

Phyto-Pharmacological Perspective of *Cadaba farinosa* forsk

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ABSTRACT

Cadaba farinosa Forsk also known as Indian Cadaba belonging to family Capparaceae is widely distributed all over the globe especially in arid area. It was used in folk medicines for the treatment of purgative, anthelmintic, antisyphilitic, emmenagogue, aperients, as a stimulant, antiscorbutic, antiphlogistic and established its potency against liver damage, cancer and oxidation in body. Several chemical constituents like Cadabicine, Cadabicine methyl ether, Cadabicine diacetate, α , β -Dihydroferulic acid, capparisine, cadibicilone, aromatic acid and kamphefrol are present in abundant amount in plant. Along with, it is wealthy in mineral and amino acid which are valuable for human and essentially for cattle's. But, its pharmacological potentials such as purgative, anthelmintic, antisyphilitic, emmenagogue, aperients, stimulant, antiscorbutic, antiphlogistic are not yet explored. Thus, present review explores the traditional uses, chemical constituents, pharmacological activity, toxicity and mineral analysis.

Keywords: Cadabicine, *Cadaba farinosa*, Capparaceae.

INTRODUCTION

The use of herbs as medicine is the oldest form of healthcare known to humanity and has been used in all cultures throughout history.¹ Medicinal plants are the back bone of folk medicine. In fact, they are the oldest friend of humans.² According to the WHO more than 80% of the world population, mostly in third world rely on herbal/traditional plant based medicines for their prime healthcare needs.³ Herbal medicines are in a wide variety of forms for their therapeutic value. Herbal plants produce and contain a variety of chemical compounds that are used to prevent and treat

diseases or promote health and well-being.⁴ Traditional medicine are derived from medicinal plants, minerals and organic matter and they are the sum total of knowledge, skill and practices based on theories, beliefs and experiences indigenous to different cultures that are used to maintain health as well as prevent, diagnose, improve and treat physical and mental illnesses.⁵

In developed countries, modern medicines are prominently used. The herbal drugs are prepared from medicinal plants only. India is plentifully endowed with wide variety of plant having medicinal

significance. Traditionally, the use of plant preparation as sources of drug are based on the knowledge and superstitions passed from generation to generation.⁶ These plants are widely used by all segment of society either directly as folk remedies or as pharmaceutical preparation of modern medicine. Medicinal plants illustrate enormous efficacy against acute and severe diseases.

Cadaba farinosaforsk (Capparaceae) also known as Indian *Cadaba* is widely distributed in arid area worldwide. It is full of minerals and amino acids which is beneficial for cattle's as well as human being. It is extensively used as food by animal. It is notorious to world since ancient period. It is ample of pharmacological actions as mentioned in 'Ayurveda and Siddha' – an ancient Indian system of medicine but its medicinal potentials are not satisfactorily studied yet.

TAXONOMICAL CLASSIFICATION

Kingdom: Plantae
Subkingdom: Tracheobionta
Super division: Spermatophyta
Division: Magnoliophyta
Class: Magnoliopsida
Subclass: Dilleniidae
Order: Capparales
Family: Capparaceae
Genus: *Cadaba* Forsk.
Species: *farinosa*⁷

General description of *Cadaba farinosa* Plant Introduction

Plant name : *Cadaba farinosa, forsk*⁸
Synonym : *Cadaba indica, Lamk.*⁹
Family : Cappariraceae(Capparidaceae).

Vernacular names Local Names

English: Indian *cadaba*
Gujarat: Kalokattiyo, Khordu
Hindi: Kodhab, katagum, Dabi¹¹
Kannad: Chegaviche
Malayalam: Kattagatti
Marathi: Kalitaka, Kalitakal
Tamil: Velivi, Viluttu
Telugu: Adamorinika, Chekarodi¹²

Exoticnames

Fula: baggahi
Hausa: bagayi
Somali: caanamacays, ditab, dornai, qalaanqaal
Swahili: kibilazi-mwitu, mvunja-vumo
Wolof: debarka, n'debarghe
Niger: Balamji
Kenya: Kalkacha, tchen-tchen
Senegal: Ndeybarga¹⁰
Arabic: Asal, Sarah

BOTANICAL DESCRIPTION

Cadaba farinosa Forsk belong to the family Capparidaceae (capparaceae). It is a middle sized family with 45 genera and nearly 600 species which are distributed throughout the world, mostly in tropical and subtropical region. The capparidaceous plants are usually herbs, erect or scandent, shrubs and rarely trees. The genera *cadaba* is represented by 30 species. The genus derived its title from "kadhab"-an Arabic name for the *cadabarotundifolia* of forskl, who mentions *cadaba farinosa* as a medicinal plant. *Cadaba farinosa Forskis* an unarmed shrubs or trees withholder, smooth, purplish, younger, pubescent, yellowish brown Stems. The Leaves are entire, simple, silvery gray and with simple scales. They are mucronate dull green, reticulately veined; base rounded having 12-35 by 8-12 mm oblong or elliptic-oblong and rarely ovate in size. The petioles are 2.5-4 mm

long. The flowers are dirty white or whitish green to yellow, develop at the tips of the branches (terminal) on apical racemes, 15 mm across and in few flowered, terminal at one sided. The upper flowers contain corymbose racemes. The flowers are with four petals which are very pale yellow, spatulate, equaling the sepals with long claws. They are 8-9 mm long, oblique mouth, pale, rose colored, toothed at apex. The Sepals are 8-13 mm long, having two outer boats shaped, valvate, ovate, acute petaloid, all pubescent outside. The Stamens are 4 or 5 in number inserted about half way up the gynophores and having 9-18 mm long pedicels with pubescent bracts minute subulate. The flower have long filamentous ovary- oblong on gynophores, 17- 23 mm long style. Shrubs or small trees of *Cadaba farinosa* are usually with no spines but branches sometimes end sharply and grow in dry short grass savanna. Fruit are 2.5 cm by 3 mm in size with cylindrical, irregularly torulose, glabrous or pubescent containing many seeds. The Seed of plant are covered in a bright orange membrane strait, surrounded by orange red-aril. Wood is white, turning light yellow on ageing.¹¹ It is moderately hard and heavy (wt, 820 kg/m³), closed and straight to slightly twisted grained, and even fine textured. It is suitable for turnery articles.¹² The Bark of plant contains a fiber.¹³

HABITAT AND DISTRIBUTION

Natural Habitat

Cadaba farinosa is mostly distributed throughout the world mostly tropical and sub-tropical regions. It is a common shrub of the arid plains of Sind and Baluchistan provinces of Pakistan. They are common not only in large depressions but also found on sandy silts of valleys, around temporary ponds and on stabilized dunes,

where there is subsoil rich in fine particles containing termite mounds.¹²

Native (other countries)

Cadaba farinosa are found in Angola, Cameroon, Democratic Republic of Congo, Egypt, Ethiopia, India, Kenya, Niger, Saudi Arabia, Senegal and Somalia. Also tropical and Sub tropical regions of Africa, Asia, Australia

Native (In India)

Cadaba farinosa are found in Punjab, central and western India, Gujarat, konkan, Deccan area, southwards Vizagapatam and Karnataka.

Biophysical limits

Altitude: 0-1600 m

Mean annual temperature: 29°C

Mean annual rainfall: 200-500 mm

Soil type: Plant mainly shows its presence in heavy soils along with rocky screeds.

Propagation methods: *Cadaba farinosa* regenerates naturally by way of seeds.

Reproductive Biology

Cadaba species belongs to hermaphroditic category whose flowers and fruit appear at the end of the rainy season and the beginning of the dry season.¹⁴

PHARMACOGNOSTIC CHARACTERS

The pharmacognostic characters in the root and root bark of *Cadaba farinosa* Forsk shows some basic cell like parenchymatous cells of cortex, collenchymas, sclerenchyma, epidermis, xylem, phloem, periderm etc. Along with some cell inclusion such as starch grains, calcium oxalate crystals, calcium carbonates, alureon grains, scattered masses of scleriods and non-collapsed phloem. Prismatic crystals are also sparsely seen in the cortical cells.¹⁵

PHYTOCHEMICAL STUDIES

Cadaba farinosa contains large number of active constituent like Alkaloids, Sugar, Carbohydrates, glycoside, Protein, Amino acid, Flavonoid, Saponin, Tannins, Phenolic compounds, Gums, mucilage and Steroids. *Cadaba farinosa* as many active phytoconstituents such as non-tannin phenolicskaempferol²¹, new spermidine alkaloid Cadabicine, L-Stachydrine and 3-hydroxystachydrine, 3-hydroxystachydrine²², three novel spermidine alkaloids one Capparisine and an aromatic acid, α,β -Dihydroferulic acid, novel sesquiterpenoid Cadabicine methyl ether and Cadabicine diacetate, besides a sesquiterpene, cadibicilone.²³ It also contains 3(4-formylphenoxy)-4-methoxybenzaldehyde, Methyl cinnamate, methyl ferulate ether, ether of p-cinnamic acid-m-ferulic acid, Thiazolidine compound.^{19,24} It also shows the presence of quercetin, isoorientin, hydroxybenzoic acid, syringic acid, vanillic acid and 2-hydroxy-4-methoxy benzoic acid.²⁵

TRADITIONAL USES

The young leaves and twins of *Cadaba farinosa* are edible and also used in spicing and flavoring food. Twins with leaves are pounded with cereals and eaten as cake or pudding in Nigeria. They are also boiled and made into gruel. The whole plant is used as fodder by all livestock except horses and donkeys, particularly during the dry season. Camels are the main consumers, since other species find it difficult to reach the foliage. Buffalo, black rhino and hartebeests also seek the foliage.¹⁶ The fodder has 30% protein content with digestibility *in-vitro* value of 78%. *Cadabafarinosa* also possess high ash content. The plant also provides fuel wood. Crushed leaves mixed with millet-

flour are used as a medicine against coughs. The Fruit are edible.¹⁷

ETHNO-MEDICINAL USES OF *Cadaba farinosa*

The whole plant is purgative, anthelmintic, antisyphilitic, emmenagogue, aperients, stimulant, antiscorbutic, antiphlogistic. It is also used in treatment of cough, fever, dysentery and as an antidote against poisoning. Leaves are externally used to relieve rheumatic pain and as a poultice to boil to promote suppuration along with a leaves of odina woodier.⁹ The boiled leaves are eaten as an anthelmintic; decoction with other ingredients is employed in the treatment of amenorrhea, dysmenorrhea and uterine obstruction, decoction of leaves with myrobalans and ginger or with a senna and Epsom salt given as purgative and antiphlogistic in syphilis, scrofula and rheumatism. The root of plant posse's similar medicinal properties like leaves, the root preparation is used in anthrax. The flower buds are stimulant, antiscorbutic, purgative, emmagogue, antiphlogistic and anthelmintic especially for round worm¹⁸. The ash of plants is rubbed into skin to relieve general body pains¹⁹.

TOXICOLOGICAL AND SAFETY ASSESSMENT

In 1943, S.J. Vander Walt and D. G. Steyn reported that the genus *Cadaba* has toxicity²⁰, but Telrandhe U.T. *et al* in 2010 reported that the different solvent extracts were administered orally with increasing dose and was found safe up to dose of 2000 mg/kg for all extract in experimental animals. No clinical signs and mortality of animals was observed.¹⁵

MINERAL AND AMINO ACID CONTENT OF *Cadaba farinosa*, Forsk

The leaves of *Cadaba farinosa* contained the highest amount of Calcium (12.2 mg/g dry weight) and stems and leaves also contain a reasonable amount of bone building minerals. It also contained nutritionally significant amount of copper, iron, magnesium, manganese, phosphorous, zinc, chromium, and molybdenum (Table 1). The stems and leaves of *Cadaba farinosa* contain 8.32 and 14.8 % of protein. (Table 2)¹⁰

PHARMACOLOGICAL ACTIVITY OF *Cadaba farinosa*

Hepatoprotective activity

The (250 and 500 mg/kg) of ethyl acetate and aqueous fraction of *Cadaba farinosa*, Forsk shows significant hepatoprotective effect against CCl₄ induced hepatotoxicity in rats. The activity was evaluated by the estimation of SGOT, SGPT, ALP, Gamma GT, total bilirubin and direct bilirubin in treated rats. Histopathological studies of rat livers also support the claim. The hepatoprotective activity was due to flavonoids and phenols present in the extract.²⁶

The leaf extract (30 mg/kg) of *Cadaba farinosa* exhibits the significant hepatoprotective effect. Degree of hepatotoxicity developed by CCl₄ free radical during in turn causes oxidation of lipid of cell membrane, simultaneously ethanolic extract of leaf confirmed decreased levels of SGPT, SGOT, ALP, Total bilirubin & reduction in improved liver weight.²⁷

The ethyl acetate extract of *Cadaba farinosa* exerts protective action by decreasing CCl₄-derived free radicals and significantly inhibit the elevated level of serum enzyme activities.²⁸

Antioxidant activity

The (250 and 500 mg/kg) of ethyl acetate and aqueous fraction of *Cadaba farinosa*, Forsk shows significant antioxidant activity (DPPH scavenging method, Nitric oxide scavenging method, Super oxide anion radical scavenging method, Hydroxyl scavenging activity) and suggests that possible mechanism for hepatoprotective activity may be due to free radical scavenging potential caused by the presence of flavonoids in the extracts.²⁶

Antiprotozoal, Schistosomicidal and Antifungal activities

Decoction of *Cadaba farinosa* commonly used as antiprotozoal, schistosomicidal and antifungal activities.²⁹

The *In-vitro* study using water, ethanol and acetone as a solvent were effective in reducing the mycelial growth of *Fusarium oxysporum* f. species.³⁰

Anticancer

Graham *et al* explained potential of *Cadaba farinosa* against cancer through their survey.³¹

Wound healing

Cadaba farinosa along with 85 plant species are traditionally used as healing agents by the local communities of the Thar Desert. Currently, all the medicinal plants species are exposed to anthropogenic impact.³²

Cytotoxic activity

The *Cadaba farinosa* shows potent *in-vitro* cytotoxicity in methanol extracts tested against FL-cells.³³

Antibacterial

The dichloromethane and ethanol extracts of *Cadaba farinosa* Forsk shows potent antibacterial activity against *Staphylococcus aureus*, *Bacillus subtilis*,

Escherichia coli, *Pseudomonas aeruginosa* and *Micrococcus flavus*.³³

Anti-diabetic activity

Alcohol and aqueous extract of *Cadaba farinosa* (leaves) were subjected for hypoglycemic activity in wistar rats (160-200 g). The oral administration of leaf extracts at dose 1000 mg/kg led to a significant blood glucose reduction. Phytochemical analysis of alcohol extract revealed the presence of terpenoids, flavonoids, steroids, proteins, alkaloids, gums, sugars and saponins but negative result was observed in aqueous extract except terpenoids, flavonoids, proteins, furans, gums and sugars. This study brings out the evidence regarding pharmacological and phytochemical activities of *cadaba*.³⁴

CONCLUSION/SIGNIFICANCE TO SOCIETY

Cadaba farinosa Forsk is though widely distributed all over the world especially in arid area but its use for improvement of health status and benefits of human being is not yet thoroughly studied. Its pharmacological activities are limited. It was used in ancient traditional medicines so there is a large scope for isolation of valuable compounds and study for their potency.

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Table 1. Mineral content of *Cadaba farinosa*, Forsk

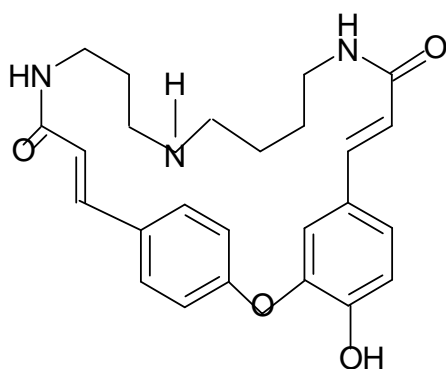
Sr. No.	Minerals	<i>Cadaba farinosa</i>	
		Stem	Leaves
1.	Al	99	662
2.	Ba	10.1	12.4
3.	Ca	7550	12.200
4.	Cd	0.539	0.743
5.	Cr	2.58	3.35
6.	Cu	10.3	14.6
7.	Fe	84	335
8.	Li	0.120	0.308
9.	Mg	818	1410
10.	Mn	43.4	129
11.	Mo	0.310	0.206
12.	Na	232	223
13.	Ni	11.86	4.12
14.	P	1170	1730
15.	Pb	Nd	0.426
16.	Se	Nd	Nd
17.	Sr	38.6	43.4
18.	Ti	1.60	7.71
19.	V	Nd	0.641
20.	Y	0.499	0.750
21.	K	11200	13200

Table 2. Amino acid content of *Cadaba farinosa*, Forsk¹⁰

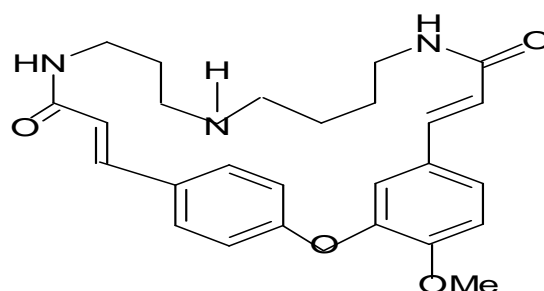
Sr. No.	Minerals	<i>Cadaba farinosa</i>	
		Stem	Leaves
1.	Alanine	3.62±0.27	8.20±0.09
2.	Arginine	4.96±0.53	9.32±0.24
3.	Aspartic	20±1.49	25.2±0.20
4.	Cysteine	1.26±0.00	2.27±0.23
5.	Glutamic	9.86±0.86	20.5±0.12
6.	Glycine	2.38±0.29	5.45±0.13
7.	Histidine	2.13±0.19	3.73±0.12
8.	Isoleucine	2.52±0.25	5.28±0.07
9.	Leucine	4.56±0.45	10.8±0.12
10.	Lysine	3.79±0.36	7.83±0.58
11.	Methionine	0.67±0.13	1.16±0.03
12.	Phenylalanine	2.82±0.28	6.50±0.21
13.	Proline	7.03±0.49	8.14±0.08
14.	Serine	4.93±0.32	8.11±0.13
15.	Threonine	2.94±0.22	6.60±0.05
16.	Tyrosine	1.92±0.17	4.65±0.21
17.	Tryptophan	1.21±0.08	3.18±0.09
18.	Valine	3.57±0.24	7.18±0.37
	Total	8.32	14.8



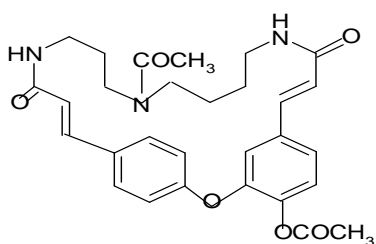
Figure.1. Cadaba farinosa, Forsk



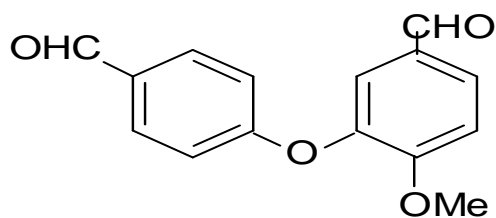
Cadabacine



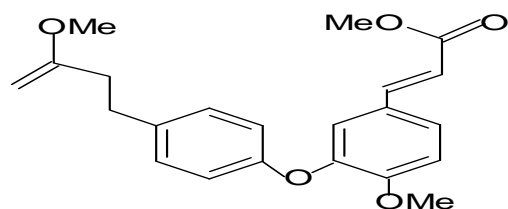
Cadabacine Methyl Ether



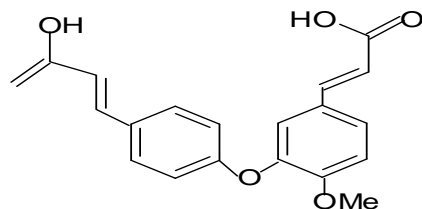
Cadabacine Diacetate



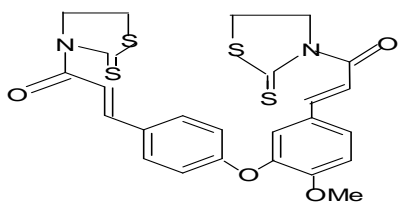
3(4-Formyl Phenoxy)-4-MethoxyBenzaldehyde



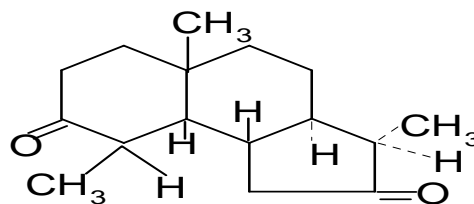
Methyl cinnamate, methyl ferulate ether



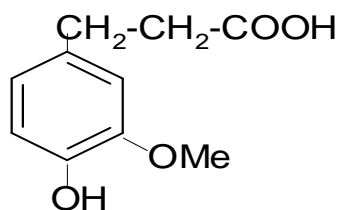
Ether of p-cinnamic acid-m-ferulic acid



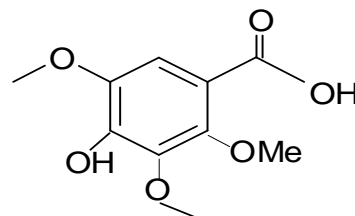
Thiazolidine compound



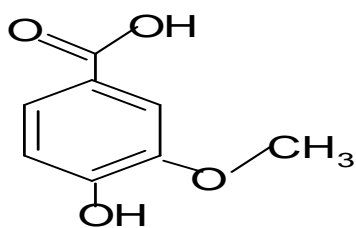
Cadabencilone



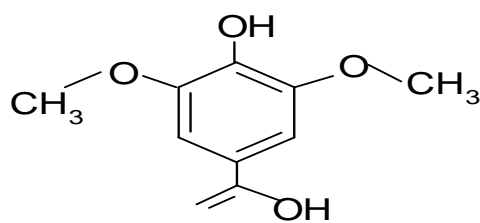
A,β-Dihydroferulic Acid (Aromatic acid)



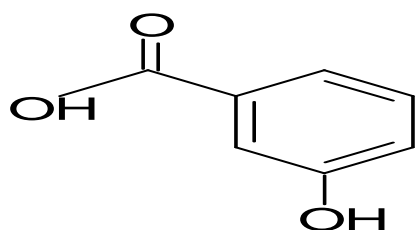
Syringic Acid



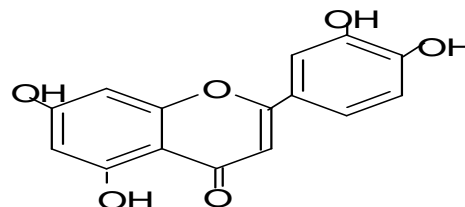
Vanillic Acid



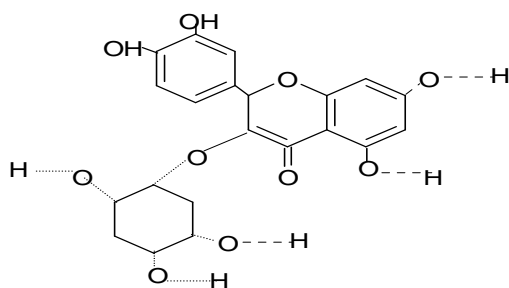
L-Strychnine



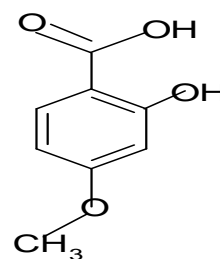
3-hydroxy benzoic acid



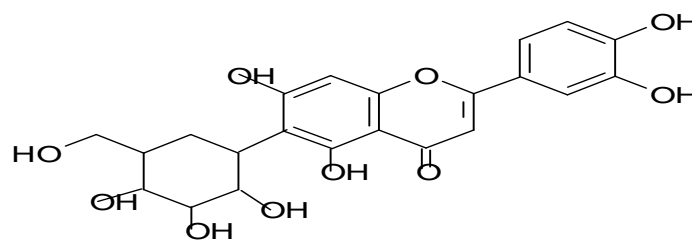
Quercetin



Isoquercetin



2-Hydroxy-4- Methoxy Benzoic Acid



Isoorientin

(All the chemical structures has been drawn by chem-draw software)