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Research Article

Phytochemical Profiling of Leaves and Stem Bark of Terminalia arjuna and Tecomella undulata

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Abstract

The traditional medicine involves the use of different plant extracts or the bioactive constituents. Phytochemical constituents are responsible for medicinal and antimicrobial activity of plant species. This type of study provides the health application at affordable cost. Hence the present study involves extraction and phytochemical analysis of leaves and stem bark extract of *Terminalia arjuna* and *Tecomella undulata* belonging to the family *Combretaceae*, and *Bignoniaceae* respectively. A qualitative phytochemical analysis was performed to check the presence of secondary metabolites like alkaloids, steroids, volatile oil, fat, tannin, carbohydrate, saponin and flavonoids in the selected plant species. Plant extracts were obtained by successive extraction of leaf and stem bark powder in soxhlet apparatus by using a series from non polar (petroleum ether) to polar (water) solvents. The samples were subjected to qualitative phytochemical screening by adopting standard methodology. Observation revealed the presence of several secondary metabolites in various organic solvents of leaves and stem bark extracts. Therefore, leaves and stem bark extracts of the selected plants may serve as a good source of constituents of useful drugs and may also be used for the preparation of herbal biocontrol agents against plant pathogens.

Keywords: *Terminalia arjuna, Tecomella undulata,* Secondary Metabolites, Phytochemical Analysis

Introduction

Since ancient times, people have been exploring the nature particularly plants in search of new drugs. This has resulted in the use of large number of medicinal plants with curative properties to treat various diseases [1]. Medicinal plants are the richest bio-resources of folk medicine, traditional systems of medicines, food supplements, nutraceuticals, pharmaceutical industries and chemical entities for synthetic drugs [2]. Modern medicine has evolved from folk medicine and traditional systems, only after through chemical and pharmaceutical screening [3].

According to the present scenario it is estimated that 40% of the world populations depends directly on plant based medicine for their health care [4]. India is the birth place of renewed system of indigenous medicine such as Unani, Ayurveda, Homeopathy and Siddha. Traditional systems of medicine are prepared from a single plant or combinations of number of plants, the efficacy depends on the use of proper plant part and its biological potency which in turn depends upon the presence of required quantity and nature of secondary metabolites in raw drug [5, 6]. According to the world Health Organization, over 80% of the world's population or 4.3 billion people rely upon traditional plant based systems of medicine for primary health care. In India, almost 95% of the prescriptions were plant based in the traditional systems [7]. Knowledge of the chemical constituents/phytochemicals of plants is very important for the synthesis of complex chemical substances. Such phytochemical screening of plants is reported by many workers [8, 9, 10].

In the present study the qualitative phytochemical analysis of leaves and stem bark of Terminalia arjuna commonly known as "Arjun" (fam-Combretaceae), and Tecomella undulata known as "Rohira", "Rohitaka" (fam – Bignoniaceae) were done for the presence of various secondary metabolites present in different organic solvents.

Materials and Methods:

Collection and Processing of Plant Samples

Plant samples of T. arjuna and T. undulate were collected from Botany Garden, University College of Science in the month of July. The plants were identified by Dr. Maina, Head BSI (Botanical Survey of India) Jodhpur, Rajasthan, India.

Mature leaves and stem bark of the selected plants were washed thoroughly with tap water and air dried in the shade. They were ground to a fine powder using high capacity electric grinder, which were then stored individually in air-tight containers with necessary markings for identification and kept in cool, dark and dry place for further use.

Extract Preparation:

Reflux method of solvent extraction was used for successive separation of different partially purified organic constituents present in dried plant material [11, 12]. For extraction of secondary metabolites, the measured amount of the powdered plant material was successively extracted in a soxhlet extractor using petroleum ether followed by benzene, chloroform, acetone, methanol and water. Extracts were dried in rotary evaporator. After drying, percent extractive value was taken then extracts were stored in stock vials and kept in refrigerator for use during experiment.

Percent of Yield was calculated according to the following formula [13].

Percent of Yield = W1/W2 X100

Where, W1= Net weight of powder in grams after extraction

W2= Total weight of powder in grams taken for extraction.

Same procedure was applied for both plants and their parts used in this study. Solvent series used for successive separation was as follows:

Pet. ether → Benzene → Chloroform → Acetone

→Methanol →Water

Chemicals:

All the solvents used for extraction of secondary metabolites were purchased from Merck. All chemicals used in the study were of analytical grade.

Phytochemical Screening:

Different extracts were screened for the presence of alkaloids, steroids, volatile oil, fat, tannin, carbohydrate, saponin and flavonoids by using standard protocols [11, 12].

Results:

The highest percent extractive value was found to be 8.65% it was of methanol fraction of Terminallia arjuna leaves. The lowest Percent extractive value 0.65% was of benzene fraction of stem bark of

Tecomella undulate. The percent extractive values of various fractions of both of the plants were ranging from 0.75% to 7.05%. The percent extractive values of leaves and stem bark of all the fractions of both of the plants are given in the Table No.1-(A) and (B)

The Phytochemical screening of various extracts of Tecomella undulata and Terminallia arjuna leaves and stem bark revealed the presence of alkaloids, steroids, volatile oil, tannin, carbohydrate, saponin and flavonoids in various extracts. All the extracts of leaves and stem bark of both of the plants do not show the presence of fat. The presence of various secondary metabolites in different organic solvents are given in Table No. 2-(A, B, C, D).

Table No.1-(A) Percent Extractive of Different Fractions of *Tecomella undulata*

S. No.	Solvent	Percent extractive value	
		Leaves	Stem bark
1.	Petroleum ether fraction	5.65	1.77
2.	Benzene fraction	5.05	0.65
3.	Chloroform fraction	4.50	1.05
4.	Acetone fraction	3.77	6.37
5.	Methanol fraction	2.50	2.30
6.	Aqueous fraction	4.12	2.87

Table No.1-(B) Percent Extractive of Different Fractions of *Terminallia arjuna*

S. No.	Solvent	Percent extractive value	
		Leaves	Stem bark
1.	Petroleum ether fraction	1.65	3.67
2.	Benzene fraction	0.85	1.17
3.	Chloroform fraction	0.97	0.75
4.	Acetone fraction	7.05	1.25
5.	Methanol fraction	8.65	2.30
6.	Aqueous fraction	5.25	2.87

Table No. 2-(A) Phytochemical Screening of Various Fractions of *Tecomella undulata* Leaf Extract

Fractions	Alkaloids	Steroids	Volatile oil	Fat	Tannins	Carbohydrate	Saponins	Flavonoids
PE	- ve	+ ve	- ve	-ve	+ ve	- ve	+ ve	-ve
Benzene	+ ve	-ve	- ve	-ve	- ve	+ ve	-ve	+ve
Chloroform	+ ve	+ve	- ve	-ve	- ve	+ ve	+ve	+ve
Acetone	- ve	-ve	- ve	-ve	+ ve	+ve	-ve	-ve
Methanol	+ve	+ ve	-ve	-ve	+ ve	+ ve	- ve	+ve
Aqueous	- ve	+ ve	- ve	-ve	- ve	- ve	+ve	-ve

+ ve -Present, - ve- Absent.

Table No. 2-(B) Phytochemical Screening of Various Fractions of *Tecomella undulate* Bark Extract

Fractions	Alkaloids	Steroids	Volatile oil	Fat	Tannins	Carbohydrate	Saponins	Flavonoids
PE	- ve	- ve	- ve	- ve	- ve	- ve	-ve	-ve
Benzene	+ve	- ve	-ve	- ve	+ve	+ve	-ve	-ve
Chloroform	+ve	- ve	-ve	- ve	+ve	+ve	-ve	+ve
Acetone	-ve	+ ve	- ve	- ve	- ve	- ve	- ve	-ve
Methanol	-ve	+ ve	-ve	-ve	- ve	+ ve	- ve	-ve
Aqueous	- ve	+ ve	- ve	- ve	+ ve	+ ve	- ve	-v e

+ ve -Present, - ve- Absent.

Table No. 2-(C) Phytochemical Screening of Various Fractions of *Terminallia arjuna* Leaf Extract

Fractions	Alkaloids	Steroids	Volatile oil	Fat	Tannins	Carbohydrate	Saponins	Flavonoids
PE	- ve	- ve	- ve	- ve	+ ve	+ ve	+ ve	+ ve
Benzene	- ve	- ve	- ve	- ve	+ ve	- ve	- ve	+ ve
Chloroform	- ve	- ve	+ ve	- ve	+ ve	- ve	- ve	+ ve
Acetone	- ve	+ ve	+ ve	- ve	+ ve	+ ve	- ve	+ ve
Methanol	+ve	+ ve	-ve	-ve	+ ve	+ ve	+ ve	+ ve
Aqueous	- ve	+ ve	- ve	- ve	+ ve	+ ve	- ve	- ve

+ ve -Present, - ve- Absent.

Table No. 2-(D) Phytochemical Screening of Various Fractions of *Terminallia arjuna* Bark Extract

Fractions	Alkaloids	Steroids	Volatile oil	Fat	Tannins	Carbohydrate	Saponins	Flavonoids
PE	+ve	+ve	-ve	-ve	-ve	-ve	-ve	+ve
Benzene	-ve	-ve	-ve	-ve	+ve	+ve	+ve	-ve
Chloroform	+ve	-ve	-ve	-ve	-ve	-ve	-ve	+ve
Acetone	-ve	+ve	-ve	-ve	+ve	-ve	+ve	-ve
Methanol	+ve	+ve	-ve	-ve	+ve	+ve	+ve	+ve
Aqueous	+ ve	-ve	- ve	- ve	+ ve	+ ve	+ve	+ ve

+ ve -Present, - ve- Absent.

Conclusion:

The phytochemical screening revealed the presence of various secondary metabolites in different fractions of Terminallia arjuna and Tecomella undulata. Hence from the above study it can be conclude that both of the selected plants can be used as constituents in the formation of various synthetic as well as herbal drugs. They may also be used for the formation of organic amendment agents and as they have flavonoids and alkaloids they may be used as antifungal agents for crop protection as well.

However, further studies are required to isolate the pure active principal from the partially purified plant extracts for proper drug development.

Discussion

In most of the traditional systems of treatment, the use of medicinal plant include the fresh or dried part, whole, chopped, powdered or an advanced form of the plant usually made through extraction with different solvents play a major role and constitute the backbone of the traditional medicine [14] . Botanical medicines or phytomedicines refer to the use of seeds, berries, leaves, bark, root or flowers of any plant for medicinal purposes by significant number of people. Although there are no apparent morphological characteristics in the medicinal plants, yet they possess some special qualities or virtues that make them medicinally important. It has now been established that the plants which naturally synthesis and accumulate some secondary metabolites, like alkaloids, glycosides, tannins, volatiles oils and contain minerals and vitamins, possess medicinal properties [15]. Accordingly, the World Health Organization (WHO) consultative group on medicinal plants has formulated a definition of medicinal plants in the following way that: “A medicinal plant is any plant which, in one or more of its organ, contains substance that can be used for therapeutic purpose or which is a precursor for synthesis of useful drugs” [16].

The term “herbal drug” determines the part/parts of a plant (leaves, flowers, seeds, roots, barks, stems, etc.) used for preparing medicines. Furthermore, WHO [17] defines medicinal plant as herbal preparations produced by subjecting plant materials to extraction, fractionation, purification, concentration or other physical or biological processes which may be produced for immediate consumption or as a basis for herbal products. Medicinal plants are plants containing inherent active ingredients used to cure disease [18].

Medicinal plants constitute an important natural wealth of a country. They play a significant role in providing primary health care services to rural people. They serve as therapeutic agents as well as important raw materials for the manufacture of traditional and modern medicine. Substantial amount of foreign exchange can be earned by exporting medicinal plants to other countries. In this way medicinal plants play significant role in the economy of a country [16] . [4].

mentioned that 30% of the worldwide sales of drugs are based on natural products.

Besides this the reduced number of herbal drugs available against pathogenic fungi also makes it necessary to discover new classes of antifungals and compounds that inhibit their resistant mechanisms. This has led to the search for therapeutic alternatives, particularly among medicinal plants and compounds isolated from them, which are used for their empirically antifungal properties [19].

The medicinal plants are rich in secondary metabolites, the anti-inflammatory, antispasmodic, antianalgesic and antidiuretic can be attributed to their high steroids, tannins, terpenoids and saponins. As well, the secondary metabolites (Flavonoids and alkaloids) present in the plants are also used against the plant pathogenic fungi as they are found to be antifungal in nature [20, 21].

[22] Stated that the bioactive extract should be standardized on the basis of phytochemical compounds. Phytochemical screening of medicinal plants is very important in identifying new sources of therapeutically and industrially important compounds. It is imperative to initiate urgent steps for screening of plants for secondary metabolites.

Hence the present study was attempt to assess the status of phytochemical properties in leaves and stem bark of T. arjuna and T. undulata to use in pharmaceutical, nutraceutical and as a constituent in the formation of antifungal formulation against the plant pathogenic fungi of commercial importance.

Conflict of Interest:

None, Not any

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