



MEMECYLON UMBELLATUM (MELASTOMATACEAE): A REVIEW

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ABSTRACT

The present review article is an effort to compile all the phytochemical and pharmacological investigations regarding the plant *Memecylon umbellatum* (Melastomataceae) which is distributed in Western Peninsula, mostly on the coast, commonly known as Iron Wood Tree. The plant is traditionally used to treat various ailments like goorrhoea, leucorrhoea, menorrhagia, diabetes, cough and also in the treatment of herpes. Several phytoconstituents has been isolated and identified from the different parts of the plant belonging to the category of glycosides, flavanols, tannins, saponins, sterols and triterpenoids. A review of chemical constituents present and their pharmacological activities are given in the present article.

Keywords: *Memecylon umbellatum*, Melastomataceae, Iron Wood Tree, Phytochemical constituents.

INTRODUCTION

Description of the plant

Memecylon umbellatum is a shrub or a small tree, belonging to the family Melastomataceae.



Morphology

➤ Leaves

Size: 3.8 - 7.5 cm in length and 1.6 - 3.8 cm in width.

Colour: Dark green and polished above, paler beneath.

Petiole: 2.5 - 5 mm long.

Shape: Elliptical or ovate, subacute or shortly and bluntly acuminate, glabrous usually attenuated but sometimes rounded at the base.

Margin: slightly revolute; midrib prominent; lateral nerve obscure.

➤ Flowers

Type: Umbellate cymes from the axils of the fallen leaves on the old wood, numerous in number.

Peduncle: several together, 3 - 10 mm long, elongating in fruit.

Pedicel: 2.5 - 3 mm long, very slender, buds pyriform.

Calyx: 2.5 mm long, companulate before expansion (saucer shaped when expanded), 3 mm across the mouth when flowering.

Disk: without or with very faint ray.

➤ Fruit

Type: Berry, globose.

Size: 6 mm in diameter.

Colour: Purplish black.

Shape: Crowned, though rather inconspicuously, with the calyx - limb, 1- (less commonly 2) seeded.

➤ Root

Type: Tap root system

Distribution

It is found distributed in Western Peninsula, mostly on the coast. Inland, mostly in evergreen and semi-evergreen shrub. It is also found distributed in Orissa, Assam, Sylhet, Tenasserim, Ceylon, Malay Peninsula-Malay Archipelago.

The plant is known by various names in different languages.

English	- Iron Wood Tree
Sanskrit	- Anjani
Kannada	- Alamaru, Alle, Neymaru
Telugu	- Alli, Peddalli
Malayalam	- Anakkayavu, Kalayam
Marathi	- Anjani, Anjun
Tamil	- Alli, Anjani



TRADITIONAL USES

In Ayurveda, the leaves are used as a cooling astringent; used in conjunctivitis as a lotion; and given internally in leucorrhoea and gonorrhoea. A lotion prepared from leaves is used to treat eye troubles. The leaves are reported to possess antiviral activity¹⁻³. Traditionally the leaves and the bark are applied to bruises. The leaves yield a yellow dye, which gives beautiful light shades, used in dyeing industry². The leaves were also used in snakebite⁴. The fruits are pulpy, astringent and edible. The paste of leaves is used in the treatment of herpes⁵. The decoction of the roots is used for the treatment of menorrhagia and the preparation from the bark for the treatment of bruises⁶. The seeds are used to cure cough and sedative⁷. The leaf powder is used for the treatment of diabetes⁸.

The wood is hard and heavy, it is traditionally used for light axe handles and walking sticks. The decoction of the root is used in excessive menstrual discharge⁹. In Dakshin Kannada District traditionally the decoction of the root is used as spasmolytic and given to small children. Karuppusamy S, 2007¹⁰, reported some medicinal plants used by Paliyan tribes in Sirumalai hills of Eastern Ghats. About 90 medicinal plants were used in 17 various health problems, highest being for wound healing (12%). The paste prepared from the leaves of *Memecylon umbellatum* applied on pimples to disappear. As per the survey the plant *Memecylon umbellatum* is one of the important medicinal plants used by Paliyan tribes especially for skin diseases.

PHARMACOGNOSTIC STUDIES¹¹

The various parameters like macro-morphology, micro morphology, quantitative microscopy, physicochemical profile and the salient diagnostic features are documented. The characteristic powder analysis and fluorescence analysis was also carried out.

Table 1: Quantitative Microscopy of the leaves of *M.umbellatum* Burm.f.

S.No	Description	Measurements
1	Stomatal Number	28.5 / Sq.mm
2	Stomatal Index Number	10.87 / Sq.mm
3	Vein Islet Number	17.1 / Sq.mm
4	Vein Termination Number	26 / Sq.mm

Table 2: Physicochemical Constants and Extractive Values of the Leaves and Stem Powder of *M. umbellatum*

Parts Used	Leaves (%w/w)	Stem (%w/w)
Total Ash	7.48	2.93
Water Soluble Ash	1.24	1.49
Sulphated Ash	59	11
Acid Insoluble Ash	0.534	0.533
Water Soluble Extractive	1.16	0.32
Alcohol Soluble Extractive	0.84	0.28

PHYTOCHEMICAL STUDIES

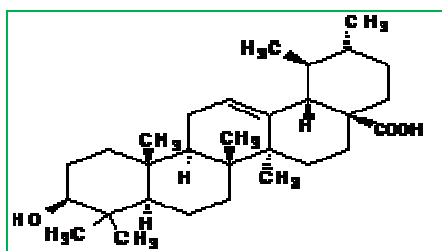
Isolation of various phytoconstituents like β -amyrin, sitosterol, oleanolic acid, ursolic acid, sitosterol- β -D-glucoside and a new substance umbelactone, from the aerial parts of *Memecylon umbellatum* have been reported¹². Isolation of some fatty acids were also been reported from the roots of *M. umbellatum*¹³. The chemical synthesis of an important phytoconstituent umbelactone was also reported via its benzyl derivative¹⁴. Two routes were employed for the synthesis of benzyl derivative, hydrogenolysis of the benzyl group in ethyl alcohol containing 10% palladium-carbon at atmospheric pressure gave crude (\pm) umbelactone (yield 90%), further subjected to preparative TLC gave pure compound, mp 60-62°C.

The total tannins in different parts of the plant were estimated by simple spectrophotometric method at 700nm, where gallic acid was used to obtain standard curve¹⁶. Calibration curve shows coefficient of variance (r_2) = 0.9994 and tannin content was found to be highest in bark (2.4125 ± 0.124) then in leaves (1.7586 ± 0.18), roots (1.3318 ± 0.16) and Stem bark (1.0538 ± 0.16), all collected in the month of Feb-March. Inflorescence showed minimum amount of tannins (0.08639 ± 0.064). Also estimations were made repeatedly with fresh and stored samples (up to 3 years) and found no significant difference in tannin content indicates tannins are stable up to three years if stored¹⁵.

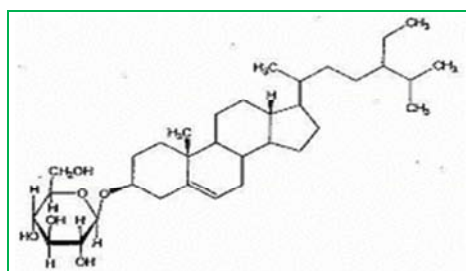
The leaves of the *M. umbellatum* which have been collected from Koppa and Bannerghatta are subjected for analysis of proximates, micro, macro and toxic elemental composition. The young and mature leaves are separately analyzed. The study revealed that moisture, carbohydrate and crude protein content are the dominant factors in both the young and mature leaf samples. Whereas, crude fat was followed by ash and crude fiber in both young and mature leaf samples of Koppa and in case of Bannerghatta samples crude fat was followed by crude fiber and ash. However, the young leaves are more nutrient than that of mature in both the cases. Among the macronutrients K was dominant which is followed by Ca, Mg, Na and P in both young and mature leaves of Koppa whereas in case of Bannerghatta samples K was followed by Ca, Mg, P and Na, in young leaves but in mature leaves Ca was followed by K, Mg, Na and P in their concentrations. The Fe was highest among the micronutrients of both young and mature leaves of Koppa and Bannerghatta samples. Fe was followed by Mn, Cu and Zn in case of Koppa samples whereas Fe was followed by Mn, Zn and Cu in young leaves and Fe was followed by Mn, Cu and Zn in mature leaves sample of Bannerghatta. There was a significant variation of Cu among the different leaf samples of Koppa and Bannerghatta samples. The Pb content of the young leaves of Koppa is higher than that of Bannerghatta samples and mature leaves of Bannerghatta samples recorded high values of Pb than that of Koppa samples. Between the 2 toxic



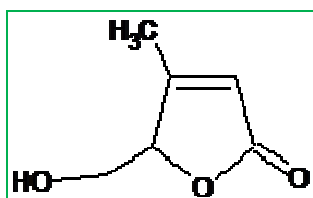
elements Pb was higher than that of Cd and the mature leaves of both Koppa and Bannerghatta samples recorded lowest concentration of Cd¹⁶.



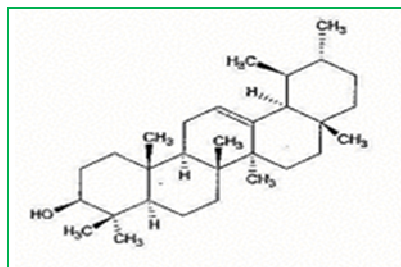
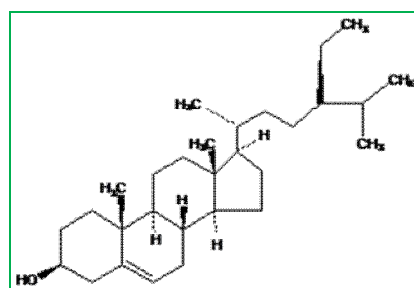
Ursolic acid



Sitostetrol glycoside



Umbelactone

 α -amyrin β -sitosterol

PHARMACOLOGICAL STUDIES

As per the report published by Australian New Crop Web Site supported by the Rural Industrial Research And Development Corporation, mentioned a plot showing number of papers regarding *Memecylon umbellatum* from 1926-2006, indicates its popularity over the time.

Hypoglycemic activity

The leaves and the roots of the plant *Memecylon umbellatum* were screened for hypoglycemic activity. Oral administration of an alcoholic extract of the leaves of *Memecylon umbellatum* showed a significant lowering of serum glucose levels in normal and alloxan induced diabetic mice¹⁷. The results of the study indicated that *Memecylon umbellatum* has interesting possibilities as a source of oral hypoglycemic agent. The alcoholic extract of the roots of *Memecylon umbellatum* also showed a significant lowering of serum glucose levels in normal and alloxan induced diabetic rats¹⁸.

Antimicrobial activity

There are reports regarding the antibacterial activity of the leaves of the plant of *Memecylon umbellatum*.¹⁹ The plant was also found active against ranikhet virus³. The antimicrobial activities of another species *M. malabaricum* were also reported. The petroleum ether, chloroform and methanol extracts of *M. malabaricum* leaves were screened for antimicrobial activity. The methanol extracts has shown significant activity against both Gram (+) and Gram (-) bacteria and fungi²⁰.

Wound healing activity

The plant was selected for the evaluation of its wound healing potential an alcoholic leaf extract of leaves of *Memecylon umbellatum* was examined for its wound healing activity in the form of ointment (0.5, 1.0, 2%w/w) in two type of wound model in rats the excision and the incision wound model. The extract ointment showed significant response in both the wound models as compared to the standard drug nitrofurazone ointment (0.2% w/w)²¹.

Anthelmintic and anti-insect activities

Different extracts of *Memecylon umbellatum* root were screened for Anthelmintic and anti-insect activities using Indian earthworms (*Pheretima posthuma*) and red flour beetle, *Tribolium castaneum* (Herbst) respectively. The acetone and methanolic extracts exhibited significant ($p < 0.01$) anthelmintic and anti-insect activities compared with the control and other extracts. Albendazole and Piperazine citrate were used as standards for anthelmintic activity while Neem Extract, Celphos (Aluminium phosphide) and citronellal for anti-insect activity. Chloroform, ethyl acetate and aqueous extracts showed weak activities. Acetone root extract showed most promising Anthelmintic activity at 20mg/mi compare to albendazole and insecticidal activity at 10mg concentration comparable to standard celphos (5%)²². A study was conducted where the ethanolic extract of the *M. umbellatum* Burm roots were screened for anthelmintic potential using Indian earthworms (*Pheretima posthuma*)²³. In an another comparative study conducted by the same group the ethanolic extract of the *M. umbellatum* roots were compared with certain ethanomedical plants of Karnataka state i.e. *C. gigantea* (leaves), *Plumbago rosia* (Roots), *Ervatamia heyneana*,

Desmodium oojeiense. The result showed that the *C. gigantea* (leaves) were found most active followed by *M. umbellatum* roots among the five extract²⁴.

Antispasmodic activity

The antispasmodic activity of the ethanol extract of the *M. umbellatum* roots were assessed in vitro using rat ileum. The results showed that the ethanol extract antagonize the acetylcholine induced contraction in a concentration dependent manner. The plant extract at a concentration of 50, 100, and 200 mg exhibited 14.28, 18.75, 37.5% inhibition respectively, against acetylcholine induced contraction in isolated rat ileum preparation. The antispasmodic activity may be due to its cholinergic system blockade. The present study reveals that the extract antagonizes the contraction in ileum stimulated by acetylcholine, indicates that the extract shows atropine like action²⁵.

Anti-inflammatory activity

The ethanolic extract of the roots of *Memecylon umbellatum* was evaluated using acute rat model by carrageenan induced rat paw oedema and a sub acute rat model by cotton peltect induced granuloma. The ethanolic extract showed significant anti-inflammatory activity in both the animal models, and the weight of adrenal glands were also found to be significantly increased in extract treated animals. The results indicate the dose dependent anti-inflammatory activity of the roots of *Memecylon umbellatum* in the acute carrageenan-induced rat paw oedema and the sub-acute granuloma pouch models²⁶.

Nephroprotective activity

The ethanol extract of *M. umbellatum* roots was investigated for nephroprotective activity against cisplatin induced acute renal damage in rats. The extract at dose levels of 100, 200, 400 mg/kg body weight showed a significant and dose dependent reduction in elevated blood urea and serum creatinine and also normalized the histopathological changes in the curative regimen. The findings suggest that the probable mechanism of nephroprotection by *M. umbellatum* root extract could be due to its antioxidant activity²⁷.

Anti-pyretic activity

The ethanol extract of *M. umbellatum* roots was investigated for anti-pyretic activity in yeast induced pyrexia model in rats. The results showed a significant and dose dependent reduction in yeast induced hyperpyrexia in rats when compared to the standard drug paracetamol²⁸.

Hepatoprotective activity

The leaves of the plant were also screened for hepatoprotective activity, and shown significant hepatoprotective activity²⁹. The another study was aimed to evaluate the heaptoprotective effect of *M. umbellatum* (Burm) roots against acetaminophen overdose induced

hepatotoxicity in rats. The degree of protection was measured by using biochemical parameters such as Serum glutamate oxaloacetate transminase (SGOT), Serum glutamate pyruvate transminase (SGPT), Serum alkaline phosphatase (ALP), total bilirubin and also by histopathology studies. *M. umbellatum* root extract at a oral dose of 200 and 400 mg/kg produced significant hepatoprotection by reducing elevated serum enzyme levels and with an almost normal histological architecture of the liver, in treated groups, when compared to the control group, showed that the *M. umbellatum* roots possesses significant hepatoprotective activity³⁰.

In an another study the hepatoprotective activity of the ethanol extract of the *M. umbellatum* roots were also screened against carbon tetrachloride induced liver damage in rates. Administration of carbon tetrachloride to rats caused significant liver damage, as evident by the altered serum biochemical parameters. There was a significant increase in serum levels of SGOT, SGPT, ALP, γ -GT and bilirubin in CCl₄ treated animals, reflecting hepatic injury. Pretreatment of rats with *M. umbellatum* root extract exhibited marked protection against carbon tetrachloride hepatotoxicity. The results showed the extract decrease the level of SGOT, SGPT, ALP, γ -GT and bilirubin by 82.61, 88.39, 53.66, 78.94, 84.21% when at the dose of 400 mg/kg when compared to standard drug silymarin that decreased serum enzyme levels by 96.73, 92.63, 92.64, 95.50, 92.98 % respectively. The result also showed that the ethanolic extract treated groups have significantly shorten the thiopental sleeping time in rats by 62.12% as compared to animals receiving CCl₄ alone³¹.

GENOTOXIC STUDIES OF MEMECYLON UMBELLATUM LEAVES

The leaf extracts of *Memecylon umbellatum* was screened for its antigenotoxic potency against cyclophosphamide induced chromosomal aberration and micronucleus formation. The result showed that the mice treated with alcoholic and aqueous extracts of *M. umbellatum*, had prevented the genotoxicity of cyclophosphamide. The frequency of chromosomal aberration and micronucleus (MN) although not significant statistically, the percentage aberration and MN formation appeared to be dose and time dependent. There was a slight depression in the mitotic index compared to negative controls. The extracts were found to be non-mutagenic on bone marrow cells of mice. The antigenocyt studies are directly related to the protective role of the extracts on the genetic material³².

CONCLUSION

Natural product market is growing tremendously in last few years. The plant iron wood tree (*Memecylon umbellatum*) had a long history of traditional uses for wide range of diseases. It has been proved that various parts of the plant were used in traditional to treat various ailments. In recent years it has been experimentally proved that the plant possess analgesic, anti-inflammatory, wound healing, hypoglycemic, antimicrobial, anti spasmodic, nephroprotective and



hepatoprotective activity. Further studies need to be carried out to explore its potential in curing disease by using isolated compound.

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