



## ETHNOPHARMACOLOGICAL PROPERTIES OF *COCCULUS HIRSUTUS* (L.) DIELS- A REVIEW

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### ABSTRACT

Plants form a reservoir of potential useful untapped source of drugs that have been serving mankind since the dawn of civilization. *Cocculus hirsutus* (L.) Diels (Menispermaceae) is a climbing scandent shrub with hairy sepals. It is used traditionally as alterative, laxative, demulcent, prurigo, eczema, dyspepsia tonic, diuretic, antiperiodic in fever, in malaria, joint pains and in skin diseases. Several phytoconstituents have been isolated like alkaloids, sterols and resins and identified from different parts of plant. Many studies have been conducted to prove its potential as diuretic, laxative, anti-inflammatory and antidiabetic. The present review aims toward forming a bridge between traditional use and modern therapeutics of *Cocculus hirsutus*.

**Keywords:** Antiperiodic, *Cocculus hirsutus*, Diuretic, Menispermaceae.

### INTRODUCTION

India is regarded as the treasure trove of herbs in the world. The proper and judicious use of herb is often successful in the treatment of illness when other conventional medicines and methods fail. Herbs demonstrate great versatility for the treatment of a broad variety of health needs. Medicinal plants are of great value in the field of treatment and cure of diseases. It has now been universally accepted that the herbal medicines are far safer than that of synthetic medicines for curing of many of complex diseases. The traditional system of medicine is so engrained in our culture that, even now 75% of the Indian population depend on this indigenous system for relief and they employ herbs as their primary medicines<sup>1</sup>.

*Cocculus hirsutus* (L.) Diels (Synonym-*Cocculus villosus*) locally called Jaljamini, belonging to the family Menispermaceae is a climbing scandent shrub with hairy sepals<sup>2</sup>. *C. hirsutus* is widely distributed to Sudan, central Asia, China and India (throughout tropical and subtropical regions). The plant grows all over India, especially in dry regions. In India, it is known by various names in different regions viz, Vevati in Gujarat, Huyer in Bengal, Kattukkodi in Tamilnadu and Vasavel at some places. Leaves are simple, alternate, ovate, sub deltoid or three lobed, obtuse and mucronate. The base of leaf is subcordate or truncate. Petioles are very short, dark green, usually subauriculate at the base. The fruit is a drupe which is size of small pea with dark purple endocarp (fig.1). The flowers are very small, unisexual and green. The male flowers occur in axillary cymose panicles, stamens are six, free, embraced by the petals, anthers are subglobose in shape. Female flowers are in axillary clusters of 1-3 and staminoids are six and styles usually cylindrical. The plant is a climber with green flowers bloom in February-March and fruits in May-June. Seeds are curved and

fleshy with annular embryo. Roots are hairy and dark brown in colour<sup>3-5</sup>.

### TAXONOMIC CLASSIFICATION<sup>6</sup>

- Kingdom: *Plantae*
- Subkingdom: *Tracheobionata*
- Division: *Magnoliophyta*
- Subdivision: *Spermatophyta*
- Class: *Magnoliopsida*
- Subclass: *Magnolidae*
- Order: *Ranunculales*
- Family: *Menispermaceae*
- Genus: *Cocculus*
- Species: *Cocculus hirsutus*

### Ayurvedic uses

According to Ayurveda, *C.hirsutus* is known as Patalagarudi in Sanskrit. Root smell is sweetish and pungent, lessen bile and burning sensation, enrich blood. It is used in diseases of urinary system. According to Unani system of medicine, it is antipyretic, tonic, lessens thirsty, good for fractures, and useful in tubercular glands related problems. It is well known herb used as first aid remedy in minor injuries. It alleviates *kapha* and *vata* doshas. It is used as *deepanee*, *pachanee* and *raktdoshagni*. It possesses light, oily and slimy attributes. It has a special potency as a detoxifier. It is an aphrodisiac and tonic in properties<sup>7-8</sup>.

### Traditional medicinal uses

The roots and leaves of *C.hirsutus* have great medicinal value and are used both, internally as well as externally for medicinal purpose. Root is bitter and used as alterative, laxative, demulcent, tonic, diuretic, antiperiodic in fever, in malaria, joint pains, in treatment



of skin diseases constipation and kidney problems<sup>9-10</sup>. Juice of leaves coagulates in water and forms mucilage which is used externally as cooling medicine in eye problems and soothing application in prurigo, eczema, impetigo and dyspepsia. When juice is sweetened with sugar, it is given in acute gonorrhoea. Decoctions of the root is mixed with long pepper is used in chronic rheumatism and syphilitic cachexia<sup>11-13</sup>.

The combination of roots of *C.hirsutus* and *Caesalpinia crista* (latakaranja) seed, matted in water is given orally to alleviate the abdominal pain. Decoctions in combinations with sugar and ginger are used in bilious dyspepsia. Roots rubbed with bonduc nuts in water are given for stomach problems especially in children. Roots act as an aphrodisiac and tonic. The juice of the ripe fruits makes a kind of bluish purple ink. The water soluble fraction of ammoniacal extract has sedative, hypotensive, bradycardiac, cardiotoxic, spasmolytic and slight anticonvulsant actions<sup>12</sup>. Due to the presence of phenolic compounds in the plant, it is used as antimicrobial, preventive infection and enhances healing. Tannins and Flavanoids present in glycosidic combination. Tannins have stringent and healing properties. This can be even used in treatment of wounds, burns, and ulcers<sup>14-15</sup>.

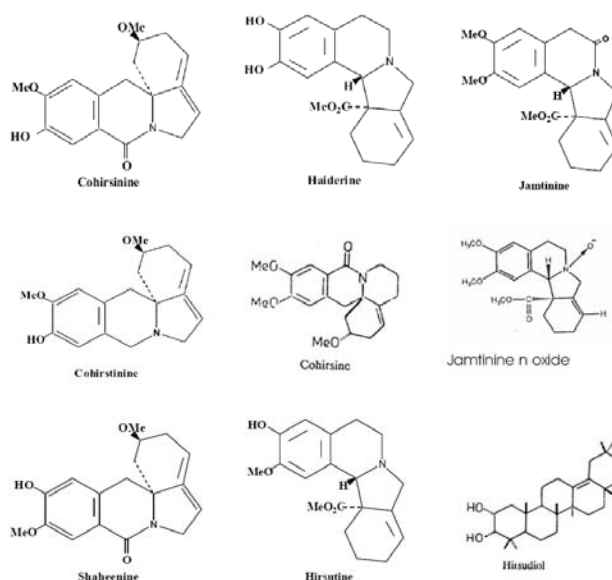
Figure 1: Photographs of *Cocculus hirsutus*



## PHYTOCHEMISTRY

Work is done by many scientists in the field of phytochemical investigation of the plant. The plant of *C.hirsutus* has been reported to contain essential oil,  $\beta$ -sitosterol, ginnol, glycosides, sterols and alkaloids<sup>16-17</sup>. Preliminary phytochemical analysis of the leaves showed presence of alkaloids, phenolic compounds, flavonoids, glycosides, and carbohydrates. The phytochemical studies show the presence of bis-benzyl isoquinoline alkaloids; viz. shaheenine<sup>18</sup>, cohirsinine<sup>19</sup>, hirsutine<sup>20</sup>, jamtinine<sup>21</sup>, jamtinine-*N*-oxide<sup>22</sup>, cohirsine<sup>23</sup>, Cohirsitine<sup>24</sup> and haiderine<sup>25</sup> which are isolated from stem and roots (fig.2). The alkaloids present in the leaves of *C.hirsutus* are D-trilobine and DL-coclaurine, isotrilobine, (+)syringaresinol and protoquercitol<sup>26</sup>. Roots are reported for the presence of D-trilobine and coclaurine, sterols and resins<sup>27</sup>.

Figure 2: Structure of isolated phytoconstituents



## PHARMACOLOGICAL ACTIVITIES

**Acute toxicity:** The aqueous extract of *C.hirsutus* aerial parts orally evaluated for the acute toxicity in mice. The lethal dose 50 (LD50) was determined. The acute toxicity was found to be higher than 3000 mg/kg.<sup>28</sup>

**Antidiabetic:** Anti-diabetic effect was observed with *C.hirsutus* when given as an aerial part extract in normal as well as diabetic rats. The effect, however, was more pronounced in diabetic animals in which administration for 15 days after streptozotocin-induced diabetes, significantly reduced blood glucose levels. After streptozotocin induced diabetes, it was observed that both standard drug (glibenclamide) and methanolic extract of *C. hirsutus* were significantly superior to control in reducing blood sugar on long treatment (15 days). *C. hirsutus* could be of benefit in diabetes mellitus in controlling blood sugar<sup>29</sup>.

The aqueous extract of leaves of *C.hirsutus* decreased the serum glucose level and improved glucose tolerance.

Total alkaloids reduced the blood sugar level of diabetic rats significantly. Hence, the alkaloids in the roots of *C. hirsutus* have been reported to be responsible for the antihyperglycemic activity. The aqueous extract of leaves of *C. hirsutus* has antihyperglycemic activity as it lowers serum glucose level in diabetic mice and significantly increases glucose tolerance. The extract also prevents loss of body weight in diabetic mice<sup>30</sup>.

Total alkaloid fraction prepared from methanol extract of roots of *C. hirsutus* showed considerable hypoglycemic activity on alloxan-induced diabetic rats. The thin layer chromatography profile of total alkaloid fraction showed the presence of four alkaloids, whereas butanol fraction showed the presence of steroids and/or triterpenoids<sup>31</sup>.

**Anti-inflammatory and Analgesic:** *C. hirsutus* holds potential for anti-inflammatory activity and analgesic activities. Ethanolic extract of *C. hirsutus* exhibited anti-inflammatory activity in albino rats using carageenan-induced method in the dose of 100 mg/kg body weight. It showed significant activity<sup>32</sup>.

**Antimicrobial:** Antimicrobial activity of *C. hirsutus* has reported against *Staphylococcus aureus*, *Pseudomonas aureus*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Salmonella typhi* using agar disc diffusion methods using petroleum ether and ethanolic extract crude alkaloid fractions is screened at various concentrations and zone of inhibitions were recorded so by this result suggest that ethanolic extract has significant antimicrobial activity and used to treat various disease<sup>33</sup>.

*C. hirsutus* exhibited antibacterial activity by the disc diffusion method. It showed a remarkable antibacterial activity. Pure organic solvents did not show any antibacterial activity. Petroleum ether chloroform, ethyl acetate, acetone, methanol, and aqueous root extract of *C. hirsutus* was tested against *Escherichia coli*, *enterobacter aerogens*, *klebsiella pneumoniae*, *salmonella typhi*, *proteus vulgaris*, *pseudomonas aeruginosa* (gram negative), *staphylococcus aureus* and *bacillus cereus* (gram positive), pathogenic bacteria. The disc diffusion assay showed that chloroform root extract of *c. hirsutus* inhibits the activity of *pseudomonas aeruginosa* and *bacillus cereus*. Ethyl acetate and acetone extract exhibit very poor activity associated with *salmonella typhi*, *enterobacter aerogens* and *proteous vulgaris*<sup>34</sup>.

**Cardiotonic:** Methanol extract of roots of *C. hirsutus* was tested for its cardiotonic activity on diabetic rats and isolated perfused frog heart respectively. The methanol extract exhibited significant cardiotonic activity on normal and hypodynamic frog heart preparation. Activity guided fractionation of methanol extract was carried out. Butanol fraction of methanol extract of roots of *C. hirsutus* was found to have significant cardiotonic activity comparable to that of ouabain<sup>35</sup>.

**Diuretic and Laxative:** The diuretic, laxative, toxicity studies have been conducted of the aqueous extract of *C. hirsutus* aerial parts (100 and 200 mg/kg, p.o.). It

showed significant diuretic activity and laxative effects in rats. The highest dose (400mg/kg, p.o.) of the ethanolic extract significantly enhanced urine output. Excretion of cations ( $\text{Na}^+$  and  $\text{K}^+$  ions) and anions ( $\text{Cl}^-$  ions) increased significantly with respect to the control group. The ethanolic extract of the leaves of *C. hirsutus* (100, 200 and 400 mg/kg p.o.) and furosemide did not significantly change the concentration of  $\text{Na}^+$ ,  $\text{K}^+$  and  $\text{Cl}^-$  ions in serum. The ethanolic extract of the leaves of *C. hirsutus* and furosemide increased the excretion of creatinine in urine but with a corresponding decrease in serum. The ethanolic extract of the leaves of *C. hirsutus* (400 mg/kg) had significant diuretic effect in rats<sup>36</sup>.

**Immuno stimulant:** The ethanolic and aqueous extract of plant of *C. hirsutus* holds potential as a protective agent against cytotoxic drugs. The extracts when studied on humoral and cell mediated immunity in normal, as well as cyclophosphamide induced immuno suppressed rats. It produced an increase in carbon clearance, humoral antibody (HA) titre, delayed type hypersensitivity (DTH) and WBC count in a dose dependent manner. *C. hirsutus* antagonizes the myelosuppressive effect induced by cyclophosphamide, which produces significant myelosuppression in experimental animal. By the administration of cyclophosphamide Hemoglobin, RBC count, WBC count, Lymphocyte, monocytes, Eosinophil count and Platelet count decrease significantly. The present investigation established pharmacological evidence to support the folklore claim that it is an immunomodulating<sup>37</sup>.

**Spermatogenic:** Testosterone levels in the testes were significantly higher in methanolic extract (both 400 and 800 mg/kg) of *C. hirsutus* treated rats after 15th days of treatment compared to the control group. The chronic treatment of the extract for 15 days has increased in the weight of testis, its diameter and seminiferous tubules. There is also a progress in spermatogenesis and increase in *cauda epididymal* sperm count. The significant increase in the weight of reproductive organs is also indirectly supports the increase availability of androgens. Increased weight and high protein concentration of the testis indicates the enhancement of testicular growth as FSH is essential for protein synthesis in gonads<sup>38</sup>.

**Biotechnological:** The antitumour metabolites production in *C. hirsutus* has been investigated in cultures and high alkaloids producing cell lines has been established. The pertinent information on the production of antineoplastic agents through tissue culture<sup>39</sup>.

## CONCLUSION

*C. hirsutus* is quick-growing traditionally important medicinal plant. *C. hirsutus* produces anti-inflammatory, antispermatogenic, antidiabetic, antitumour, antimicrobial, diuretic and laxative activity. *C. hirsutus* is rich of chemical constituent, which have therapeutic and medicinal value like alkaloids, phenolic compounds, flavonoids, glycosides, and carbohydrates.



*C.hirsutus* has great potential as anti inflammatory drug and it can play a important role in developing new formulation for treating inflammation, diabetes and enhancing immunity. The detail research will also carry on isolation of bioactive chemicals and clinical study of plant extracts as well as ayurvedic/herbal formulation. It has proved it efficacy in the management of various complex diseases including diabetes, diuretic, viral and microbial infections but still a lot of works to be done for exploring the evidences for other traditional uses of the plant.

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