

Pharmacological Review on *Hedychium coronarium* Koen. :

The White Ginger Lily

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ABSTRACT

Hedychium coronarium K. (Zingiberaceae) is a rhizomatous flowering plant popularly called white ginger lily. It is found to have various ethnomedicinal and ornamental significance. The plant is native to tropical Asia and the Himalayas. It is widely cultivated in tropical and subtropical regions of India.¹ Its rhizome is used in the treatment of diabetes. Traditionally it is used for the treatment of tonsillitis, infected nostrils, tumor and fever. It is also used as antirheumatic, excitant, febrifuge and tonic. It has been reported that the essential oil extracted from leaves, flowers and rhizome of the plant have molluscicidal activity, potent inhibitory action, antimicrobial activities, antifungal, anti-inflammatory, antibacterial and analgesic effects. This paper reports on its pharmacological activities such as anti-inflammatory, analgesic, antioxidant, antibacterial, antiurolithiatic, antinociceptive, CNS depressant, cancer chemoprevention and anticancer, Antimicrobial, Mosquito Larvicidal, cytotoxicity activity.

Keywords: *Hedychium coronarium*, Anti-inflammatory, Antioxidant, Antiurolithiatic, Mosquito larvicidal.

INTRODUCTION

India is rich in ethnic diversity and indigenous knowledge that has resulted in exhaustive ethnobotanical studies. Plants have been the major source of drugs in medicine and other ancient systems in the world. In Ayurveda, drugs are in general called as "Aushadha" or "Bhesaja" which means that it cures pain and sorrowful experiences. The plant sources of drugs are called "Aushadhi". Plant drugs form the lion's share of traditional drugs.¹ Many plant species, possessing medicinally important compounds, are disappearing at an alarming rate due to destruction of its natural habitats owing to rapid agricultural development, urbanization, indiscriminate deforestation and uncontrolled collection of plant materials.

In present pharmaceutical field, plants form the major sources for medicines, as the large number of drugs in use are obtained from plants, like vasicine from *Adhatoda vasica*, Boswellic acid from *Boswellia serrata*, momordicosides from *Momordica charantia*, Levodopa from *Mucuna pruriens*, phyllanthin from *Phyllanthus amarus*, Terestrosins from *Tribulus terrestris* etc.

The medicinal plants are rich in secondary metabolites, which are potential sources of drugs and essential oils of therapeutic importance. Medicinal plants are widely used in various ailments, because of their safety besides being economical, effective and their easy availability. According to a survey (1993) of World Health Organisation (WHO), the practitioners of traditional system of medicine treat about 80% of patients in India, 85% in Burma and 90% in Bangladesh.²

In traditional systems of medicine the Indian medicinal plants have been used in successful management of various disease conditions like bronchial asthma, chronic fever, cold, cough, malaria, dysentery, convulsions, diabetes, diarrhoea, arthritis, emetic syndrome, skin diseases, insect bite etc. and in treatment of gastric, hepatic, cardiovascular & immunological disorders.³

Although 20000 plants species are used in traditional medicine, most species have not been thoroughly examined chemically and pharmacologically. The present review article gives an account on different screening models used in various pharmacognostic

activities of the plant *Hedychium coronarium* K.

Hedychium, popularly called ginger lily is a rhizomatous flowering plant belonging to family Zingiberaceae. The plant is native to tropical Asia and the Himalayas. India has rich diversity of ginger lily with 44 taxa, which includes 31 species and 13 varieties and is mainly distributed in Northeast India and South India. 24 species of *Hedychium*, a genus of Zingiberaceae had been reported in Northeast India, out of the 65 valid taxon in the world which indicates its highest species concentration in this region. The Zingiberaceae plant *Hedychium coronarium* K. has many common names like butterfly ginger, butterfly lily, cinnamon jasmine, garland flower and ginger lily.⁴

Plants from genus *Hedychium* Koenig (Zingiberaceae) are herbs with perennial tuberous rootstocks; root fibres hardly thickened; stem elongate, leafy. Leaves distichous, oblong or lanceolate. Flowers usually in terminal spikes; bracts oblong, subcoriaceous, one or more flowered. Calyx tubular, 3-toothed. Corolla tube long, slender, lobes equal, linear, spreading. Perfect stamen 1; lateral staminodes linear or cuneate-oblong. Lip large, 2-fid. Ovary 3-celled; ovule many, superposed on axile placentas; style long, filiform; stigma subglobose. Fruit a globose 3-valved capsule. Seeds many, small, with a lacerate aerial.⁵

CHEMICAL CONSTITUENTS

Previous phytochemical investigations showed that the plant contains the diterpenes-coronarins A, B, C, D and isocoronarins D. Studies also showed the presence of phenolic compounds, flavonoids, protein, steroids and triterpenoids, cardiac glycosides, diterpene, tannin, saponin and oil but tested negative for the presence of alkaloids in the rhizomes of the plant. Phlobatannin was present in the methanolic rhizome extract of *H. coronarium*¹. Forty six compounds were identified in the rhizome oil of *H. coronarium*. The main components identified were linalool, limonene, trans-meta-mentha, 2,8diene, γ -terpinene and 10-epi- γ -eudismol.⁵ Essential oil from the flowers were investigated and a total of 29 components were identified and the main constituents included β -transocimene, linalool, 1,8-cineole, α -terpineol, 10-epi- γ -eudesmol, sabinene and terpinen-4-ol.



Hedychium coronarium plant

THERAPEUTIC USES

Hedychium coronarium is an erect rhizomatous herb. It is cultivated in tropical and subtropical regions of India. The plant is widely utilized in traditional medicine systems wherever it grows, although applications vary by region. This plant has tremendous medicinal properties and its various parts are used in traditional as well as modern medicine.⁶ Its rhizomes are consumed by local people of Manipur. It is used as a febrifuge, tonic, excitant and anti-rheumatic in the Ayurvedic system of traditional Indian medicine. It has been reported that its rhizomes are used for the treatment of diabetes, tonsillitis, infected nostrils, tumor and fever.⁷ The local people of Manipur consume its rhizomes as vegetable. Its rhizome is used in the treatment of diabetes. Traditionally it is used for the treatment of tonsillitis, infected nostrils, tumor and fever. It is also used as antirheumatic, excitant, febrifuge and tonic. It has been reported that the essential oil extracted from leaves, flowers and rhizome of the plant have molluscicidal activity, potent inhibitory action, antimicrobial activities, antifungal, anti-inflammatory, antibacterial and analgesic effects.¹

Studies have indicated the potential analgesic, anti-inflammatory activity⁸, anti-urolithiatic activity⁹, anti-nociceptive activity¹⁰, CNS depressant activity¹¹ in the extract of their rhizomes. The essential oil from the flowers were studied for their anti-oxidant and anti-inflammatory activities.¹² whereas the essential oil obtained from the rhizomes was studied for its anti-bacterial activity.⁵ The labdane diterpenes were isolated from rhizomes and their cancer chemopreventive potential was evaluated.¹³ Antimicrobial, Mosquito Larvicidal and Antioxidant Properties were studied in Leaf and Rhizome extracts.¹⁴



Rhizome of *Hedychium coronarium K*

PHARMACOLOGICAL ACTIVITIES

1. ANTI-INFLAMMATORY ACTIVITY

Successive hexane, chloroform and methanol extracts of the rhizome of *Hedychium coronarium Koenig* were subjected to evaluate analgesic and anti-inflammatory activities in animal model. In acetic acid-induced writhing test, the chloroform and methanol extract at doses of 400 mg/kg body weight showed marked inhibition of writhing reflex. Both the chloroform and methanol extracts showed significant elongation of tail flick time at this dose. In carrageenan induced rat paw edema test, the chloroform and methanol extracts at this dose showed statistically significant inhibition of paw edema after carrageenan injection. Although different extracts of *H. coronarium* exhibited significant analgesic and anti-inflammatory activities, the exact mechanisms underlying the observed pharmacological effects can only be elucidated after isolation of active constituents using a wide range of experimental models.⁸

2. ANTI-BACTERIAL ACTIVITY

The essential oil obtained from rhizomes of *Hedychium coronarium Koenig* was analysed by GC and GC-MS. Forty six compounds representing 98.7 % of *H. coronarium* oil were identified. These oils showed antibacterial activity against five pathogenic bacteria, viz. *Escherichia coli*, *Staphylococcus aureus*, *Salmonella typhi*, *Pseudomonas aeruginosa* and *Proteus vulgaris*. The

essential oils revealed antimicrobial activity against all the five cultures. *Hedychium coronarium* rhizome essential oil extract elucidated maximum efficacy against *Proteus vulgaris* and *Pseudomonas aeruginosa* followed by *Salmonella typhi*, *E. coli* and *Staphylococcus aureus*.⁵

3. ANTI-UROLITHIASIS

Urolithiasis or Lithiasis is a consequence of complex physical processes. Crystals retained in kidney can become nucleus for stone formation. In this study, ethanolic & aqueous extracts of roots and rhizomes of *Hedychium coronarium J. Koenig* plant were evaluated for their potential to dissolve experimentally prepared kidney stones like calcium oxalate by titrimetric method with an invitro model. This study evaluates antilithiatic activity in vitro of different extracts of *H. coronarium J. Koenig* roots and rhizomes and a standard drug cystone. From the study results, it is observed that ethanolic roots and rhizomes extract produced the highest dissolution of calcium oxalate stones in comparison to other extract. This study has given primary evidence that this plant possess lithontripectic property.^{9, 15}

4. ANTI-OXIDANT ACTIVITY

Antioxidants play an important role as health protecting factor. Scientific evidence suggests that antioxidants reduce the risk for chronic diseases including cancer and heart disease. A

rapid, simple and inexpensive method to measure antioxidant capacity of food involves the use of the free radical, 2,2-Diphenyl-1-picrylhydrazyl (DPPH) which is widely used to test the ability of compounds to act as free radical scavengers or hydrogen donors and to evaluate antioxidant activity. Hence, the study has been undertaken to evaluate *H. coronarium J. koenig* plant for their possible antioxidant action by DPPH scavenging method. This study showed alcoholic extract of roots & rhizomes of *Hedychium coronarium J. Koenig* plant in higher concentration possess best antioxidant potential as compare to standard ascorbic acid with IC50 value 9.0 and 18.9 µg/ml. for ascorbic acid and alcoholic extract respectively. Isolated phytoconstituent from alcoholic extract of this plant was 8a, hydroxy hedychilactone and its structure was confirmed by IR, NMR and Mass spectroscopic datas.^{9,12}

5. ANTI-NOCICEPTIVE ACTIVITY

The study is based on the investigation of antinociceptive activity observed from the methanolic extract of the rhizomes of *Hedychium coronarium*. Tail immersion method in mice has been used for the evaluation of the central pharmacological actions. Similarly acetic-acid induced writhing-test was used for the evaluation of the peripheral pharmacological properties. A substantial rise in pain threshold is seen in a dose dependent manner with the methanolic extract of the rhizomes of *H. coronarium*. From this study, it could be concluded that the plant extract of *H. coronarium* is known to possess significant antinociceptive properties that could be mediated from the depression in the central mechanism of pain, enhancing the support of the plant for use in pain and inflammatory disorders. However, it is essential to study further to understand the exact mechanisms underlying in the compound(s) yet to be isolated that could be responsible for the antinociceptive properties.¹⁰

6. CNS DEPRESSANT

The study was aimed to investigate the neuropharmacological actions of the methanolic extract of rhizomes of *Hedychium coronarium* using hole-

cross and open field test in mice. The extract displayed dose dependent suppression of motor activity and exploratory behavior in mice in the tested models. From the study. It could be concluded that the plant extract possesses remarkable CNS depressant activity which may be mediated through the depression of central mechanism of pain, thereby lends support to the traditional use of the plant in pain and inflammatory disorders. However, further studies are needed to be conducted to understand the exact mechanisms of CNS depressant by isolating the compound responsible for such actions.¹¹

7. CANCER CHEMOPREVENTION ACTIVITY

The study was aimed at investigation of cancer chemopreventive activity of *Hedychium coronarium k*. Three labdane diterpenes [isocoronarin D, methoxycoronarin D, ethoxycoronarin D and benzoyl eugenol were isolated from rhizomes and their chemopreventive potential was evaluated using in vitro assays, namely the inhibition of NF- κ B, COX-1 and -2, the induction of antioxidant response element (ARE), and the inhibition of cell proliferation. The results indicate that the cancer chemoprevention effect of the labdane diterpenes from *H. coronarium* most probably involve the inhibition of NF- κ B, which may also account for the alleged anti-inflammatory activity of the plant. An increase in the liposolubility of these labdanes increased NF- κ B inhibition and decreased cytotoxicity.¹³

8. ANTI-MICROBIAL ACTIVITIES

The essential oil, methanolic and aqueous extracts of the leaves and rhizomes of *Hedychium coronarium Koen.* (Zingiberaceae) were assayed for their antimicrobial activity. The leaf and rhizome essential oil displayed significant antimicrobial activity, as determined by the disc-diffusion method, inhibiting the growth of all five fungal and four bacterial strains tested. The strongest activity of leaf oil was observed against *C. glabrata*, followed by *M. furfur* and *C. albicans*, whereas the strongest activity of

rhizome oil was observed against *C. glabrata*, followed by *C. albicans* and *M. furfur*. The antimicrobial nature of the essential oil from several *Hedychium* species was related to their high terpenoid contents.^{14,16}

9. MOSQUITO LARVICIDAL ACTIVITY

The essential oil, methanolic and aqueous extracts of the leaves and rhizomes of *Hedychium coronarium* Koen. (Zingiberaceae) were assayed for their mosquito larvicidal properties against *Aedes aegypti* larvae. Both the leaf oil the rhizome oil showed the larvicidal activity. β -Pinene, α -pinene and 1,8-cineol in *H. coronarium* serve as the principal larvicidal components of both oils. *H. coronarium* essential oil could be considered as a contribution to the search for new biodegradable larvicides of natural origin.¹⁴

CONCLUSION

Various parts of the plant *Hedychium coronarium* K has been widely studied in different areas for its pharmacological activities by utilizing several experimental screening models and based on the previous research works, it could be concluded that this plant has the potential to be explored as a natural medicinal source. It is alleged that the comprehensive information presented in this review on its pharmacological activities offer enticement for proper evaluation of the uses of various parts of this plant in medicine. The use of this plant as conventional drug requires further medico-chemical investigation.

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