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Cadaba fruticosa Druce: Medicinal plant

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Abstract
The *Cadaba fruticosa* (L.) *Druce* is wild plant belonging to Family *Capparaceae*. A plant having many medicinally important properties. Mainly used as Antimicrobial, Anticancer, Antidiabetic, Antioxidant Activity Ant inflammatory Activity. Phytochemical screening, FTIR, GCMS Analysis of Methanolic and Ethanolic extract of plant has been studied. In silico Molecular Docking is also done for its Fertility Activity. In literature Review found that the Methanolic extract of *Cadaba fruticosa* shows highest Antimicrobial Activity as compare to Aquoes extract. Silver Nanoparticle also prepared which give higher Antimicrobial activity. Anticancer activity of plant studied against HeLa Cancer Cell Lines. Leaf juice of plant having various effect such as, used in Dysentery, Cough and Lungs problem, worm infection syphilis, Fever. Also used for general weakness, Poisoning, Deobstruent, Emmenagogue. The plant also found heavy metals, minerals and trace elements.

Keywords: *Cadaba Fruticosa*, HeLa cancer cell, tissue culture plant

Introduction
Cadaba fruticosa (L.) *Druce*is an Ancient Medicinal plant. It is an unarmed shrub having 5m Hight, having *Capparaceae* Family. Trifoliolate leaves. Axillary, solitary, racemose flowers and having 4 sepals. Flowering stage is Nov to Dec. Fleshy, long, cylindrical fruits. Seeds contain Testa, cartilaginous, subglobuse, cotyledons, convolute. Leaf juice are used as a remedy for Dysentery, Purgative, cough, Lungs problems, fever, Deobstrant. Fruits are generally used for worm infection. Cadabin, Cadabicine, Stachidrine, 3-Hydroxy Stachydrine Cadabalone, obtained from leaves. Aqueous extract of plant contains terpenoids, flavones, anthraquinones and sugars. Alcoholic extract of plant contains steroids, alkaloids, saponins.

Synonyms
Cleome Fruticosa L.
Cadaba fruticose tamk
MozambeTevigateRufin
Stroemia Tetranda Vahl

Vernacular Name
Common Name: Indian Cadaba
Hindi: Kodhab, Dabi, Kodhab
English: Capper brush
Tamil: Vuldhi, Vazhuthi, Chikondi.
Telugu: Adamorinika
Marathi: Habal, Vaelivee
Gujarat: Kalokattiyo, Khordu
Kannad: Cheguviche
Malayalam: Kattgatti

Distribution
It is commonly seen in Jungles and Rocky areas. This is first reported from the Nalgonda District, Andhra Pradesh, India.Its natural habitat is subtropical or tropical dry shrubland. In India Punjab, Central and western India, Gujrat, Tamilnadu and Karnataka. Also found in Pakistan, Indo-China, Sri-Lanka, Myanmar.

Other species
1) *Cadaba Fruticosa* Forsk
Cadaba Indica Lam
Stroemia Tetrandra Vahl Symb
2) *Cadaba Trifoliata*

Taxonomical classification
Kingdom: Plantae
Clade: Angiosperms
Clade: Eudicots
Clade: Rosids
Order: Brassicales
Family: Capparaceae
Genus: Cadaba
Species: C fruticosa

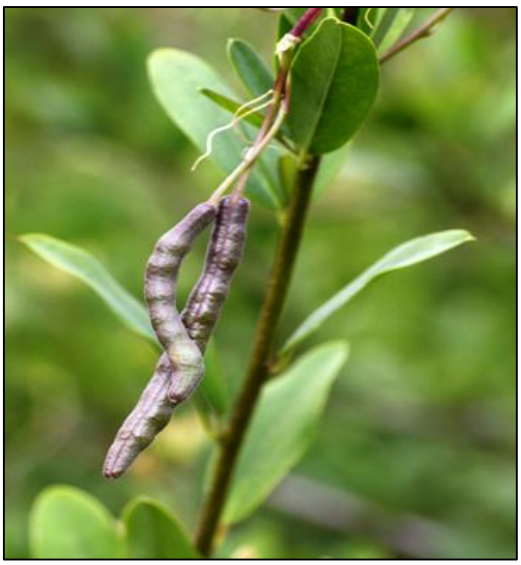

Fig 1: Leaf of *Cadaba Fruticosa*

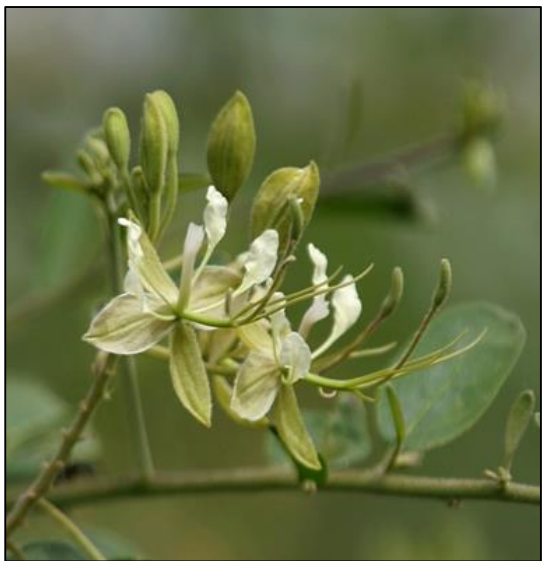

Fig 2: Flower of *Cadaba Fruticosa*

Microscopy
Adaxial epidermal cells, shallowly sinuate surface, slightly striated. Xylem and Phloem are also present. Cylindrical C' shaped Petiole. Ranunculaceus (Anomocytic) type of Stomata, starch Grain, Prismatic Calcium Oxalate crystals are seen. Flowering period is November to April.

Phytoconstituents

Table 1: Chemical constituents found in the plants

Source phytochemicals	Reference
Plant extract Aqueous extract of Indian Cadaba contain Terpenoids, Proteins. Furans, Alcoholic extract of plant contain steroids, alkaloids, saponins. Plant also contain flavones, anthraquinones and Quercitine.	(8)
LeafCadabin, cadabicine acetate,cadabalone,Capparisine and α – B –dihydroferulic acid	(1)
Stem bark Cadabicine methyl ester, sesquiterpene, Cadabicine.	(9)
Leaves and stem L-stachydrine, L_3 hydroxy stachydrine, Quercetin, Parahydroxy (9) Benzoic acid, syringic acid, vanillic acid, 2-hydroxy, 4- methoxy Benzoic acid.	(9)

Preliminary phytochemicals analysis

Table 2: Phytochemical Testing

Name of compound	Aqueous	Chloroform	Ethanol
Alkaloids	+	+	+
Flavonoids	++	+	+
Tannins	++	+	-
Phenols	++	+	+
Steroids	-	-	+
Terpenoids	+	-	+
Cardiac glycosides	+	+	+
Starch	-	-	-
Cellulose	+	+	+
Carbohydrate	+	-	-
Fix oil and fat	+	-	+
Protein	+	-	+
Quinone	-	-	-

Medicinal Activities
In the current era, Herbal products are considered to safer than the synthetic products. Synthetic products are hazardous to Human life and the Environment.

Table 3: Medicinal activity observed in different parts of Cadaba Plant

Source Observed medicinal activity	Reference
Plant *Cadaba fruticosa* showed antimicrobial, antidiabetic, Antipyretic, anti-inflammatory activity, antioxidant activity.	(7)
Leaf Ethanolic and methanolic extract of plant showed Antimicrobial and anticancer activity. Anticancer activity studied against The Human Cervical Cancer Cell (HeLa) and it is done by MTT assay at different Concentration.	(1)
Leaf juice Leaf juice is used as remedy for dysentery, purgative, cough, lungs problem and stimulant. Snake bite, antidotes for poisoning	(8)
Fruits Warm infection.	(3)
Leaf extracts Helminthiasis, uterine Deobstrant, syphilis, antiphlogistic, fever, General weakness. Fresh leaves are mixed with milk or ground nuts to prepare a paste and is used for Neurological Disease, given for 3 days.	(8)
Bark boils blister and cuts.	(8)
Root decoction it is used Purgative, Deobstruent, Emmenagogue and Aperients.	(8)

Medicinal Uses

Traditional Uses: almost all parts of plant having medicinal value. Leaf extract are used in Helminthiasis, uterine de obstruents, syphilis, antiphlogistic, fever, general weakness. Leaves also used in snake bite, antidotes for poisoning. Root decoction is given for round worm. Bark is used in boils blister and cuts. The plant also shows antidiabetic effect. Fresh leaves are mixed with milk or ground nuts to prepare a paste and is used for Neurological Disease, given for 3 days.

Pharmacological Activity

Antimicrobial and Anticancer Activity

Ethanol and methanol extract of wild and tissue cultured of *Cadaba fruticosa* were prepared and compared for its antimicrobial activity against Six human pathogenic Organism. The test organisms used were human bacterial pathogen viz., Streptococcus pyogenes Staphylococcus (MTCC442), aureus Escherichia coli (MTCC96), (MTCC1195) and Klebsiella pneumoniae (MTCC109) and fungal pathogens like (MTCC3017) and Candida albicans Trichoderma viride (MTCC167). Study was done by Agar Disk diffusion method.

The gram-positive bacteria Streptococcus pyogenes, Staphylococcus aureus and gram-negative bacteria Escherichia coli, Klebsiella pneumoniae were pre-cultured in nutrient broth and kept overnight in a rotary shaker at 37 ℃, centrifuged at 10,000 rpm for 5 min. The pellet was suspended in double distilled water and the cell density was standardized spectrophotometrically (A nm).

The fungal 610 inoculums, were Candida albicans, Trichoderma viride prepared from 5 to 10day old culture grown on Potato dextrose agar medium, the Petri dishes were flooded with 8 to 10 ml of distilled water and the conidia were scraped using sterile spatula.

Agar Disk diffusion assay were used for preliminary screening of Antimicrobial activity of wild and tissue cultured plant ethanol and ethanol extract, the dried extract were dissolved in respective solvent. then a stock solution of 1 g/m prepared by dilution method, the sterile 9 mm disk were impregnated with various conc. as 20µl,40µl and 50µl and incubated for 24 hr at 37ºC for drying, then each extract was tested in triplicate against positive control substances as antibiotic of Streptocycline. Fter that the dried sterile disks were then placed carefully onto the surface of the agar inoculated with microbial culture and the zone of inhibition were measured in mm from the circumstance of disk.

The activity of bacterial pathogen was determined after 24 hrs. at 37 ℃ and also fungal pathogen was determined after 72 hrs. of incubation at 28 ℃.

The highest zone of inhibition was observed in Escherichia Coli (14±0.82 mm and 08±1.05mm) at 60ul Concentration and Methanolic extract highest zone of inhibition (14±0.14 mm and (09±0.12mm) at 60ul concentration against Streptococcus pyogenes and staphylococcus aureus.

Cytotoxicity study

Cytotoxic activity studied with the help of The Human Cervical Cancer Cell (HeLa) and it is done by MTT assay at different concentration.

Cell line preparation:

The human cervical cancer cell line (HeLa) was obtained from National Centre for Cell Science (NCCS), Pune and grown in Eagles Minimum Essential Medium containing 10% fetal bovine serum (FBS). The cells were maintained at 37 ℃, 5% CO, 95% 2 air and 100% relative humidity and Maintenance cultures were passaged weekly and the culture medium was changed twice a week.

Cell treatment procedure

The single layer was separated with the help of Trypsin, EDTA (ethylene diamine tetra acetic acid) to make single cell suspension and viable cell were counted by Haemocytometer. Dilution was done by medium containing 5%FBS to give final density of 1×10^5 cells/ml.

One hundred microliters/well of cell suspension were inoculated into 96-well plates at plating density of 10000 cells/well and incubated to allow for cell attachment at 37ºC, 5% CO_2, 95% air and 100% RH. After 24 hrs. The 2 cells were treated with serial dilutions of the test samples. They were initially dissolved in dimethyl sulfoxide (DMSO) and an aliquot of the sample solution was diluted to twice to get the desired final maximum test concentration with serum free medium. Additional four serial dilutions were made to provide a total of five sample concentrations. Then the Aliquots of 100 µL of these different sample dilutions were added to the appropriate wells which already containing 100 µL of medium, resulting in the required final sample concentrations. Following sample addition, then the plates were incubated for an additional 48 hrs. at 37 ℃, 5% CO_2, 95% 2 air and 100% relative humidity. The medium containing without samples were consider as control and triplicate was maintained for all concentrations.

MTT

3-[4,5-dimethylthiazol-2-yl] 2,5-diphenyltetrazolium bromide (MTT) is a yellow water soluble tetrazolium salt. A mitochondrial enzyme in living cells, succinate dehydrogenase, brake the tetrazolium ring and converting the MTT to an insoluble purple formazan. So that, the amount of formazan produced is directly proportional to the number of viable cells. After 48 hrs. of incubation, 15 µL of MTT (5 mg/ml) in phosphate buffered saline (PBS) was added to each well and incubated at 37 ℃ for 4 hrs. The medium with MTT

was then flicked off and the formed formazan crystals were solubilized in 100 µl of DMSO after that the absorbance was measured at 570 nm using micro plate reader and the percentage cell viability was then calculated with respect to control as follows.

% Cell viability = [A] Test / [A] control x 100
% Cell inhibition = 100 - [A] Test / [A] control x 100

Result and Conclusion
The highest % of Anticancer activity of Ethanol extract of wild plant is 53.14 and Tissue culture cadaba plant is 54.78 at 5 mg/ml concentration. The % of inhibition was increase with increase in concentration.

Antipyretic activity
This study was used to evaluate the antipyretic activity of aqueous and ethanol extracts of *Cadaba fruticosa* (L.) Druce leaf, on normal body temperature and yeast induced pyrexia in Wistar albino rats. The aqueous and ethanol extracts showed significant reduction in normal body temperature and yeast induced pyrexia at 500 mg/kg body weights at 23rd hour of administration of yeast when compared to the standard antipyretic drug paracetamol. The dose of 100 mg/kg of both the extracts produced less significant antipyretic effect. Rat were divided into six groups of animal and body temperature was induced by measuring Rectal temperature at the dose level of 500mg/kg. Fever was increase by injecting 15% suspension of Brewer's yeast (Saccharomyces cerevisiae).

Procedure
The rats were allowed to remain quiet in the cage for some period of time.
A thermistor probe was inserted 3-4cm deep into the rectum, after fastened the tail, to record the basal rectal temperature.
Then given a subcutaneous injection of 10ml/kg of 15% w/v Brewer's yeast suspended in 0.5% w/v methyl cellulose solution to the animals and the animals were returned to their housing cages.
After nineteen hr of the yeast injection, the rats were again restrained in individual cages to record their rectal temperature. Then immediately aqueous and alcoholic extracts were administered orally at doses of 100 and 500 mg/kg to the first four groups of animals, Then the fifth group received distilled water and lastly the sixth group received 45 mg/kg of paracetamol as drug control.
After that Rectal temperature of all the rats were recorded at 19hrimmediately before, extract, paracetamol administration and again at 1hr interval up to 23hr after yeast injection.

Antioxidant and ant inflammatory activity
The antioxidant potential of *C. fruticose* were evaluated by Determination of the reducing power and 1,1-Diphenyl-2-picryl-hydrazyl (DPPH) radical scavenging activity which were carried out on different concentrations of the methanolic extract and the total phenolic content of the methanolic extract were alsomeasured.

Ant inflammatory activity
***In vitro* anti-inflammatory test was done by HRBC membrane stabilization method**
The reaction mixture (4.5 mL) containing 2 mL of hypotonic saline (0.25% NaCl), 1 mL 0.15 M phosphate buffer (pH 7.4) and 1 mL of test solution (100-2000 µg mLG1 of final volume) in normal saline. Then added about 0.5 mL of 10% rat RBC in normal saline. For control tests: Isotonic saline 1 mL was used instead of test solutions while product control tests lacked red blood cells. Then the mixtures were incubated at 56 °C for 30 min. Then tubes were cooled under running tap water for 20 min. The mixtures were centrifuged and take absorbance of the supernatants at 560 nm. And % membrane stabilizing activity was calculated as follows:

% Stabilization =100-(O.D. of test -O.D. of product control/ O.D. of control) ×100
% cell haemolysis =O.D. of test/ O.D. of control) ×100

The methanolic extract shows significant antioxidant and ant inflammatory activity

Antidiabetic activity
In literature survey found that the plant of Cadaba shows antidiabetic activity.

Conclusion
In the literature survey of *Cadaba fruticosa druce* (L.) found that the plant having wide range of medicinal properties. Leaf extract of plant had antimicrobial, anticancer, antidiabetic, ant inflammatory activity. Root of plant is used in worm infection. Also used in fever, vitigo, weakness, uterine obstruent, Dysentery, lungs Problems. Plant act as antidote for poisoning, emmenagogue, purgative.

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