

Recent Developments of *Caesalpinia Decapetala*

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ABSTRACT

Caesalpinia decapetala (Roth) Alston is classified under the family capsalpiniaecae. The plant is found all over the world and warmer part of India. It is originally from India and Malaysia. It is climbing shrub with prickly braches. Young branches are densely covered by tiny brownish or golden colour hairs with sharp recovered thorns. Older stem is thick with large thorns. The leaves are bipinnate, alternatively arranged and have a pair of small leafy stipules at their base. The flowers are usually yellow or pale yellow in colour. The fruits are flattered pod, oblong with small beak at one end. Each pod contains 4-9 rounded seeds. Roots, stem, bark, flowers and seeds of plant showed medicinal properties. Hence the plant can act as a herbal medicine. *Caesalpinia decapetala* shows anti-TMV, anti-anaphylactic, anti-oxidant, anti-cancer, anti-diarrheal, anti-microbial, anti-pyretic, anti-inflammatory, anti-diabetic activities. It also shows analgesic acute toxicity in mice and contraceptive activity in female hamsters. Terpenoids, carbohydrates, flavonoids, resins, alkaloids, proteins, sterols, fats, oils, phenols, tannins, glycosides and diterpenoids are found out in *Caesalpinia decapetala* by phytochemical screening.

Keywords : Anti-Oxidant, *Caesalpinia Decapetala*, Anthelminthic, Female Hamster, Diterpenoid, Cassane.

I. INTRODUCTION

Plants have been used for treatment of diseases from time immemorial and were still principle form of medicine in the most developed centuries till about 70 years back. Till the end of 20th century every village and rural community had a wealth of herbal folk which is seen even today. The herbs were used for common health problems applied as lotions or even mixed with fat and rubbed as ointment. Herbal medicines are effective against different therapies. Herbal medicines are safe and more reliable has increased the interest in these medicines. Digestive problems, cardio vascular disorders, metabolic problems, liver disorder and disorders of central nervous system can be cured by different part of plant. Western drugs are made up from plant extracts. The standard of the medicine, the safety and effectiveness is to be assured to make the safe use of the traditional herbal plants. Phytochemicals are the chemicals secreted by plants are important because they protect plants as well as human being from various diseases.

Out of 300000 species of the plants only 5% species have been studied scientifically for their medicinal uses. India has 45000 diverse groups of species spread over 16 different agro climatic zones, 10 vegetation zones, 25 biotic provinces, 426 habitats of specific species. Besides this, there are up to 18000 flowering plants, 2500 algae, 23000 fungi, 1600 types of lichen and 1800 varieties of bryophytes. Out of these 15000-20000 are of medicinal value. But only 7000 to 7500 plants are used for medicinal purposes. Researchers found that developing countries depend upon herbal plants to cure disease where there is lack of hospital facility. All the parts of plants namely root, stem, bark, leaves, flowers and seeds are used as herbal medicine. It is commonly known as crested fever nut. In Ayurveda, *Caesalpinia decapetala* is used as anti-inflammatory, anti-malarial, anti-histamine, anti-asthma, anti-aging agent and anti-pyretic properties. It is also used to cure diseases like skin diseases, medicinal paste for treating poisonous snake bite, treating liver stagnation type reflux oesophagities, treating ecthyma and headache, for rabies, treating hyperosteoegeny. Different parts of it are used to prepared Chinese medicines.

Synonyms:

- Latin Name :Caesalpinia decaepetala (Roth) Alston
- Marathi Name: Chillar, Chillhari, Chillati.
- English Name: Mysore thorn, Shoofly Black Bonduc.
- Sanskrit Name: Kantaki Karanja
- Hindi Name: Ralan, Alia, Arlu, Kingan.
- Gujrati Name: Kirmich Chilar
- Urdu Name: Kander Relan
- Kannada Name:Gajalige, Hotasige, Hunnula, Kurudu, Gejjuga, Kurutugajjika
- Malayalam Name: Inna

Geographical Distribution:

Caesalpinia decapetala (Roth) Alston is a climbing shrub and is widely distributed around the world. It is found out throughout warmer parts of India, Myanmar, China, Japan. It is introduced in the tropical regions of India, Korea, Thailand, Laos, Vietnam, Malaysia, Philippines. All the parts root, bark, leaves, flowers and seeds are used as herbal medicines.

II. Morphology Characters

Caesalpinia decapetala is originally from Asia and Malaysia. It is a large sprawling shrub (growing up to 7m) with prickly branches; it can climb on large tree up to 20m high. Young branches are densely covered by tiny brownish or golden colour hairs having sharp thorns. Older stem is thick with large thorns. The leaves are bipinnate, alternately arranged and have a pair of small leafy stipules at their base. The stipules are 4-20 mm long, egg shaped in outline with broad end at base but taper to a point. The leaves are borne on stalk 3-8 cm long. Each stalk has 4-10 pair of branchlets called pinnae. Each branchlets has 8-12 pairs of leaflet called pinnules. The leaflets are 7-20 mm long and 2-8 mm wide. They are oblong or abovate form outer side and narrower end toward base. The flowers are usually pale yellow or yellow in colour sometimes whitish. It has five petals with 10-15 mm long, five sepals with 9-10 mm long, ten stamens with 10-16 mm long and a style with 15-20 mm long topped with a cup-shaped stigma. Four petals are circular in shape but upper petal is smaller and narrower than the others. The flower are borne on stalks 15-25 mm long and arranged in erect position. The fruits are flattened, pods, oblong with small beak at one end.

These woody pods are 6-10 cm long and 25mm wide with hairs and turns from green to brown as they mature. After maturity they split to release 4-9 rounded seeds. These seeds are 6-10 mm in diameter with brown to black in colour. The seeds get scattered after breaking of pods. The seed surface is smooth, outer coating of seed is too thick and hard hence it required several months to years for its germination.

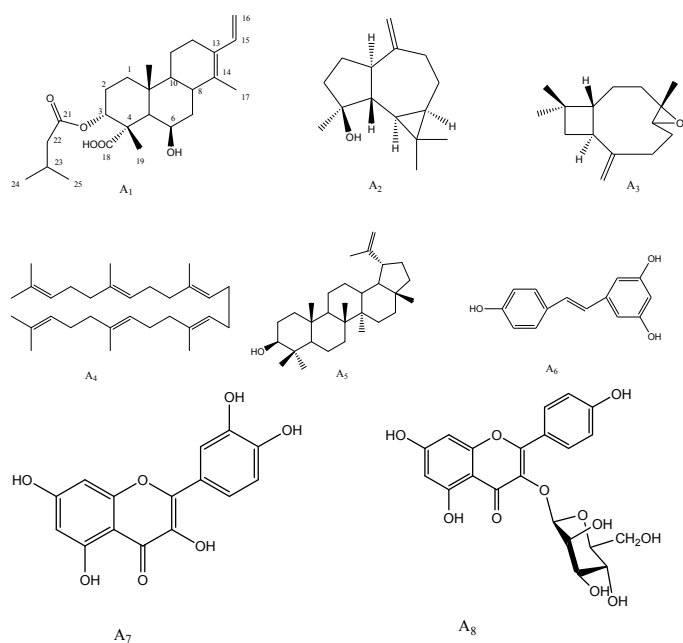
III. Traditional and Modern Uses

Herbal plants are used for medical purposes long back in India. They play important role in illness as well as in maintaining health. It has medicinal properties like anti-inflammatory¹, anti-oxidant, anti-histamine, anti-skin aging agent, anti-asthma-COPD herbal composition, anti-pyretic analgesic, anti microbial, anti-diarrheal², anti- cancer, anti-hyperalycemic³, anti-diabetic. *Caesalpinia decapetala* plant is used to cure diseases like skin, diabetic, bacterial, pyretic, diarrhea, asthma and malaria. Root extract of *C. decapetala* is used to treat sexually transmitted infections⁴. Bark is poisons and used as fish poisoning. Fruit extract shows inhibitory effect against candida abbcans⁵. It is used to prevent cold and treat bronchitis. Used in eye drop for treating trachoma caused by *Chlamydia trachomatis* in Chinese medicine⁶. In Chinese medicinal pest for treating poisonous snake bite⁷. Leaves of *C. decapetala* mixed with essential oil which shows antibacterial activity⁸. Used for treating blood stasis type closed bone fracture⁹. Used in Chinese medicine lotion for treating ecthyma with headache¹⁰. It is used in Chinese medicine for treating scaled and burn¹¹. For treating hyperlipemia caused by excessive uptake of meal¹². This plant is used in Chinese medicine for treating rabies¹³. It has been used in treatment of jaundice, stomach disorder and biliousness. The leaves and roots are used as purgative and emmenagogue¹⁴. It shows anti fertility activity¹⁵.

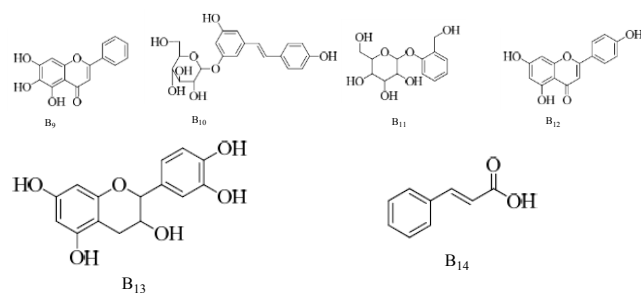
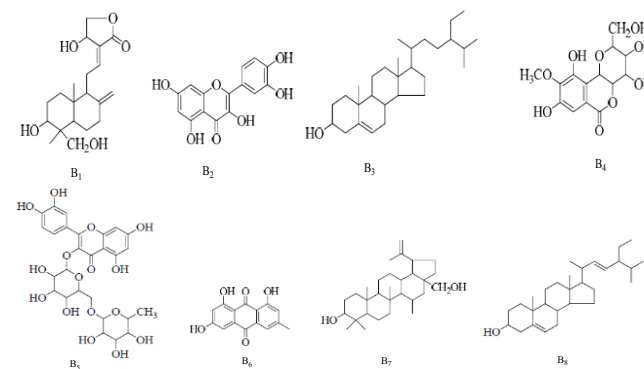
IV. Phytochemical Investigation

Caesalpinia decapetala (Roth) Alston is a medicinal plant. In Vietnam it is used as traditional medicine as an anti-inflammatory and immunomodulatory. The genus *caesalpinia* contains cassane diterpenoid in it. From the leaves of *C. decapetala* eight known compound are isolated namely A₁) spathulenol, A₂) 4,5 epoxy-8(14)-caryophyllene, A₃) squalene, A₄) lupeol, A₅) trans-

resveratrol, A₆) quercetin, A₇) astragalin and A₈) stigmasterol. Along with these compound new cassane diterpenoid, caesaldecane is isolated and its structure is find out. Structures of compounds are given below.



Fourteen known compounds were isolated using column chromatography and physical identification was performed by physical and spectral analysis. Most of compounds were isolated from roots of *Caesalpinia decapetala*. The biological activities of compounds were also evaluated by 3 – (4, 5 dimethylthiazol-2-yl) - 2, 5 – diphenyl tetrazolium bromide (MTT) and 2, 2-diphenyl -1- picrylhydrazyl (DPPH) assays. Emodin(B₆), baicalein (B₉) and apigenin (B₁₂) shows antitumor activity against the MGC – 803 cell line. Quercetin(B₂), rutin (B₅), baicalein(B₉) and epicatechin (B₁₃) shows stronger DPPH scavenging activity. Andrographolide(B₁), bergenin (B₄), betulin(B₇), polydatin(B₁₀), salicin(B₁₁) are isolated by first time. The compounds were identified by ¹H- NMR and ¹³C-NMR spectroscopy. The structures of compounds are as follows.



Out of fourteen compounds two terpenoids (B₁, B₇), five flavones (B₂, B₅, B₉, B₁₂ & B₁₃), two sterols (B₃, B₈), one isocoumarin (B₄), one anthraquinone (B₆), two polyphenols(B₁₀, B₁₁). All compounds except B₃, B₈, B₁₃ and B₁₄, were isolated from the roots of *Caesalpinia decapetala*²¹.

V. Pharmacological Activities

Anti Diabetic Activity³:

Insulin or hypoglycaemic agents can be used to treat diabetes mellitus. Diabetes can be treated by herbal and natural products which are safe and widely being evaluated for their therapeutic and safety potential¹⁶. Natural products are rich source of different effective drugs. Substances derived from plant origin have show activity in treating non-insulin dependent diabetes mellitus (NIDDM)¹⁷. *Caesalpinia decapetala* has been locally claimed to be effective as anti diabetic and even effective in diabetic wound healing. Aqueous ethanol extract of leaves and whole plant was given to alloxan-induced diabetic rabbit orally. 300 mg/kg and 500 mg/kg oral extract doses were able to reduce average blood glucose level from 250.6 mg/dL to 204.2 mg/dL and 188 mg/dl respectively during 14 days. Total cholesterol, triglyceride and low density lipoprotein (LDL) level increased significantly while high density lipoprotein (HDL) decreased in diabetic rabbits.

Hypercholesterolemia and hypertriglyceridemia Activity³:

Both of above have been found in alloxan- induced diabetic rabbits¹⁸. Aqueous methanol of extract of wood and pericarp of *C. decapetala* is given to the rabbits orally. The extract decreases the total cholesterol and triglycerides level in diabetic rabbit. *C. decapetala* treatment significantly decreased the elevated levels of SGPT and SGOT levels in diabetic groups. It showed

that *C. decapetala* reduce the risk of liver failure. The plants also decrease the elevated levels of serum urea and serum creatinine which showed that this may act as crucial trigger for kidney to revert to their metabolic homeostasis. Thus *C. decapetala* protect the activity of liver and kidney. Anti-diabetic activity of plant is due to presence of polyphenol, flavonoids, tannines in it.

Analgesic Activity:

The activities were studied by hot plate method and acetic acid-induced writhing response to albino mice. Acetic acid causes severe abdominal pain and contraction (writhing). The activity was evaluated by reduction in the number of writhing and compares it with control group. 0.2 ml 3% acetic acid was injected in the abdominal cavity via intra peritoneal injection to Swiss albino mice having weight between 20-30 g. Aqueous methanolic and n-hexane extract of *C. decapetala* were given to the mice and writhing were measure with time. The extract was given orally of 100 mg/kg dose.

For evaluating the analgesic effect of aqueous methanolic and n-hexane extract of *C. decapetala* the hot plate method analgesia meter was used. Writhing gets reduced in both methods. It shows that *C. decapetala* having analgesic property. It may be due to presence of phenols, tannins, oils, flavonoides and glycosides.

Anti-Inflammatory activity¹:

Anti-inflammatory activity was studied by using aqueous methanolic and n-hexane extract of *C. decapetala* to the Swiss albino mice. 0.1 ml carrageenan in 0.9% normal saline increases paw circumference which is indication of inflammation. By giving extract dose of *C. decapetala*, paw circumference get reduced. It shows the anti-inflammatory activity of *C. Decapetala*¹⁹.

Anti-pyretic Activity¹:

Anti- pyretic activity was studied by using aqueous extract of methanol and n-hexane of *C. decapetala*. Initially temperature of Swiss albino mice was increased by giving yeast-induced pyrexia. Then extract of plant and aspirin was treated with animals. It decreases the rectal temperature. It shows the anti-pyretic activity of *C. decapetala* plant.

Acute Toxicity in mice¹:

The animals were given extract of *C. decapetala* in n-hexane and methanol with doses of 500, 1000, 1500 and 2000 mg/kg body weight and normal saline and measured the mortality for 2 days. Their body weight was monitored per day for one week. There is no change in weight and behaviours of animals. No animal was died during study. Hence the plant *C. decapetala* is non-toxic to mice.

Anti-Microbial Activity²:

The ethanol extract of *C. decapetala* leaves shows anti microbial activity. 150 and 300 mg/kg dose of plant extract was given to the Wistar albino rat which inhabits the growth of *Staphylococcus aurous*, *Bacillus subtilis*, *Escherichia coli* and *klibsiella pneuroniae*. Anti-microbial activity was performed against gram positive and gram negative bacteria strains. Carbohydrate, tannin, flavonoids and glycosides present in *C. decapetala* could be responsible for anti-microbial activity.

Anti-Diarrheal Activity²:

Castor oil induced diarrhoea

The Wistar albino rats weighing 150-200 gm were administrated vehicle orally, 1 mg/kg loperamide orally, 150 mg/kg and 300 mg/kg of ethanolic extract of leaves orally for four groups respectively. After 30 mins 1 ml castor oil is given orally to each group. The number of frequency and weight of diarrhoea were measured for six hours²⁰. Ethanol extract of *C. decapetala* leaves reduced the frequency of defecation, weight of wet stools was observed in extract treated group compare to other groups. Thus the leave of *C. decapetala* could be used for treatment of various gastrointestinal diseases in folk medicine. Anti-diarrhoeal property is due to presence of tannins and flavonoids. These compounds will precipitate proteins and reduces the peristaltic movement as well as intestinal secretions.

Anti-cancer Activity:

Fourteen known compounds were isolated from *C. decapetala* by column chromatography. Biological activities of these compounds were evaluated by 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyl tetrazolium bromide (MTT) and 2,2-diphenyl-1-picrylhydrazyl (DPPH) assays. Out of fourteen compounds emodin, baicalein and apigenin show anti tumour activity against the

human gastric carcinoma cell line MGC-803. MTT assay is widely used method for the detection of cell survival and growth. The inhibitory percentage of cells was treated with 20 $\mu\text{mol/L}$ of each compound for 72 hrs. Baicalein had the best anticancer activity with an inhibition rate of 75.7% at a concentration of 20 $\mu\text{mol/L}$ while apigenin had the best anticancer activity with an inhibition rate of 34.1% at a concentration of 5 $\mu\text{mol/L}$. In previous studies it was found that emodin could increase the Reactive Oxygen Species (ROS) levels of cells and increase the apoptosis-inducing effect. It enhances the drug's cancer cell killing activity.

Anti-oxidant Activity ²¹:

Out of fourteen compounds isolated from *C. decapetala* (Roth) Alston, quercetin, rutin, baicalein and epicatchin showed stronger DPPH scavenging activity compared with ascorbic acid. The DPPH assay is used to examine the antioxidant activity of compound. It has tendency to isolate pure compounds to act as hydrogen atom donors. The antioxidant activity of antioxidant standard was assessed on the basis radical scavenging effect of the stable DPPH free radical. All compounds dissolved in ethanol with Vc as positive control. It was found that rutin had high DPPH scavenging activity with the rate of 75.8 % at 5 $\mu\text{mol/L}$ while baicalein had high antioxidant activity with the scavenging rate at 93.4% at 20 $\mu\text{mol/L}$. The compound with more phenolic hydroxyl groups having high DPPH scavenging capacity. Quercetin, rutin, baicalein and epicatchin belong to flavonoids which have good antioxidant properties. Roots of *C. decapetala* are used for anti-cancer and anti-oxidant properties.

Anti-Tobacco Mosaic Virus (TMV) Activity ²²:

From NMR spectroscopic data analysis and the time - dependant density functional theory calculation *C. decapetala* plant contains three new and ten known diterpenoids. Most of the diterpenoids shows anti-TMV activity.

Contraceptive activity in Female hamsters ²³:

The ethanolic extract of the aerial parts of *C. decapetala* was prepared. It is given orally for 1-8 days post- coitum at 500 mg/kg dose. It shows significant contraceptive activity in female hamsters.

Anti-anaphylactic activity ²³:

Caesaljinin, a cassane triterpenoid isolated from the roots of *C. decapetala* showed inhibitory activity against the anaphylactic contraction in taenia coli of guinea-pigs sensitized by anti-egg albumin rabbit IgE.

VI. Conclusion

Caesalpinia decapetala is widely distributed all over the world. In India it is found in warmer regions. Each part of this plant shows medicinal application. Hence it can act as herbal medicine. It has many pharmacological applications. Still there is lot of scope for further research. This plant shows Anti-pyretic Activity ¹, Acute Toxicity in mice ¹, Anti-Microbial Activity ², Anti-Diarrheal Activity ², Anti-cancer Activity, Anti-oxidant Activity ²¹, Anti-Tobacco Mosaic Virus (TMV) Activity ²², Contraceptive activity in Female hamsters ²³ and Anti-anaphylactic activity ²³.

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