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REVIEW ON PHYTOCHEMICAL INVESTIGATION OF *CADABA FRUTICOSA*

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ABSTRACT

The past decade shows the importance of plants in the field of medicine, by helping to fight against the various diseases. *Cadaba fruticosa* is one of the most important medicinal plants, found in the tropical region of Indian sub-continent. Plant medicinal value proves by its phytochemical analysis which includes alkaloids, simple phenolics, flavanol, flavones, leucoanthocyanin, saponins and steroids along with minerals including sodium, potassium, calcium, iron, magnesium, aluminum, manganese, copper, nickel, chromium and zinc.

Keywords: *Cadaba fruticosa*, phytochemistry, secondary metabolites, medicinal use

INTRODUCTION

Plants based medicines have been used for many centuries. In many developing countries herbal medicines are used by majority due to strong confidence on traditional methods of treatment as well low cost and easily accessibility. However most recently herbal medicines are getting popular globally as replacement for modern pharmaceutical medicines **[1]**. During the last decade, use of traditional medicine has prolonged globally and has gained attractiveness. With its expanded use, quality control, safety and efficacy of herbal medicine have become major concern of public and authorities **[2]**. Significant research work is still required to develop standard methods for QC of herbal and alternative medicines. Due to the unavailability of pharmacopoeial data on the variety of plant extracts, isolation and standerization of active constituents responsible for desired results is difficult **[3]**. Phytochemical screening of medicinal

plants is therefore of vital importance for the development of new, efficient and targeted drugs **[4]**. The major Reactive Oxygen Species (ROS) have significant roles in cell signaling and homeostasis **[5]**. However there number increases due to environmental stress causing damages to cell structure like loss of membrane integrity, cell injury and cell death. Many medical condition including diabetes and its vascular complications **[6]**, cancer **[7]**, cardiovascular diseases **[8]**, inflammatory diseases **[9]** are generated and accelerated due to the generation of ROS. These kinds of diseases may be controlled and even treated by herbal medicines. Plants having bioactive components including flavonoids, phenolic compounds, tannins, alkaloids and saponins may be explored for herbal medicines **[5]**.

Cadaba fruticosa member of Capparacae family commonly known as 'vizhuthi' in tamil and 'Capper bush' in english is distributed throughout the world in mostly tropical and sub-tropical regions **[10]**. In Indian subcontinent *C. fruticosa* is found in Punjab, central and western India, Gujarat, Tamilnadu and Karnataka, widely in Tamil nadu's northern districts and is being utilized in siddha medicine for long **[11]**. Juice of leaf is used traditionally for the treatment of general weakness, dysentery and diarrhea **[12]**. It is also used for treating gonorrhea, syphilis **[13]** and rheumatism **[14, 15]**. It is used in gastrointestinal and urine complaints and as vermicide **[16, 17, 18]**. Leaves are anti-diabetic **[19]** and antipyretic **[20]**. It also possesses antimicrobial activity **[21]**. Leaf juice is used as eye drops by the ethnic people of Andhra Pradesh **[22]**. It is also used as an antidote against poisoning in Padukkotai District of Tamilnadu **[23, 24]**. The roots of plant possess similar medicinal properties like leaves. The root preparation is used in anthrax. The flower buds are stimulant, antiscorbutic, and purgative, emmogogue, antiphlogistic and anthelmintic especially for round worm **[25]**.

Phytochemical investigation of aqueous extract of the leaves of *C. fruticosa* revealed the presence of furals, flavonoids and terpenoids while phenols, gums, flavonoids, saponins, sugars, terpenoids, alkaloids and steroids were present in the alcoholic extract **[19]**. Presence of these biologically active components in *C. fruticosa* may render antioxidant property to it.

Heavy Maetals and Trace elements using ICP-MS

As a medicinal plant it has heavy and trace elements which plays an important role for the treatment of various diseases, like iron, copper, manganese, zinc, cobalt, calcium, sodium, potassium, magnesium and aluminium and heavy metals chromium, cobalt, copper, zinc, cadmium, nickel etc. Varied quantities of these trace elements in different medicinal plants may be correlated for the treatment of diseases develop by body due to deficiency or excess of these elements. A study has been carried out to evaluate the quantities of these trace elements by P Ramachandra Reddy and *et al* on the leaves of *C. fruticosa* using Inductively Coupled Plasma-mass Spectroscopy (ICP-MS) **[26]**. The study was conclusive of the fact that the leaves of *C. fruticosa* is secure drug and promising source of herbal medicine as the heavy metals were found to be in permissible limits of WHO and FDA whereas trace elements were in amounts considerable for the management of various disorders.

Table 1: Heavy and Trace Elements Found in *Cadaba fruticosa (L.) Druce*. Leaf

S. No.	Elements	Concentrations in ppm
Heavy Metals		
1.	**Selenium**	**0.522**
2.	**Lead**	**1.119**
3.	**Arsenic**	**0.139**
4.	**Cadmium**	**0.111**
5.	**Chromium**	**17.171**
6.	**Nickel**	**2.285**
Trace /Mineral Elements		
1.	**Iron**	**35.207**
2.	**Copper**	**0.046**
3.	**Manganese**	**16.543**
4.	**Zinc**	**14.168**
5.	**Cobalt**	**0.046**
6.	**Calcium**	**5106.048**
7.	**Sodium**	**1548.524**
8.	**Potassium**	**6802.406**
9.	**Magnesium**	**3039.73**
10.	**Aluminum**	**24.681**

GC-MS analysis

Another study **[27]** for the identification of the phytochemical constituents present in the ethanolic extract of the aerial parts of *C. fruticosa* was carried out using GC-MS analysis. Twenty compounds were separated on GC chromatogram and were identified through mass spectrum. The library used for detection was of NIST ver. 2.0 year 2005.

Table 2: Phytochemicals Present in the Ethanolic Extract of the Aerial Parts of *C. fruticosa*

S#	Name	M.W	M. Formula	Nature of Compound	R.T	% age	Reported Activity
1.	2-Tridecen-1-ol,(E)-	198	$C_{13}H_{26}O$	Alcohol	11.02	16.23	No activity reported
2.	Pyrrolidine, 1,1'-methylenebis-	154	$C_9H_{18}N_2$	Pyrrolidine	11.27	11.91	No activity reported
3.	1,6-Anhydro-3,4-dideoxy-á-D-manno-hexapyranose	130	$C_6H_{10}O_3$	Anhydrous sugar	11.90	3.91	No activity reported
4.	Phytol	296	$C_{20}H_{40}O$	Diterpene	14.16	19.39	Anticancer Anti-inflammatory Antimicrobial, Diuretic
5.	5,10-Dioxatricyclo [7.1.0.0(4,6)]decane	140	$C_8H_{12}O_2$	Epoxide	14.77	1.87	No activity reported
6.	Azonia-5-hexene-1-ol, N,N-dimethyl-, carbamate ester, bromide	173	$C_8H_{17}N_2O_2$	Carboxylic	16.70	0.49	No activity reported
7.	3-Hexadecycloxycarbonyl-5-(2-hydroxyethyl)-4-methylimidazolium ion	409	$C_{24}H_{45}N_2O_3$	Amino	19.15	1.43	Antimicrobial
8.	Octane, 1,1'-oxybis-	242	$C_{16}H_{34}O$	Alkane	20.54	1.19	Antistatic agent
9.	Octadecane, 1-(ethenyloxy)-	296	$C_{20}H_{40}O$	Ether	21.89	2.14	Antisepsis
10.	1,2-15,16-Diepoxyhexadecane	254	$C_{16}H_{30}O_2$	Epoxide	23.23	4.38	Cytotoxicity
11.	2,6,10-Dodecatrien-1-ol, 3,7,11-trimethyl-	222	$C_{15}H_{26}O$	Sesquiterpene Alcohol	23.42	1.73	Antimicrobial, Anti-inflammatory, Anti hyperlipidemic
12.	Methoxyacetic acid, 3-tridecyl ester	272	$C_{16}H_{32}O_3$	Ester	24.55	3.24	Cytotoxicity
13.	3-Trifluoroacetoxypenta decane	324	$C_{17}H_{31}F_3O_2$	Acetate	25.84	1.62	No activity reported
14.	(Bicyclo[3.3.1]nonan-9-one,1,2,4-trimethyl-3-nitro-(2-endo,3-exo,4-exo)-(.+-.)-	225	$C_{12}H_{19}NO_3$	Nitrogen	26.74	1.67	Antimicrobial
15.	Heptadecane, 2,6,10,15-tetramethyl-	296	$C_{21}H_{44}$	Alkyl	27.12	2.77	Sex hormone in algae
16.	(1-Ethyl-3,7-dimethylocta-2,6-dienylthio) benzene	274	$C_{18}H_{26}S$	Amino	27.63	1.87	No activity reported
17.	Z,Z,Z-4,6,9-Nonadecatriene	262	$C_{19}H_{34}$	Alkene	30.47	7.18	Antioxidant
18.	1,3-Bis-(2-cyclopropyl,2-methylcyclopropyl)-but-2-en-1-one	258	$C_{18}H_{26}O$	Ketone	31.00	4.61	No activity reported
19.	(1-Naphthalenepropanol,à-ethyldecahydro-5-(hydroxymethyl)-à,5,8a-trimethyl-2-methylene-, [1S-[1à(S*),4aá,5à,8aà]]-	308	$C_{20}H_{36}O_2$	Poly hydroxyl	31.37	1.82	No activity reported
20.	Androstan-3-one,17-hydroxy-2,4-dimethyl-,(2à,4à,5à,17á)-	318	$C_{21}H_{34}O_2$	Steroids	31.94	10.55	Formation of 5alpha-dihydrotestosterone

R. Radha and *et al* carried out phytochemical analysis of the ethanolic and water extract of leaves of *C. fruticosa* [19] The alcoholic extract exhibit positive tests for terpenoids (Noller's test), flavones (Shinadow's test), steroids (Libermann-Burchard test), proteins (Biuret test), alkaloids (Dragendroff's reagent), Gum (5% ferric chloride), saponins (Frothing test), and sugars **[28]**, while water extracted showed presence of terpenoids, flavones, proteins, furan, gum and sugars. These extracts were then subjected for hypoglycemic activity in wistar rats (160-200 g). The alcohol extract showed significant plasma glucose lowering effect at dose 1000 mg/kg when compared to the same dose of aqueous extracts.

Table 3: Anti-diabetic Activity of Alcohol and Aqueous Extract of *C. fruticosa*

Diabetic rats treated with	Blood sugar level in mg/dl (days)				
	3rd	6th	9th	12th	15th
Aqueous extract of *Cadaba fruticosa* 1000 mg/kg	237±4	194±4	168±2	143±4	124±3
Alcoholic extract of *Cadaba fruticosa* 1000 mg/kg	233±4	188±5	142±2	124±3	103±3
Glibenclamide 10 mg/kg	274±2	232±5	163±4	153±3	91±2

Values are mean ± S.D. p<0.001 statistical evaluation

Antimicrobial and Antioxidant Activities

In a study by *Rajeswari et al. in vitro* antimicrobial and antioxidant activities of the leaf extracts of the *C. Fruticosa* were evaluated **[29]**. For the antimicrobial activities of the aqueous and methanolic extracts of leaves of *C. fruticosa* different bacterial strains including *Staphylococcus aureus*, *Streptococcus pyogenes*, *Escherichia coli*, *Klebsiella pneumoniae*, *Salmonella typhi* and *Pseudomonas aeruginosa* obtained from MTTC were used. The extracts were evaluated by disc diffusion method of Kirby Bauer and compared with that of the standard antibiotic cefotaxime. Most of the bacterial test strains used in this study was inhibited by the extracts however the methanolic extract was more effective then aqueous extract and has significant amount of antimicrobial activity.

Table 4: Antimicrobial activity of the Leaf Extracts of *C. fruticosa* and Cefotaxime on the Selected Bacterial Strains

Microorganism	Aqueous extract (µg/ml perdisc)		Methanolic extract (µg/ml perdisc)		Cefotaxime
	100	200	100	200	
Staphylococcus aureus	-	9	10	14	23
Streptococcus pyogenes	-	8	9	13	28
Escherichia coli	8	11	11	14	25
Klebsiella pneumonia	-	9	9	12	24
Salmonella typhi	9	11	11	15	25
Pseudomonas aeruginosa	8	12	7	11	26

The diameter zones of inhibition are reported in mm; (-) indicates resistance

Phenolic compounds are significant in human diet as they possess antioxidant properties. They contain aromatic ring with one or more hydroxyl groups in their structure. Being hydrogen donors they are good antioxidants **[30]**. The major components of phenolic content in plants are flavonoids **[31]**. The total phenolic content of the methanolic extract of the leaves of *C. fruticosa* was determined by Singleton *et al*. **[32]** and was found to be 39.8 ±1.92 mg GAE/g (dry basis).

The DPPH scavenging activity of the methanolic extract was determined by the method of Blois **[33]**. A decrease in the absorbance of DPPH was observed with increasing concentration of the extracts showing that the leaves of *C. fruticosa* are a source of natural antioxidants. However the DPPH scavenging activity of the methanolic extract of *C. fruticosa* was lesser than that of quercertin.

Reducing power is also an important measure of the antioxidant potential of many medicinal plants **[34]**. The reducing power of the methanolic extract of *C. fruticosa* was determined by the method of Oyaizu **[35]** and showed dose-dependent reducing power indicating good antioxidant property.

CONCLUSION

In this article, *cadaba fruticosa* phytochemistry, and medicinal importance are described. Different activities from the secondary metabolites of the *C fruticosa* describe its medicinal importance. It has flavonoids, terpenoids, alkaloids, tannins, flavones, saponins and steroids which are the source of its anticancer, ant diabetic agent.

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