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Preliminary Phytochemical Analysis of Traditionally used Medicinal Plants

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ABSTRACT

World plant biodiversity is the largest source of herbal medicine and still about 60-80% world population depend on plant based medicines. Phytochemicals present in plants are main source of medicines; hence the present study on preliminary phytochemical screening of some traditionally used medicinal plants. Qualitative phytochemical analysis of these plants confirm the presence of various secondary metabolites like alkaloids, anthroquinones, coumarins, emodins, fatty acids, flavonoids, glycosides, leucoanthocyanins, lignin's, phenols, reducing sugars, saponins, steroids, tannins and triterpenoids. The results suggest that the phytochemical properties for curing various ailments and possess potential anti-inflammatory, antimicrobial and antioxidant and leads to the isolation of new and novel compounds.

Keywords: Phytochemical screening, secondary metabolites, medicinal plants, phenols, flavonoids, lignins.

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INTRODUCTION

Plants have been utilized as medicines for thousands of years all over the world and are a source of many potent and powerful drugs. More than 35,000 plant species are used for medicinal purposes. Traditional medicines have become more popular in the treatment of many diseases due to popular belief that green medicine is safe, easily available and with fewer side effects [1]. The World Health Organization (WHO) estimated that 80% of the population of developing countries relies on traditional medicines, mostly plant drugs, for their primary health care needs [2]. Whether in the simple form of plant parts or in the more complex form of crude extracts, mixtures etc, Today a substantial number of drugs are developed from plants [3] which are active against a number of diseases.

Phytochemicals are responsible for medicinal activity of plants [4]. These are non-nutritive chemicals that have protected human from various diseases. Phytochemicals are basically divided into two groups that are primary and secondary metabolites based on the function in plant metabolism. Primary metabolites are comprise common carbohydrates, amino acids, proteins and chlorophylls while secondary metabolites consist of alkaloids, saponins, steroids, flavonoids, tannins and so on [5, 6]. Phytochemical constituents are the basic source for the establishment of several pharmaceutical industries. The constituents are playing a significant role in the identification of crude drugs [7]. Recently numbers of plants were screened for secondary metabolites for their medicinal values Svensonia hyderobadensis [8], Boswellia ovalifoliolata [9], Dysophylla myosuroides and Talinum cuneifolium [10], Memecylon umbellatum [11], Naringi crenulata [12], Momordica charantia [13], Andrographis neesiana [14], Indigofera heterantha [15], Dalbergia sisso [16] and Cephalotaxus koreana [17]. In this order we are studied, qualitative preliminary phytochemical analysis in 31 traditionally used medicinal plants.

EXPERIMENTAL

Collection and identification of Plant material

The plant samples were collected from Tirumala hills and different locations of Chittoor District. Taxonomic identification of the plants were carried out with the help of Gamble [18] and also compared with the herbarium present in Department of Botany, Sri Venkateswara University, Tirupathi, Andhra Pradesh, India.

Sampling of plant material

Fresh leaves of 31 different plant species free from diseases were collected during the month of May, 2011. The leaves were washed thoroughly 2-3 times with running tap water, leaf material was then air dried under shade, after complete shade drying the plant material was grinded in mixer, the powder were kept in small plastic bags with paper labeling.

Preparation of extract

The grinded leaf materials of 5g weighed separately using an electronic balance and were crushed in 25 ml of sterile water, boiled at 50-60^{0}C for 30 minutes on water bath and it was filtered through Whatman No.1 filter paper. Then filtrate was centrifuged at 2500 rpm for 15 minutes and filtrate was stored in sterile bottles at 5^{0}C for further use [19].

Phytochemical screening

The condensed extracts were used for preliminary screening of phytochemicals such as steroids, alkaloids, lignin and phenols [20]; fatty acids, glycosides, triterpenoids and saponins [21]; tannins, leucoanthocyanins and emodins [22]; reducing sugars [23]; anthroquinones [24], flavonoids [25]; and coumarins [26].

RESULTS AND DISCUSSION

The Phytochemical screening and qualitative estimation of 31 medicinal plants studied showed that the leaves were in rich phenols and lignins followed by flavonoids, reducing sugars and tannins (Table-1). Steroids, saponins, fatty acids and emodins are present in 14, 13, 13 and 11 plants respectively. Maximum numbers of secondary metabolites were found in Chloroxylon swietenia, Gmelina asiastica, Vitex negundo, Ixora coccinia, Gmelina arborea, Morinda pubescens, Tectona grandis and Leonotis nepetiifolia.

Alkaloid compounds are found in aqueous leaves extracts of A. viridis, C. swietenia, A. lanata, G. asiastica, E. heterophylla, J. angustifolium, S. nodiflora, T. grandis and T. bellirica. These are produced by large variety of organisms including bacteria, fungi, plants and animals; and are part of the group of natural products; some alkaloids have a bitter taste while many to toxic to other organisms [27]. Anthraquinons are present in C. inerme, C. swietenia, C. gigantea, G. asiastica, I. coccinia, T. grandis, V. negundo, O. indicum and L. nepetiifolia. Anthraquinones are used better stomach ache and in the treatment of diarrhoea [28] and these are an important chemical raw material and organic intermediates that are broadly applied in the field of dyestuff, papermaking, medicines, agricultural chemicals etc. [29]. Coumarins are absent in 27 plant species and present only G. arborea, M. pubescens, S. nodiflora and V. negundo leaves aqueous extracts. Various studies have been demonstrated that coumarins are potential antioxidants and their antioxidant activities are due to their ability to scavenge free radicals and to chelate metal ions [30]. Emodin compounds are absent in 20 plants and present in 11 plant species. Emodins isolated from a great deal at herbs are an effective constituent with many effects. Lots of pharmaceutical studies have demonstrated that emodins have many biological effects, such as anti-cancer, anti-microbial and anti-inflammatory effects [31]. Fatty acids and saponin compounds are found in 13 plant species. Traditionally saponins have been extensively used as detergents, as pesticides and molluscicides, in addition to their industrial applications as foaming and surface active agents and also have beneficial health effects [32]. Saponin has relationship with sex hormones like oxytocin. Oxytocin is a sex hormone involved in controlling the onset of labour in women and the subsequent release of milk [33].

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Table 1: Preliminary photochemical screening of traditionally used medicinal plants

S.No.	Name of the plant	Name of the secondary metabolite														
		Al	An	Co	Em	Fa	Fl	Gl	Le	Li	Ph	Re	Sa	St	Ta	Ti
1.	*Acalypha indica* L. **(Euphorbiaceae)**	-	-	-	-	+	-	-	-	+	-	+	-	-	-	-
2.	*Aerva lanata* (L.) Juss. ex Schult. **(Amaranthaceae)**	+	-	-	-	-	-	-	-	+	+	-	-	-	-	-
3.	*Amaranthus viridis* L. **(Amaranthaceae)**	+	-	-	-	+	-	-	-	+	-	+	+	-	-	-
4.	*Andrographis paniculata* (Burm.f.) Wall. Ex Nees in Wall. **(Acanthaceae)**	-	-	-	-	-	+	-	-	+	+	-	-	+	+	-
5.	*Bacopa monnieri* (L.) Juss. Ex Schult. **(Scrophulariaceae)**	-	-	-	-	-	-	-	-	+	+	+	+	-	+	-
6.	*Calotropis gigtantea* (L.) R.Br **(Asclepiadaceae)**	-	+	-	-	+	+	+	-	-	+	+	-	-	+	-
7.	*Chloroxylon swietenia* DC. **(Meliaceae)**	+	+	-	+	+	+	-	-	+	+	+	+	+	+	-
8.	*Clerodendrum inerme* (L.) Gaertn. **(Verbenaceae)**	-	+	-	-	+	+	-	-	+	+	+	+	-	+	-
9.	*Ecbolium viride* (Forssk.) Alston in Trimen. **(Acanthaceae)**	-	-	-	-	+	+	+	-	+	+	-	+	-	+	-
10.	*Euphorbia heterophylla* L. **(Euphorbiaceae)**	+	-	-	-	+	-	-	-	+	+	+	-	-	+	+
11.	*Givotia moluccana* (L.) Sreem. **(Euphorbiaceae)**	-	-	-	+	-	+	-	-	+	+	+	-	-	-	-
12.	*Gmelina arborea* Roxb. **(Verbenaceae)**	-	-	+	-	+	+	+	-	+	+	+	+	-	-	+
13.	*Gmelina asiastica* L. **(Verbenaceae)**	+	+	-	+	+	+	-	-	+	+	+	+	+	+	-
14.	*Ixora coccinia* L. **(Rubiaceae)**	-	+	-	+	+	+	-	+	+	+	+	-	+	+	-
15.	*Jasminum auriculatum* Vahl. **(Oleaceae)**	-	-	-	-	-	+	-	-	+	+	+	-	-	+	-
16.	*Jasminum grandiflorum* L. **(Oleaceae)**	-	-	-	-	-	-	+	-	+	+	+	-	+	+	-
17.	*Jasminum angustifolium* (L.) Willd **(Oleaceae)**	+	-	-	-	-	+	-	-	-	-	+	+	+	-	-
18.	*Lantana camara* L. **(Verbenaceae)**	-	-	-	-	+	+	-	-	-	+	+	-	+	-	-
19.	*Leonotis nepetiifolia* (L.) R. Br. **(Lamiaceae)**	-	+	-	+	-	+	-	-	+	+	+	+	+	+	-
20.	*Morinda pubescens* J.E. Smith **(Rubiaceae)**	-	-	+	-	-	+	+	+	+	+	+	-	+	+	-
21.	*Oroxylum indicum* (L.) Benth. ex Kurz. **(Bignoniaceae)**	-	+	-	+	-	+	-	-	+	+	+	-	-	+	+
22.	*Passiflora foetida* L. **(Passifloraceae)**	-	-	-	-	-	+	-	+	+	+	+	+	-	-	-
23.	*Pterocarpus santalinus* L.f. **(Fabaceae)**	-	-	-	+	-	+	-	-	+	-	-	+	+	+	-
24.	*Santalum album* L. **(Santalaceae)**	-	-	-	-	-	+	-	-	+	+	-	-	-	+	-
25.	*Stereopermum colaris* (Buch-Ham. Ex Dillw) Mabb. **(Bignoniaceae)**	-	-	-	-	-	+	-	-	+	+	+	-	+	+	-
26.	*Synedrella nodiflora* (L.) Gaertn. **(Asteraceae)**	-	-	-	+	-	+	-	-	+	+	+	-	-	-	+
27.	*Tecoma stans* (L.) Kunth. **(Bignoniaceae)**	+	-	-	+	-	+	-	-	+	+	+	-	-	+	-
28.	*Tectona grandis* L.f. **(Verbenaceae)**	+	+	-	+	+	+	-	-	+	+	+	-	-	-	+
29.	*Terminalia bellirica* (Gaertn.) Roxb. **(Combretaceae)**	+	-	-	+	-	+	-	-	+	+	+	-	-	+	-
30.	*Vernonia einerea* (L.) Less. **(Asteraceae)**	-	-	-	-	-	+	-	-	-	-	+	+	+	-	-
31.	*Vitex negundo* L. **(Verbenaecae)**	-	+	+	+	+	+	+	-	+	+	+	-	+	-	+

Note: Al – Alkaloids, An-Anthraquinons, Co-Coumarins, Em-Emodins, Fa-Fatty acids, Fl-Flavonoids, Gl-Glycosides, Le-Leucoanthocyanins, Li-Lignins, Ph-Phenols, Re-Reducing sugars, Sa-Saponins, St-Steroids, Ta-Tannins, Ti-Triterpenoids, '+' indicates present, '-' indicates absent.

Flavonoids and reducing sugars are found in 25 plants out of 31 plants and flavonoids are absent in the leaves of A. indica, A. viridis, B. monnieri, A. lanata, E. heterophylla and J. grandiflorum. Flavonoids are a group of polyphenolic compounds which influence the radical scavenging, inhibition of hydrolytic and oxidative enzymes and also act as anti-inflammatory agent [34]. The flavonoids show antioxidant activity and their effects on human nutrition and health is considerable. The mechanisms of action of flavonoids are through scavenging or chelating process [35, 36]. They also inhibit microbes which are resistant to antibiotics [37]. Flavonoids are free radical scavengers, super antioxidants and potent water soluble which prevent oxidative cell damage and have strong anti-cancer activity [38]. As antioxidants, flavonoids provide anti-inflammatory actions [39, 40]. Reducing sugars are absent in A. paniculata, E. viride, A. lanata, S. album, S. nodiflora and P. santalinus. Glycosides compounds are found in only C. gigantea, E. viride, G. arborea, M. pubescens, J. grandiflorum and V. negundo. Leucoanthocyanins are present in aqueous leaf extracts of I. coccinia, M. pubescens and P. foetida. Phenols and lignin compounds are identified in 26 plants and phenols are absent in A. indica, A. viridis, J. angustifolium, V. cinerea and P. santalinus. Primarily phenolic compounds are of great importance as cellular support material because they form the integral part of cell wall structure by polymeric phenolics [27], bioactive polyphenols have attracted special attention because they can protect the human body from the oxidative stress which may cause many diseases, including cancer, cardiovascular problems and ageing [41]. The phenolic compounds are one of the largest and most ubiquitous group of plant metabolites. A number of studies have focused on the biological properties such as antiapoptosis, anti-aging, anticarcinogen, anti-inflammation, anti-artherosclerosis, cardiovascular protection and improvement of the endothelial function, as well as inhibition of angiogenesis and cell proliferation activity [42]. Phenolic compounds have been extensively used in disinfections and remain the standards with which other bactericides are compared [43]. Deficiency of ascorbic acid is associated with pains in the joint and defect in skeletal calcification, anemia, manifestation of scurry hemorrhage from mucous membrane of the mouth and gastrointestinal track [44]. Lignins are absent in the aqueous extracts of leaves of C. gigantea, J. angustifolium, V. cinerea, S. nodiflora and L. camara. Lignins are significant components in the global carbon cycle; the resistance of lignin to microbial degradation enhances its persistence in soils [45]. Steroid compounds are found in 14 plant species. It should be noted that steroidal compounds are of importance and of interest in pharmacy due to their relationship with sex hormones [13]. Tannin substances are present in 18 plant species. Tannins contribute property of astringency i.e. fasten the healing of wounds and inflamed mucous membrane and have received considerable attention in the fields of nutrition, health and medicine, largely due to their physiological activity, such as antioxidant, antimicrobial and anti-inflammatory properties [46]. Tannins are complex moieties produced by majority of plants as protective substances; they have wide pharmacological activities and have been used since past as tanning agents and they posses astringent, anti-inflammatory, antidiarrhoeal, antioxidant and antimicrobial activities [47].

Triterpenoids are showed in E. heterophylla, G. arborea, T. grandis, V. negundo, T. stans and O. indicum. Triteripenoids which are attributed for analgesic and anti-inflammatory activities.

CONCLUSION

The medicinal plants appear to be rich in secondary metabolites, widely used in traditional medicine to combat and cure various ailments. The anti-inflammatory, antispasmodic, analgesic and diuretic can be attributed to their high phenols, tannins, triterpenoids, saponins and flavonoids. Exploitation of these pharmacological properties involves further investigation of these active ingredients by implementation of techniques like extraction, purification, separation, crystallization and identification.

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