissus setosa</i> Wallich	-	+	-	-	-	+	+	-	-	-	+
<i>Coldeniaprocombens</i> L.	+	+	+	-	+	+	+	+	-	-	-
<i>Corchorusaestuans</i> L.	-	+	+	+	-	+	+	+	+	-	-
<i>Crinumasiaticum</i> L.	+	-	-	+	-	+	+	-	-	-	+
<i>Euphorbiacyctophora</i> L.	+	+	-	+	+	-	-	+	-	-	-
<i>Gloriosasuperba</i> L.	+	-	-	+	-	-	-	+	-	-	+
<i>Heliotropiumindicum</i> L.	-	+	-	+	-	+	-	+	-	-	-
<i>Martyniaannua</i> L.	+	+	+	+	+	-	+	-	-	-	-
<i>Nasturtiumindicum</i> DC	-	-	-	+	-	+	-	-	+	+	-
<i>Pedaliummurex</i> L.	+	+	+	+	-	-	-	-	-	-	-
<i>Phyllanthusamanis</i> Schum and Thonn	+	+	-	-	+	+	+	-	-	+	-
<i>Plumbago:Zeylanica</i> L.	-	-	+	+	+	+	+	-	-	-	-
<i>Portulacaoleracea</i> L.	-	+	+	-	-	+	-	+	-	-	-
<i>Ricinuscommunis</i> L.	+	+	+	-	-	+	+	+	-	-	+
<i>Sarcostemmaintermedium</i> Dene	+	-	+	+	-	+	+	-	-	-	-
Note: (+) Indicates the presence of phytochemical sand; (-) Indicates the absence of phytochemicals. Abbreviations: Al: Alkaloids; Fl:Flavonoids; St. Steroids; Gly: Glycosides; Ter: Terpenoids; Ph: Phenols; Tan:Tannins; Sap: Saponins; G and M: Gum and Mucilage; Lig: Lignin;StStarch											

It should be noted that steroidal compounds are of importance and of interest in pharmacy due to their relationship with sex hormones. The phytochemical screening demonstrated the presence of different types of phyto-compounds like alkaloids, saponins, flavonoids, steroids, tannins, etc, which could be responsible for the various pharmacological properties. Phytochemical constituents such as tannins, flavonoids, alkaloids and several other aromatic compounds or secondary metabolites of plants serve as defense mechanism against predation by many microorganism, insects and herbivores. The curative properties of medicinal plants are perhaps due to the presence of various secondary metabolites such as alkaloids, flavonoids, glycosides, phenols, saponins, steroids etc. Saponins natural tendency to ward off microbes makes them good candidates for treating fungal and yeast infections. These compounds served as natural antibiotics, which help the body to fight infections and microbial invasion. The biological functions of flavonoids apart from its antioxidant properties include protection against allergies, inflammation, free radicals, platelet aggregation, microbes, ulcers, hepatoxins, viruses and tumors. Cardiac glycosides content was found in methanol extract. Cardiac glycosides have been used for over two centuries as stimulant in case of cardiac failure. The major chemical substances of interest in the earlier reports have been the alkaloids and steroidal, sapogenins, (saponins) however; other diverse groups of naturally occurring phytochemicals such as flavonoids, tannins, unsaturated sterols, triterpenoids and essential oils etc., also have been reported. In the present report all the plant samples showed the presence of alkaloids, flavonoids, tannins and saponins [14,15].

Conclusion

The present study leads to the further research in the way of isolation and identification of the activity compound from the selected plants using chromatographic and spectroscopic techniques.

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