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## Review on *Erythroxyllum Monogynum* Roxb.

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### ABSTRACT

The plants are less harmful in nature; hence they are the best option in the treatment of many diseases. Medicinal plants are considered to be the biosynthetic laboratory for many phytopharmaceuticals. The essential values of some plants have long been published but a large number of them remain unexplored as yet. So there is a necessity to explore their uses and also to conduct pharmacognostic and pharmacological studies to ascertain their therapeutic properties.

**Keywords:** *Erythroxyllum monogynum*, Pharmacological, Phytochemical

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## INTRODUCTION

*Erythroxylum monogynum* is also known as Red cedar or Bastard sandal, which is a small, much-branched, evergreen tree with a small glabrous dark brown trunk, It is native to Peninsular India and Sri Lanka. Flowering and fruiting occur throughout the year. The plant is known to have high medicinal value. It is taken to cure many diseases such as stomachic, dyspepsia, fever, and dropsy in ayurvedic medicine. Red cedar is common in the forests along the Godavari river. The wood is used as a substitute for sandal. The brahmins of Manthani on the Godavari, make use of it in their religious ceremonies.



**Figure 1:** *Erythroxylum monogynum* plant showing white flowers

### Vernacular Names

English: Red cedar or Bastard sandal

Hindi: Devadar

Malayalam: Vella devatharam

Tamil: Sembulichan

Telugu: Gatiri

Kannada: Natkadeodar

Sinhala: Devadar



**Figure 2:** *Erythroxylum monogynum* plant showing red fruits

**Taxonomical Classification**

Kingdom: Plantae

Division: Angiosperms

Class: Eudicots

Sub class: Rosids

Order: Malpighiales

Family: Erythroxylaceae

Genus: *Erythroxylum*

Species: *Erythroxylum monogynum*

**Plant Description**

*Erythroxylum monogynum* is a medium sized tree which grows about 7 m in height with bark dark brown and very rough trunk. Flowers are white in colour, attractive to bees and butterflies. Ripe fruits are blood red in color. The wood is having a pleasant odor similar to sandal wood and is very hard and heavy<sup>1,2,3,4</sup>

**Botanical Description**<sup>1,4</sup>**Leaves**

Leaf Type: Simple

Leaf Arrangement: Alternate, distichous

Leaf Shape: Obovate

Leaf Apex: Obtuse, emarginate

Leaf Base: Cuneate

Leaf Margin: Entire

Leaf venation: Pinnate

Leaf blade length: 2-6.5 x 1-3 cm,

**Flower**

Flowers are bisexual, white, axillary, solitary or 1-4 in axillary fascicles; sepals 5-6, ovate, acute, glabrous; petals 5-6, white, oblong, with an erect double ligule on inner side, imbricate, stamens 10-12, monadelphous; ovary 3-4-celled, styles 3-4, united into a style with capitate stigmas; ovary superior, 3-4-celled, ovules 1-2 in each cell.

**Fruit**

Type of fruit is drupe, somewhat 3-angled, ellipsoid, apiculate, glabrous, and reddish in colour with a single seed.

**Bark**

Brown colored bark. Cork patches are seen rarely. Bark is rough due to longitudinal and transverse ridges, fissures and wrinkles. It is having a fibrous fracture.

**Wood**

Hard and heavy wood with pleasant odour. Appearance of annual rings can be seen on the surface. Wood is bitter in taste.

**Phytochemical Studies**

Phytochemicals like tannins, glycosides, flavonoids, steroids and phenols were present in the hydroalcoholic extract of *Erythroxylum monogynum*<sup>5</sup>. The methanol and acetone leaf extracts of *Erythroxylum monogynum* showed that the plant contains tannins, saponins, flavonoids, alkaloids, terpenoids, phytosterols, cardiac glycosides and carbohydrates<sup>6</sup>.

**PHARMACOLOGICAL STUDIES****Antibacterial activity**

The extract of the leaves of *Erythroxylum monogynum* were evaluated for its phytoconstituents, and to approve the antibacterial property of the strains of bacterial species, namely, *Escherchia coli*, *Klebsiela pneumoniae*, *Pseudomonas putida* and *Staphylococcus aureus*. The highest inhibition zone noted for aqueous extract of *E.monogynum* leaves against *E.coli* was 14.66 mm followed by ethanol extract 13.80 mm. The study evidenced the utilization of the plant in traditional biomedicine for the curing of ailments caused by the microorganisms<sup>6</sup>.

**Antioxidant activity**

The aqueous and ethanolic extract of the leaves of *Erythroxylum monogynum* has been evaluated for *in vitro* antioxidant activity. Among both the extracts, ethanolic extract showed potent antioxidant activity. Hence this ethanolic extract was further fractionated using various solvent systems like; Pet ether – Chloroform - Ethyl acetate – n Butanol and evaluated for antioxidant potential. DPPH assay, reducing power and H<sub>2</sub>O<sub>2</sub> scavenging assay have been used to evaluate antioxidant potential. Ascorbic acid was used as reference compound for all the assays. All the analysis was made with the use of UV-Visible spectrophotometer. The results of all assays showed that extracts and fractions of the leaves of *Erythroxylum monogynum* possess significant free radical scavenging and reducing power properties. Chloroform fraction separated from crude ethanolic extract was found to possess more superior antioxidant potential among all tested fractions in *in vitro* assays. Hence, it is necessary to evaluate the leaves of *Erythroxylum monogynum* for oxidative stress related disorders<sup>7</sup>.

**Antidiabetic activity**

Antidiabetic potential of *Erythroxylum monogynum* in streptozotocin induced diabetic rats were evaluated. Diabetes was induced by single dose of streptozotocin intraperitoneally to female wistar rats. Diabetic rats were stabilized for six day and from seventh day chloroform

fraction of *Erythroxylon monogynum* was administered at a dose of 250 mg/kg, p.o. and 500 mg/kg for 3 weeks. Glibenclamide 10 mg/kg P.O. was used as a standard. The effect of chloroform extract and standard drug on various parameters like; body weight, blood glucose and serum lipid profile were recorded. Histopathological changes were studied in pancreases of representative animals of the each group. Administration of chloroform fraction of *Erythroxylon monogynum* at a dose of 250 mg/kg, p.o. and 500 mg/kg, p.o did not showed any significant change in blood glucose level of normoglycemic rats, whereas, oral glucose tolerance test depicted significant reduction in blood glucose level at 30 to 60 min. In streptozotocin induced diabetic rats, extract of the plant was found significantly beneficial in controlling elevated blood glucose level and serum lipid parameters. The findings were strengthening by improved antioxidant status in diabetic rats as well as protection towards pathological damage of pancreases. The results showed by 500 mg/kg of chloroform fraction of *Erythroxylon monogynum* were comparable with standard treatment of glibenclamide 10 mg/kg. From the study we can confirm that the chloroform fraction of *Erythroxylon monogynum* possess antidiabetic action in streptozotocin induced diabetic rats<sup>8</sup>.

#### **Antitumour and cytotoxic activity**

Plants resistant and susceptible to crown gall were analysed at laboratory level for cytotoxic and antitumor activity to know whether the plants resistant to crown gall has any constituents or compounds that are cytotoxic or anti-tumour against human tumours. Methanolic extract of *Erythroxylum monogynum* showed highest cytotoxic activity against brine shrimps at an LC<sub>50</sub> of 172.3ppm. Further the plant was assessed for the antitumor activity against the tumors induced by *Agrobacterium tumefaciens* using carrot disc anti tumour bioassay. Results indicated that the extract of *Erythroxylum monogynum* inhibited tumor induction on carrot discs at a lowest concentration of 800ug/ml. The overall results indicate a strong cytotoxic and anti-tumour activity in a crown gall susceptible plant.<sup>9</sup>

#### **Hepatoprotective activity**

An experiment was conducted for seven days to evaluate the hepatoprotective activity of *Erythroxylum monogynum* in Carbon tetrachloride (CCl<sub>4</sub>) (1ml/kg) induced rats. The hydroalcoholic extract of plant was prepared by maceration technique. The 5 group of rats were maintained as Control, CCl<sub>4</sub> induced, CCl<sub>4</sub> and Liver tonic, CCl<sub>4</sub> and extract 150mg/kg and CCl<sub>4</sub> and extract 200mg/kg. On the eighth day blood was collected by retro orbital puncture for the study of serum parameters like SGOT (Serum Glutamate Oxaloacetate Transaminase), SGPT (Serum Glutamate Pyruvate Transaminase) and bilirubin. The liver was isolated and processed for the histopathological examinations. The decreased levels of SGOT, SGPT, and total bilirubin in the treated rats were an indication of the hepatoprotective

activity of extract. The regeneration of hepatocytes was also evidenced for hepatoprotective activity of the extracts <sup>10</sup>.

### **Antiobesity activity**

Anti obesity potential of chloroform fraction of *Erythroxylum monogynum* in high fat diet induced obesity in wistar rats were evaluated. Female rats were fed with high fat diet for eight weeks. Chloroform fraction of the plant was administered at a dose of 250 mg/kg, p.o. and 500 mg/kg for last 3 weeks with an intake of high fat diet. Parameters like body weight, feed consumption were monitored throughout experimental period. On the 57<sup>th</sup> day, various biochemical parameters like serum glucose, serum lipid profile, liver profile and total protein were estimated. Effect of treatment on cardiovascular risk factor indicator that is, atherogenic index was also calculated. Finally effect on vital organs like liver, heart and kidney as well as epididymal fat pad were also recorded. Due to treatment, there was a significant reduction in dose dependant manner in body weight and other elevated biochemical parameters like serum glucose, lipid and liver profile levels in high fat diet fed animals were significantly improved due to treatment of chloroform fraction of the plant. Atherogenic index as well as relative epididymal fat pad weight was found to be reduced due to the treatment with the *Erythroxylum monogynum* extract <sup>11</sup>.

### **Nephroprotective activity**

A study was conducted to assess the ethanolic extract of the leaves of *Erythroxylum monogynum* in alloxan induced nephrotoxicity in wistar strained albino rats. Extraction of the ethanol extract of *Erythroxylum monogynum* was performed by maceration. Several biochemical parameters were assessed and histological studies were done. Oral administration of the extract resulted in significant reduction in mean values of urea, uric acid and creatinine. The present study indicates that the ethanolic extract of *Erythroxylum monogynum* exhibit nephroprotective activity in alloxan induced nephrotoxic rats <sup>12</sup>.

### **Antihyperlipidemic activity**

A study was conducted to assess the antihyperlipidemic activity of the ethanolic extract of the leaves of *Erythroxylum monogynum*. Several biochemical parameters were assessed. Oral administration of the extract resulted in significant reduction in mean values of cholesterol and triglycerides. The present study indicates that the ethanolic extract of *Erythroxylum monogynum* possess antihyperlipidemic activity <sup>12</sup>.

### **Ameliorative activity**

An evaluation was done to know the effect of *Erythroxylum monogynum* leaf extract in chromium (K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>) induced testicular toxic male albino rats. The extract was prepared by the hydro alcohol solvent through maceration technique. The fertile male albino rats were

divided into 4 groups. Group 1 as control, group 2 as chromium in 150 ppm in distilled water group 3 chromium and hydro alcoholic extract of *Erythroxylum monogynum* 200mg/kg and group 4 as chromium, hydro alcoholic extract of *Erythroxylum monogynum* 300 mg/kg. The administration of the chromium and extract was given orally for 30 days. On 31st day the blood samples of the rats were collected through retro orbital plexus. The blood samples collected were used to perform serological tests. Then the rats were sacrificed to separate the cauda epididymis and testes. The cauda epididymis was finely teased in saline to study the sperm count and motility. The testes were subjected to histopathological examination. The decreased sperm count and motility was observed in the group 2. The sperm count and motility were increased in the group 3 and group 4 compare to group 2. The SGOT, SGPT and ALP were decreased in the group 3 and 4 compare to group 2. The increased HDL, total protein and albumin levels were seen in the extract treated groups. The reduced levels of total cholesterol, triglycerides, LDL and VLDL were observed in the group 3 and 4 rats. The testes sections were also supported the ameliorative activity with reforming germinal cells in seminiferous tubules of the testis of extract treated rats<sup>13</sup>.

#### **Anti plasmodial activity**

The anti plasmodial activity of different solvent extracts of leaves of *Erythroxylum monogynum* were studied against *Plasmodium falciparum*. Methanol extract of *Erythroxylum monogynum* showed IC<sub>50</sub> value of 12.23 µg/mL, The results of the present study justify the use of this medicinal plant in traditional practice, and also, a further study on the isolation of anti-plasmodial molecules from their active crude extracts has to be carried out.<sup>14</sup>

#### **CONCLUSION**

The present review is a scientific evidence for the ethnomedical applications of the *Erythroxylum monogynum* as an ideal and effective medicinal plant in the management of many diseases and disorders. Novel drugs can be isolated and designed from the plant in many more diseases in future also. Since the plant has not been explored completely, the researchers can pay an attention towards the same.

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