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Traditional utilization and phytochemical analysis of medicinal herb *Exacum* Linn. from central Western Ghats

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ABSTRACT

In the present study, we focused on the traditional utilization and phytochemical screening of *Exacum* Linn., a traditional medicinal herb in the Western Ghats of Karnataka, India. There are five species of *Exacum viz*., *E. bicolor*, *E. pedunculatum*, *E. lawii*, *E. carniatum* and *E. pluminum* reported from Western Ghats of Karnataka. *Exacum* species were used to treat fever, dysentery, sore throat in addition to treat cough, body pain and eye diseases. Analysis of methanol and aqueous extracts showed the presence of phytochemicals such as flavonoids, saponins and alkaloids.

Keywords: *Exacum*, Western Ghats, Traditional uses, Phytochemical

Introduction

India is a country rich in both ethnic and biodiversity. It offers immense scope for ethnobotanical studies [1]. Various communities use vast number of the plant species in ethnomedicine and in general over 7500 species are utilized in primary health care by various tribes [2]. Plants are able to synthesize wide range of chemical substances (secondary metabolites), which are not necessarily involved in the essential metabolism of the cells. Therapeutic properties of the plants are mainly due to chemical substances such as alkaloids, phenolic compounds and terpenoids. It is essential to pay more attention especially towards medicinal plants, whereby investigation may add new safe and side-effect free drug to the world's pharmacopoeia before they are lost forever [3]. Traditional methods, especially the use of medicinal plants, still play a vital role to cover the basic health needs in the developing countries and moreover the use of herbal remedies has risen in the developed countries in the last decades [4].World plant biodiversity is the largest source of herbal medicine. It is estimated that about 60-80% of world population rely on plant based medicines which are being used since the ancient ages as a traditional health care system. It is now clear that the medicinal value of these plants lies in the bioactive phytochemical constituents that produce definite physiological effects on the human body. These natural compounds formed the base of modern drugs as we use today [3,4]. Documentation of traditional knowledge of the medicinal uses of plant species has been considered a high priority and can lead to the discovery of drugs benefiting mankind [6,7]. *Exacum* Linn. (Gentianaceae) is one of the plant genera being used in the traditional health care system in Karnataka. The plant grows to a height of 40-100cm; the flowers are blue or lilac in color, the flowering takes place in September to December [5]. As there have been few previous reports of *Exacum* use in the Western Ghats, the present study was undertaken to document the local ethnobotanical knowledge and the use of *Exacum* by the various communities and also to screen phytoconstituents present in various *Exacum* species.

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Materials and methods

Collection and identification of plants

The plant materials were collected randomly from the grasslands of Bababudangiri, Mullayyanagiri, Kemmanugundi, Kodachadri, Hulikal region of

Chikamagalore and Shimoga district, Karnataka. The plants were identified by referring various floras [5,8,9]. We collected the traditional uses of the plants from the traditional herbal healers by questionnaire method.

Extraction and phytochemical analysis

The collected plant materials were shade dried for 15-20 days (to avoid denaturation of active compounds) and powdered in a blender. 50g of dried flower materials taken in separate conical flasks were added with 100ml of solvents (methanol and distilled water). The flasks were plugged with cotton wool and left for 72 hours. The flasks were stirred occasionally. The content of each flask was passed through 4-fold muslin cloth followed by Whatman filter paper and the solvents were evaporated. The sticky greenish extracts obtained were stored in refrigerator [10,11]. Phytochemical analysis was carried out to screen for the presence of major phytoconstituents *viz*., glycosides, alkaloids, tannins, flavonoids, saponins, triterpenes and steroids [12].

Results and discussion

Description of plant

Exacum is a herbaceous plant, sometime sub-shrubby in nature and much branched; leaves opposite, entire, usually 3 or more–ribbed; flowers are in terminal and axillary usually dichasiodial cymes, calyx deeply 4-5 lobed, stamens 4-5, inserted, ovary 2 celled, ovules many in each cell on large flashy placenta adnate to the septum, style long, stigma small, seeds many and minute. Distribution of various *Exacum* species in Western Ghats of Karnataka is shown in Table 1.

Table 1: Distribution of *Exacum* species in Western Ghats of Karnataka

Name	Distributed areas
E. bicolor	Nittur, Sampekatte ,Kodachari, Savahaklu, Sringeri, Kerekatte, Kudremukh and Kemmannugundi in Grassy pastures above 3000ft
E. pedenculatum	Distributed in all plain district. They found in Samse, Malleshwara, Sampekatte, Tunghabhadra forest, Kerekatte in grassland of ever green forest, Bileshvara, Kemmannugundi 5100ft, Kudremukh, Hebbegiri and Savehaklu
E. lawii	Found up to 4000ft in Bababudangeri and Mullayanageri
E. carniatum	Hulikal
E. sessile	Rare in Yedur and Hebbegiri

A total of 30 elders and traditional medicinal practitioners in the study area were interviewed and information was collected on the *Exacum* collection method, the preparation, value and use of the *Exacum*. Most of the practitioners collected the *Exacum* from forests as necessary. The traditional healers they collect the plant from forest regions and wash it with water to remove the soil particles and soak whole plant in water and boiling then filtered it. The filtrate is directly used as syrup and also some healers mix this juice with other ingredients and oils then used for cure the body pain like analgesics and also used as a cooling agent to reduce body heat. Based on our field survey the plants are used for to treat fever, dysentery and sore throat in addition it is also used to treat cough, body pain and eye diseases. Table 2 shows the traditional uses of various *Exacum* species in Western Ghats of Karnataka.

Table 2: Uses of *Exacum* species in different parts of Western Ghats of Karnataka

Name	Uses
E. bicolor	Plant pacifies vitiated pitta, inflammation, hemorrhage, fever and burning sensation and also it is used as a tonic, febrifuge, stomachic and skin disease, used as anti diabetic
E. pedunculatum	Decoction of this whole plant is taken for fever and also used for dysentery. Some time it is used as a substitute for chiretta and gentian
E. lawii	It is having laxative properties and the powder of this plant is given to kidney disorders
E. carniatum	Decoction of this whole plant is used for fever
E. pluminum	This plant is used to treat diabetes

The result of preliminary phytochemical screening of five species *Exacum* is shown in Table 3. Highest and least extract yield was obtained in case of *E. bicolor* and *E. sessile* respectively. The result revealed that both solvent extracts of all species contained flavonoids. In comparison with methanol extract, aqueous extract showed the presence of fewer secondary metabolites. Steroids, glycosides and tannins were not detected in both solvent extracts of all species. Triterpenes were not detected in aqueous extract of all species. It may be attributed to relative solubility of phytochemicals in these two solvents.

Table 3: Yield and results of phytochemical screening *Exacum* Linn.

Species	Yield (%)		Methanolic extract							Aqueous extract						
	M	**Aq**	**A**	**F**	**G**	**S**	**St**	**T**	**Tr**	**A**	**F**	**G**	**S**	**St**	**T**	**Tr**
E. bicolor	3.0	3.2	+	+	-	+	-	-	+	-	+	-	-	-	-	-
E. pedunculatum	2.8	2.7	+	+	-	+	-	-	+	-	+	-	-	-	-	-
E. lawii	2.8	2.4	+	+	-	-	-	-	-	-	+	-	+	-	-	-
E. carniatum	2.0	1.6	-	+	-	+	-	-	+	-	+	-	-	-	-	-
E. sessile	1.7	1.5	+	+	-	+	-	-	-	+	+	-	-	-	-	-

(M- Methanol; Aq- Aqueous; A- Alkaloids; F- Flavonoids; G- Glycosides; S- Saponins; St- Steroids; T- Tannins; Tr- Triterpenes; '+' detected; '-' not detected)

Affinoside, an acetophenone glycoside, was isolated from the aerial parts of *E. affine* and its structure was found to be 2-O-primeverosylpaeonol [13]. The extraction of *E. tetragonum* furnished the secoiridoids gentiopicroside and methyl grandifloroside [14]. Two flavonoid compounds, luteolin and chlorogenic acid were detected in *E. bicolor* by HPLC [15]. Compounds belonging to alkaloid, polyphenolic and glycoside group were detected by GCMS analysis of whole plant extract of *E. bicolor* [16]. The study of Ashwini and Majumdar [17] showed the presence of various phytochemicals such as phenols, saponins, flavonoids and alkaloids in different solvent extracts of leaf of *E. bicolor*. Similarly, our study also showed that the flower extracts of different species of *Excaum* contained phytochemicals such as flavonoids and alkaloids. Traditional medicine remains the primary healthcare system in various communities across the world. Many plant species are widely used as remedies for treating multiple ailments. *Exacum* species have been used traditionally to treat several diseases or ailments. The decoction made from whole plant of *E. pedunculatum* was taken to treat fever with dysentery in Paliyan tribes of Sirumalai hills of southern India [18]. Medico-botanical survey of Kumar parvatha of Kukke Subramanya, Karnataka carried out by Shiddamallayya *et al*. [19] showed the utilization of whole plant of *E. bicolor* as tonic and stomachic. In Ambalabe rural community of Madagascar, the decoction made from the leaves of *Exacum quinquenervium* is taken orally to treat diarrhea [20]. Our study showed that the *Excaum* species are used for the treatment of various ailments such as fever and inflammations in Western Ghats of Karnataka and this indicates that the plant can be used for preparation of drugs related to treat fever and body pains. The possible therapeutic role these *Exacum* species could be ascribed to the presence of various phytochemicals that have been detected in the extracts.

Conclusion

Traditional knowledge is a vital tool for conservation of plant genetic resources. The present study showed the traditional utilization of various *Exacum* species for the treatment of several ailments in Western Ghats of Karnataka, India. Preliminary phytochemical analysis of flower extracts of *Exacum* species revealed the presence of phytoconstituents such as alkaloids and flavonoids which may account for the therapeutic efficacies of the plant species. Further studies are warranted for recovery of bioactive principles from *Exacum* species and their therapeutic potentials.

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